# Transit

## BGP configurations for a Transit ISP

# Definitions

- Transit – carrying traffic across a network, usually for a fee

  traffic and prefixes originating from one AS are carried across an intermediate AS to reach their destination AS

- Peering – private interconnect between two ASNs, usually for no fee
- Internet Exchange Point – common interconnect location where several ASNs exchange routing information and traffic

# ISP Transit Issues

- Only announce default to your BGP customers unless they need more prefixes
- Only accept the prefixes which your customer is entitled to originate
- If your customer hasn’t told you he is providing transit to his customers, don’t accept anything else he may announce

# ISP Transit Issues

Many mistakes are made on the Internet today due to incomplete understanding of how to configure BGP for transit

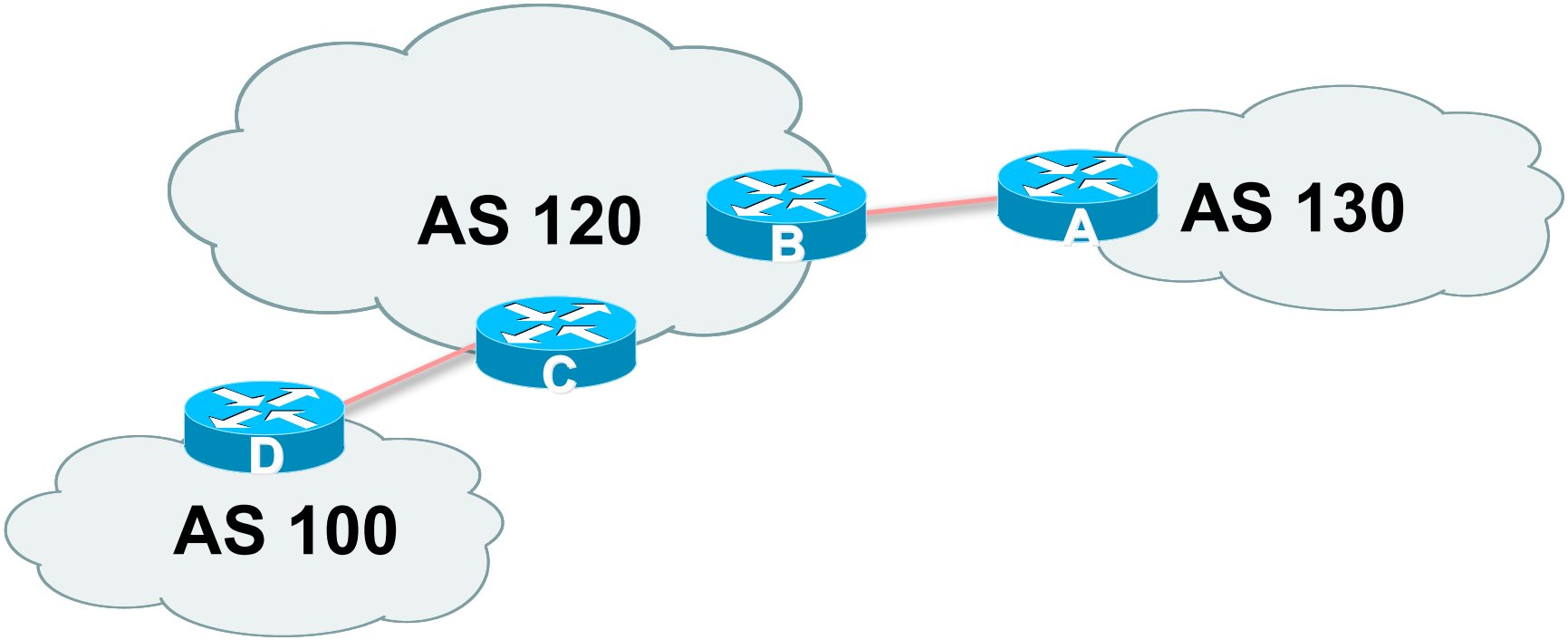
# ISP Transit Provider

## Simple Example

# ISP Transit

- AS130 and AS100 are stub/customer ASes of AS120
  - they may have their own peerings with other ASes
  - minimal routing table desired
  - minimum complexity required

