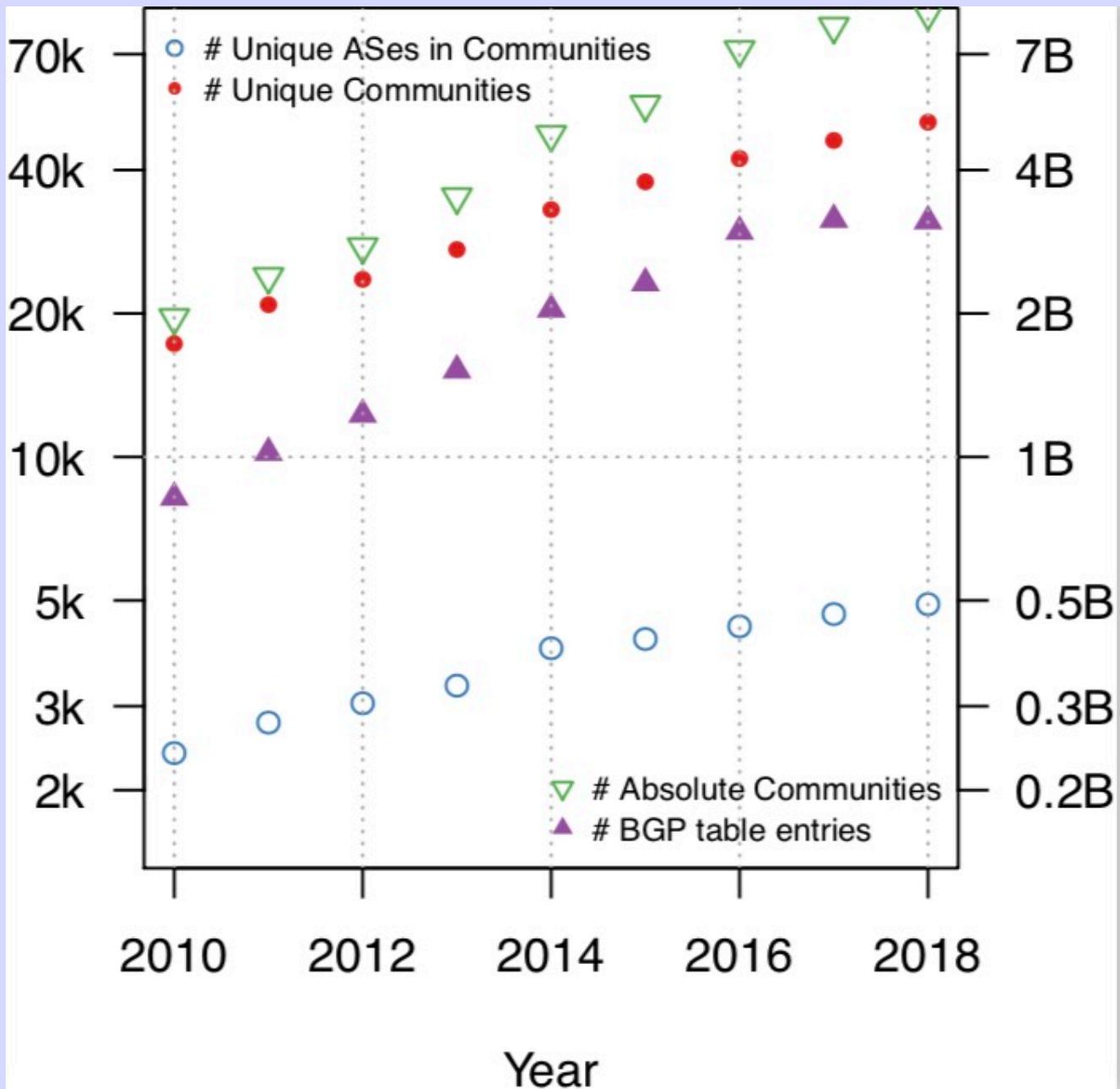


# Weaponizing BGP Using Communities

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Robert Beverly, Cristel Pelsser, Georgios  
Smaragdakis, Randy Bush, Anja Feldmann



# Ill-Defined Semantics

We have a syntax, **AS:<blarg>**

But there are no formal semantics, just convention and BCPs

We're putting semantics in comments

```
i = 0; /* i = 42 */
```

# Flavors, We Think

- Active
  - Path prepending
  - Modify local preference
  - Remote triggered blackholing
  - Selective announcements
- Passive
  - Location Tagging
  - RTT Tagging

And then  
anything a  
thousand  
kiddies  
have  
invented

# Propagation

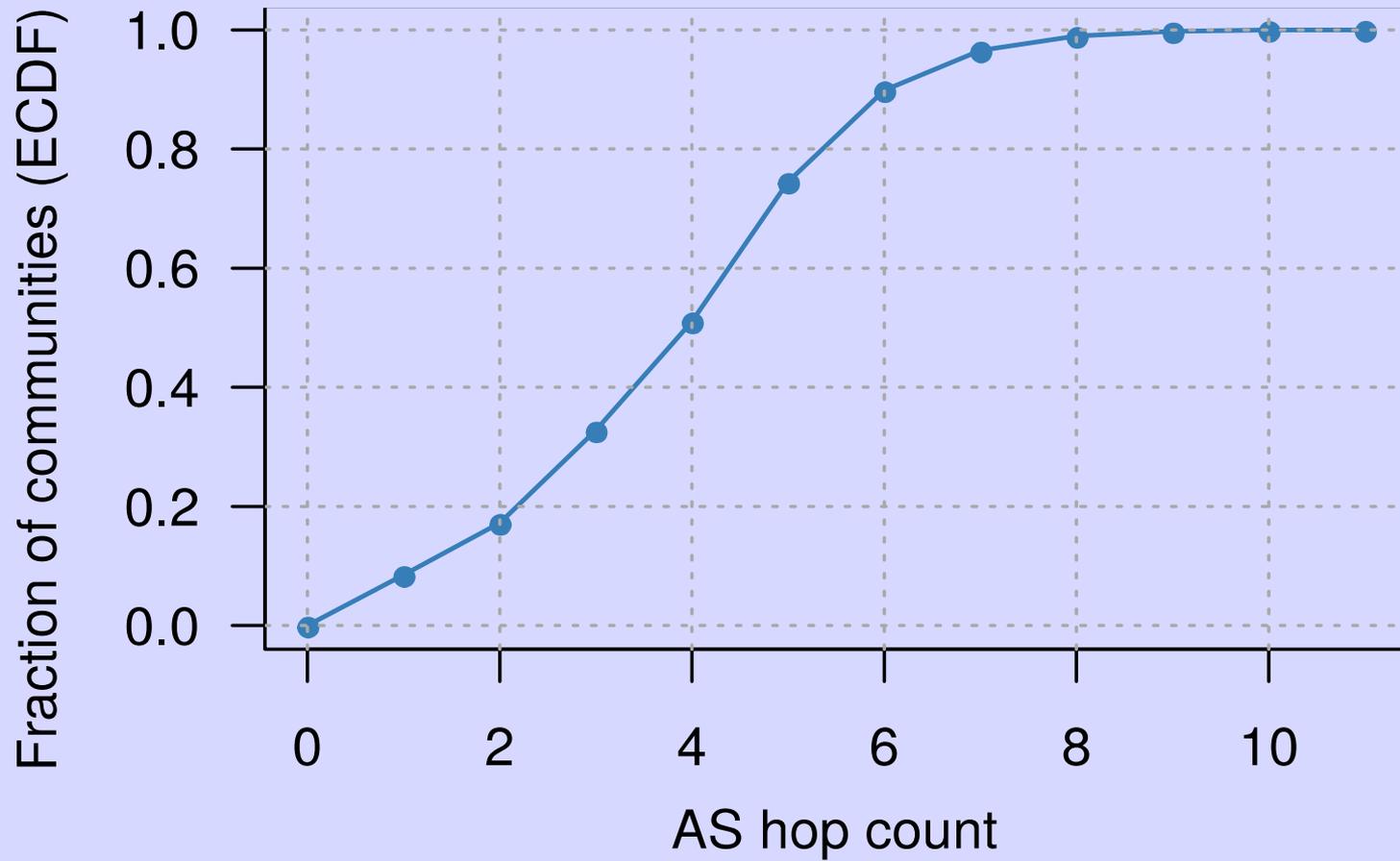
- RFC 1997: Communities are a transitive optional attribute
- RFC 7454: Scrub own, forward foreign communities
- So many people do not expect them to propagate that widely
- I, for one, did not