# ISP Transit




- AS120 is transit provider between AS130 and AS100

# ISP Transit

- Router A Configuration

```
router bgp 130
 network 121.10.0.0 mask 255.255.224.0
 neighbor 122.12.10.2 remote-as 120
 neighbor 122.12.10.2 prefix-list upstream out
 neighbor 122.12.10.2 prefix-list default in
!
ip prefix-list default permit 0.0.0.0/0
ip prefix-list upstream permit 121.10.0.0/19
!
ip route 121.10.0.0 255.255.224.0 null0
```

# ISP Transit

- Router B Configuration

```
router bgp 120
 neighbor 122.12.10.1 remote-as 130
 neighbor 122.12.10.1 default-originate
 neighbor 122.12.10.1 prefix-list Customer130 in
 neighbor 122.12.10.1 prefix-list default out
!
ip prefix-list Customer130 permit 121.10.0.0/19
ip prefix-list default permit 0.0.0.0/0
```

- Router B announces default to Router A, only accepts customer /19

# ISP Transit

- Router C Configuration

```
router bgp 120
 neighbor 122.12.20.1 remote-as 100
 neighbor 122.12.20.1 default-originate
 neighbor 122.12.20.1 prefix-list Customer100 in
 neighbor 122.12.20.1 prefix-list default out
!
ip prefix-list Customer100 permit 109.0.0.0/19
ip prefix-list default permit 0.0.0.0/0
```

- Router C announces default to Router D, only accepts customer /19

# ISP Transit

- Router D Configuration

```
router bgp 100
 network 109.0.0.0 mask 255.255.224.0
 neighbor 122.12.20.2 remote-as 120
 neighbor 122.12.20.2 prefix-list upstream out
 neighbor 122.12.20.2 prefix-list default in
!
ip prefix-list default permit 0.0.0.0/0
ip prefix-list upstream permit 109.0.0.0/19
!
ip route 109.0.0.0 255.255.224.0 null0
```

# ISP Transit

- This is simple case:
  - if AS130 or AS100 get another address block, it requires AS120 and their own filters to be changed
    - Some ISP transit providers are better skilled at doing this than others!
  - May not scale if they are frequently adding new prefixes

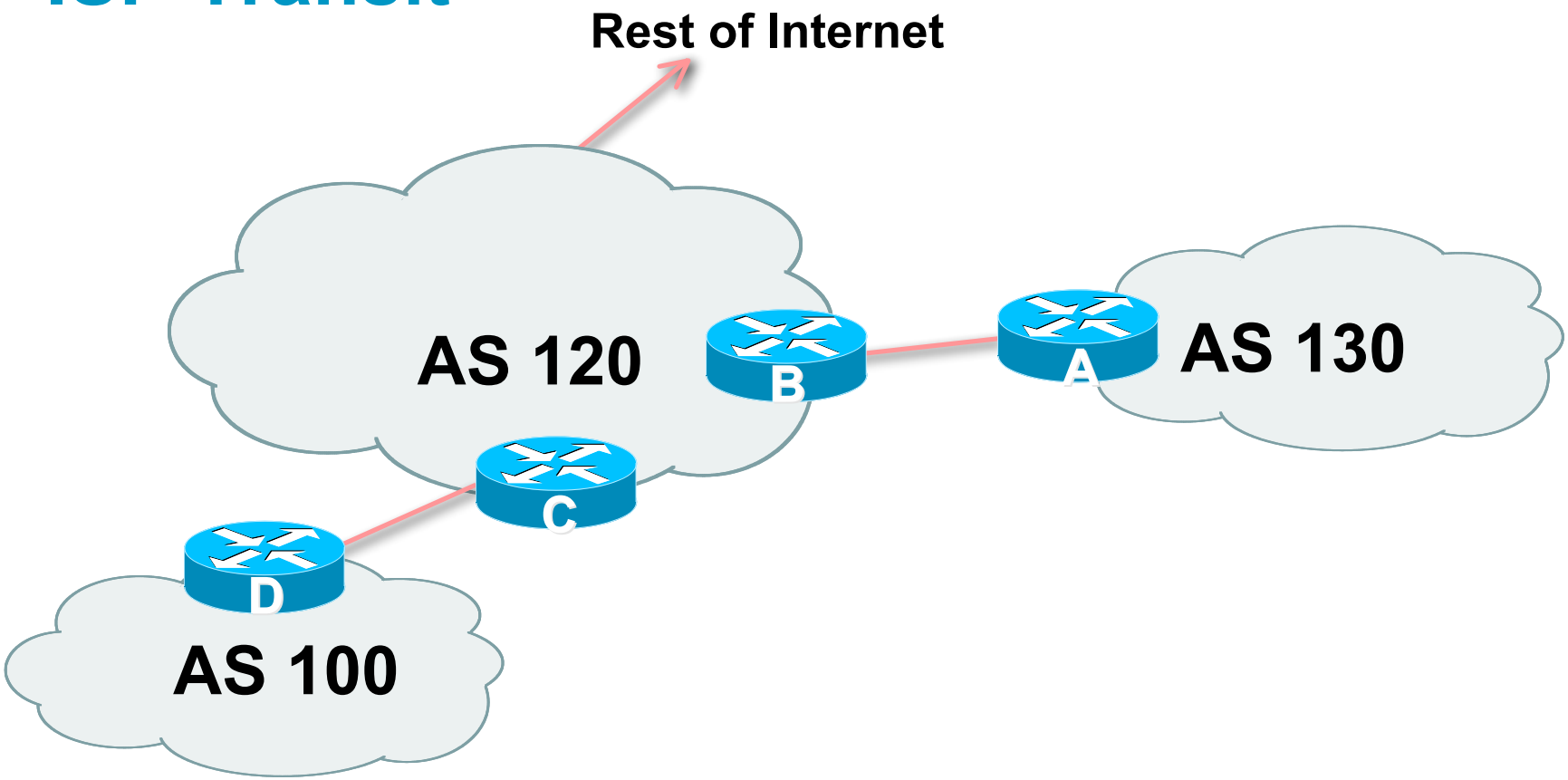
# ISP Transit Provider

## More complex Example 1

# ISP Transit

- AS130 and AS100 are stub/customer ASes of AS120
- AS120:
  - Provides transit between AS130 and AS100
  - Does not provide full Internet access to AS130
  - Provides full Internet access for AS100

# ISP Transit




- AS120 is transit provider between AS130 and AS100

# ISP Transit

- Router A Configuration

```
router bgp 130
 network 121.10.0.0 mask 255.255.224.0
 neighbor 122.12.10.2 remote-as 120
 neighbor 122.12.10.2 prefix-list as130-prefixes out
 neighbor 122.12.10.2 prefix-list bogons in
!
ip prefix-list as130-prefixes permit 121.10.0.0/19
!
ip route 121.10.0.0 255.255.224.0 null0
```

# ISP Transit

- Router B Configuration

```
router bgp 120
 neighbor 122.12.10.1 remote-as 130
 neighbor 122.12.10.1 prefix-list as130-cust in
 neighbor 122.12.10.1 prefix-list bogons out
 neighbor 122.12.10.1 filter-list 15 out
!
ip as-path access-list 15 permit ^$
ip as-path access-list 15 permit ^100$
ip prefix-list as130-cust permit 121.10.0.0/19
```

- Router B announces AS120 and AS100 prefixes to Router A, only accepts customer /19

# ISP Transit

- Router C Configuration

```
router bgp 120
 neighbor 122.12.20.1 remote-as 100
 neighbor 122.12.20.1 default-originate
 neighbor 122.12.20.1 prefix-list as100-cust in
 neighbor 122.12.20.1 prefix-list default out
!
ip prefix-list as100-cust permit 109.0.0.0/19
ip prefix-list default permit 0.0.0.0/0
```

- Router C announces default to Router D, only accepts customer /19

# ISP Transit

- Router D Configuration

```
router bgp 100
 network 109.0.0.0 mask 255.255.224.0
 neighbor 122.12.20.2 remote-as 120
 neighbor 122.12.20.2 prefix-list as100-prefix out
 neighbor 122.12.20.2 prefix-list default in
!
ip prefix-list default permit 0.0.0.0/0
ip prefix-list as100-prefix permit 109.0.0.0/19
!
ip route 109.0.0.0 255.255.224.0 null0
```

# ISP Transit

- AS130 only hears AS120 and AS100 prefixes

  Inbound AS path filter on Router A is optional, but good practice (never trust a peer)