Only 14% of Transit  
ASs propagate  
communities

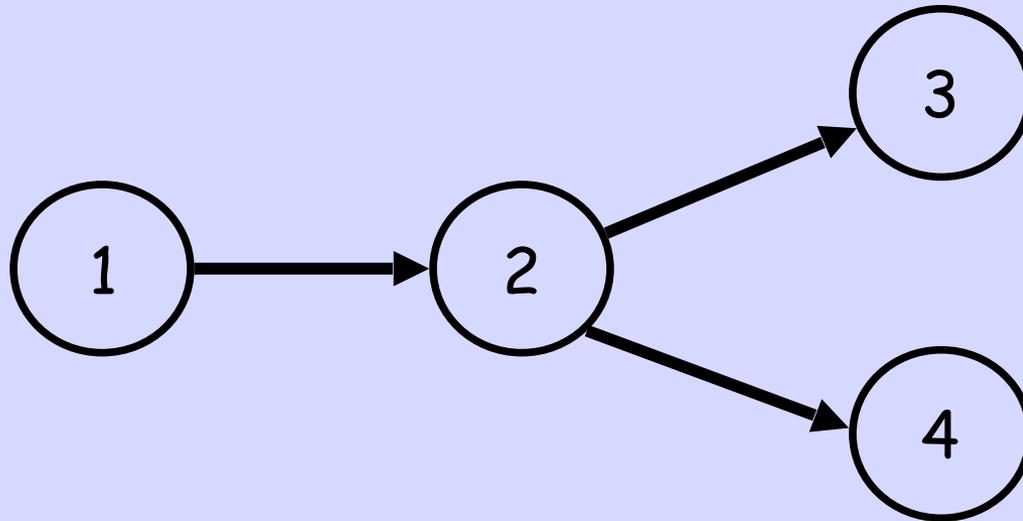
(2.2k of 15.5k)

# Surprise!

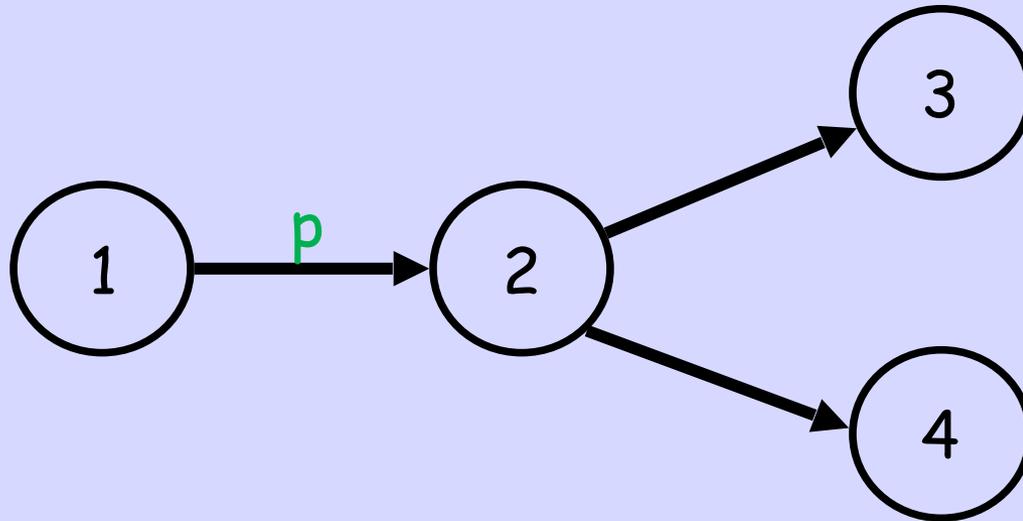
- 14% seems small, but AS graph is highly connected
- More than 50% of communities traverse more than four ASes
- 10% of communities have a hop count of more than six ASes
- Longest community propagation observed: through 11 ASes