  Inbound Martian prefix-list filters are mandatory on all Internet peerings

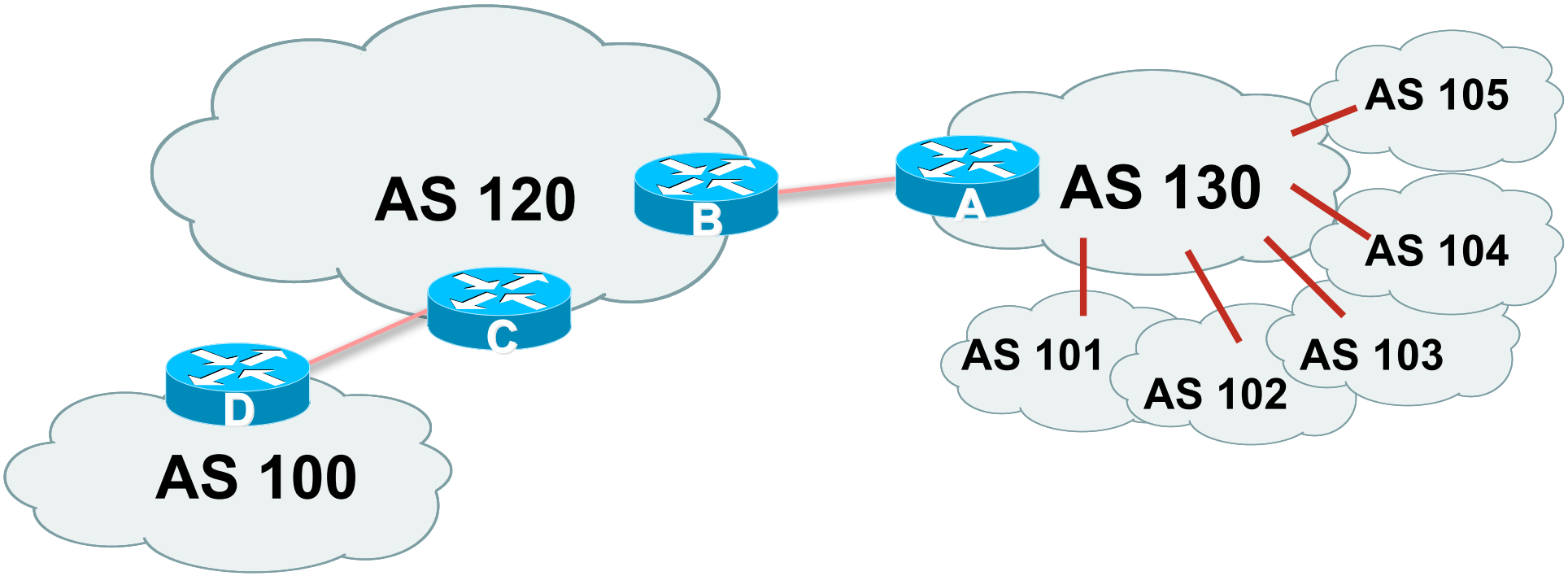
# ISP Transit Provider

## More complex Example 2

# ISP Transit

- AS130 and AS100 are stub/customer ASes of AS120
  - AS130 has many customers with their own ASes
    - AS105 doesn’t get announced to AS120
  - AS120 provides transit between AS130 and AS100

# ISP Transit




- AS130 has several customer ASes connecting to its backbone

# ISP Transit

- Router A Configuration

```
router bgp 130
 network 121.10.0.0 mask 255.255.224.0
 neighbor 122.12.10.2 remote-as 120
 neighbor 122.12.10.2 prefix-list upstream-out out
 neighbor 122.12.10.2 filter-list 5 out
 neighbor 122.12.10.2 prefix-list upstream-in in
!
ip route 121.10.0.0 255.255.224.0 null0 250
!
```

..next slide

# ISP Transit

```
!
! AS-path filters…
ip as-path access-list 5 permit ^$
ip as-path access-list 5 permit ^(101_)+$
ip as-path access-list 5 permit ^102$
ip as-path access-list 5 permit ^103$
ip as-path access-list 5 permit ^104$
ip as-path access-list 5 deny ^105_
!
```

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# ISP Transit

```
! Outbound Bogon prefixes to be blocked to eBGP peers
ip prefix-list upstream-out deny 0.0.0.0/8 le 32
ip prefix-list upstream-out deny 10.0.0.0/8 le 32
ip prefix-list upstream-out deny 127.0.0.0/8 le 32
ip prefix-list upstream-out deny 169.254.0.0/16 le 32
ip prefix-list upstream-out deny 172.16.0.0/12 le 32
ip prefix-list upstream-out deny 192.0.2.0/24 le 32
ip prefix-list upstream-out deny 192.168.0.0/16 le 32
ip prefix-list upstream-out deny 224.0.0.0/3 le 32
ip prefix-list upstream-out deny 0.0.0.0/0 ge 25
! Extra prefixes
ip prefix-list upstream-out deny 121.10.0.0/19 ge 20
ip prefix-list upstream-out permit 0.0.0.0/0 le 32
```

..next slide

# ISP Transit

```
! Inbound Bogon prefixes to be blocked from eBGP peers
ip prefix-list upstream-in deny 0.0.0.0/8 le 32
ip prefix-list upstream-in deny 10.0.0.0/8 le 32
ip prefix-list upstream-in deny 127.0.0.0/8 le 32
ip prefix-list upstream-in deny 169.254.0.0/16 le 32
ip prefix-list upstream-in deny 172.16.0.0/12 le 32
ip prefix-list upstream-in deny 192.0.2.0/24 le 32
ip prefix-list upstream-in deny 192.168.0.0/16 le 32
ip prefix-list upstream-in deny 224.0.0.0/3 le 32
ip prefix-list upstream-in deny 0.0.0.0/0 ge 25
! Extra prefixes
ip prefix-list upstream-in deny 121.10.0.0/19 le 32
ip prefix-list upstream-in permit 0.0.0.0/0 le 32
!
```

# ISP Transit

- Router B Configuration

```
router bgp 120
 neighbor 122.12.10.1 remote-as 130
 neighbor 122.12.10.1 prefix-list bogons in
 neighbor 122.12.10.1 prefix-list bogons out
 neighbor 122.12.10.1 filter-list 10 in
 neighbor 122.12.10.1 filter-list 15 out
!
ip as-path access-list 15 permit ^$
ip as-path access-list 15 permit ^100$
```

- Router B announces AS120 and AS100 prefixes to Router A, and accepts all AS130 customer ASes

# ISP Transit

- Router C Configuration

```
router bgp 120
 neighbor 122.12.20.1 remote-as 100
 neighbor 122.12.20.1 default-originate
 neighbor 122.12.20.1 prefix-list Customer100 in
 neighbor 122.12.20.1 prefix-list default out
!
ip prefix-list Customer100 permit 109.0.0.0/19
ip prefix-list default permit 0.0.0.0/0
```

- Router C announces default to Router D, only accepts customer /19

# ISP Transit

- Router D Configuration

```
router bgp 100
 network 109.0.0.0 mask 255.255.224.0
 neighbor 122.12.20.2 remote-as 120
 neighbor 122.12.20.2 prefix-list upstream out
 neighbor 122.12.20.2 prefix-list default in
!
ip prefix-list default permit 0.0.0.0/0
ip prefix-list upstream permit 109.0.0.0/19
!
ip route 109.0.0.0 255.255.224.0 null0
```

# ISP Transit

- AS130 only hears AS120 and AS100 prefixes

  inbound AS path filter on Router A is optional, but good practice (never trust a peer)

  Special Use Address prefix-list filters are required on all Internet peerings

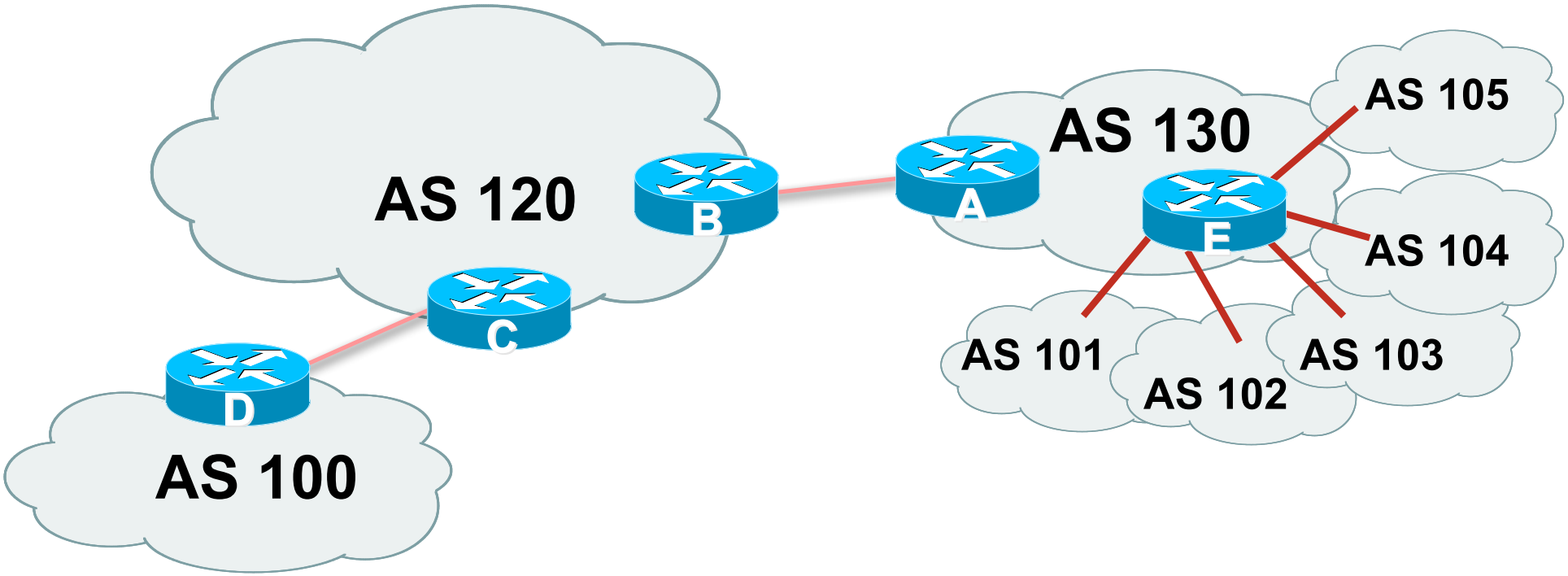
# ISP Transit Provider

## More complex Example 3

# ISP Transit

- AS130 and AS100 are stub/customer ASes of AS120
  - AS130 has many customers with their own ASes
    - AS105 doesn't get announced to AS120
  - AS120 provides transit between AS130 and AS100
- Same example as previously but using communities

# ISP Transit




- AS130 has several customer ASes connecting to its backbone

# ISP Transit

- Router A configuration is greatly simplified
  - all prefixes to be announced to upstream are marked with community 130:5100
  - route-map on outbound peering implements community policy
  - Martian prefix-lists still required

# ISP Transit

- Router A Configuration

```
router bgp 130
 network 121.10.0.0 mask 255.255.224.0 route-map setcomm
 neighbor 122.12.10.2 remote-as 120
 neighbor 122.12.10.2 prefix-list upstream-out out
 neighbor 122.12.10.2 route-map to-AS120 out
 neighbor 122.12.10.2 prefix-list upstream-in in
!
ip route 121.10.0.0 255.255.224.0 null0 250
!
```

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# ISP Transit

```
!
ip community-list 5 permit 130:5100
!
! Set community on local prefixes
route-map setcomm permit 10
 set community 130:5100
!
route-map to-AS120 permit 10
 match community 5
!
```

- upstream-in and upstream-out prefix-lists are the same as in the previous example

# ISP Transit

- Router E Configuration

```
router bgp 130
 neighbor x.x.x.x remote-as 101
 neighbor x.x.x.x default-originate
 neighbor x.x.x.x prefix-list customer101 in
 neighbor x.x.x.x route-map bgp-cust-in in
 neighbor x.x.x.x prefix-list default out
 neighbor x.x.x.x remote-as 102
 neighbor x.x.x.x default-originate
 neighbor x.x.x.x prefix-list customer102 in
 neighbor x.x.x.x route-map bgp-cust-in in
 neighbor x.x.x.x prefix-list default out
```

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# ISP Transit

```
 neighbor s.s.s.s remote-as 105
 neighbor s.s.s.s default-originate
 neighbor s.s.s.s prefix-list customer105 in
 neighbor s.s.s.s route-map no-transit in
 neighbor s.s.s.s prefix-list default out
!
! Set community on eBGP customers announced to AS120
route-map bgp-cust-in permit 10
 set community 130:5100
route-map no-transit permit 10
 set community 130:5199
```

- Notice that AS105 peering has no route-map to set the community policy

# ISP Transit

- AS130 only announces the community 130:5100 to AS120
- Notice how Router E tags the prefixes to be announced to AS120 with community 130:5100
- More efficient to manage than using filter lists

# Transit

## BGP configurations for a Transit ISP