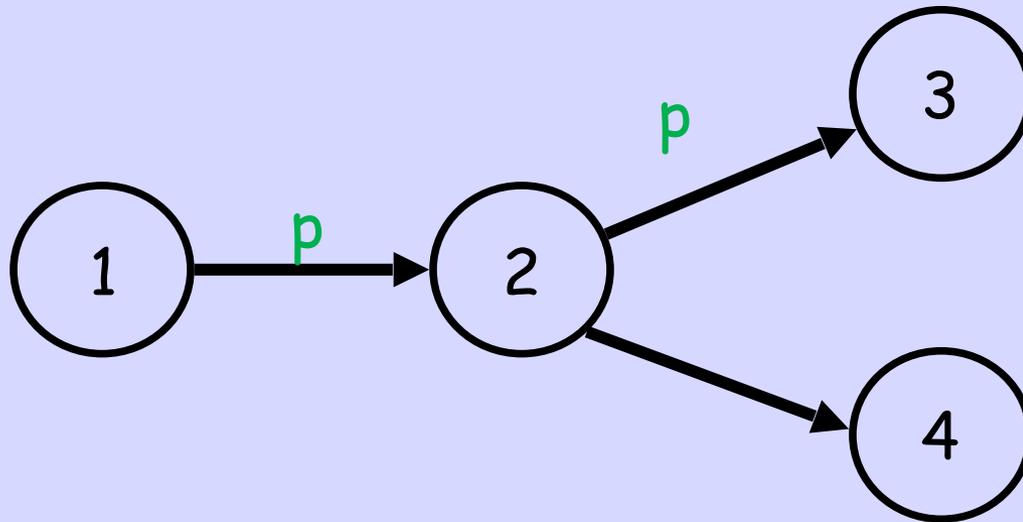
# On/Off Path



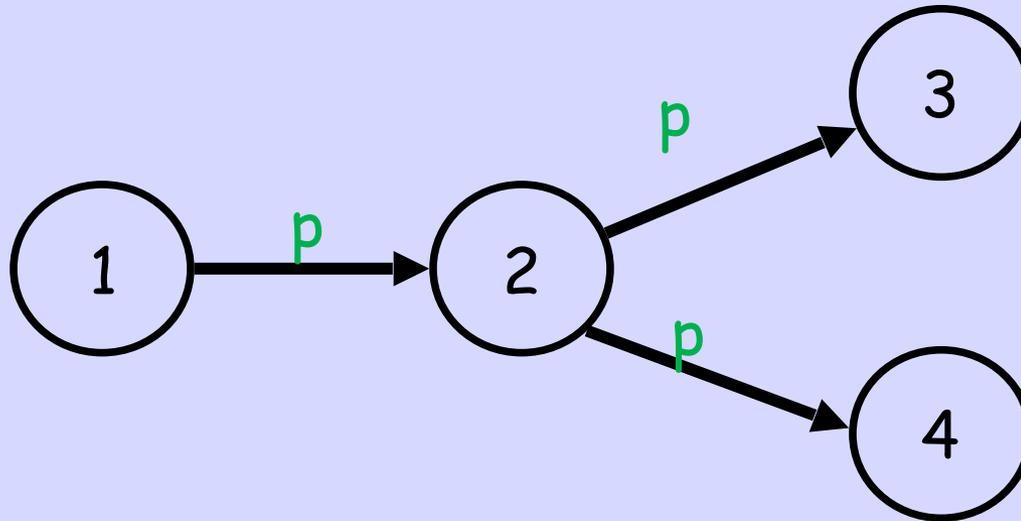
# On/Off Path



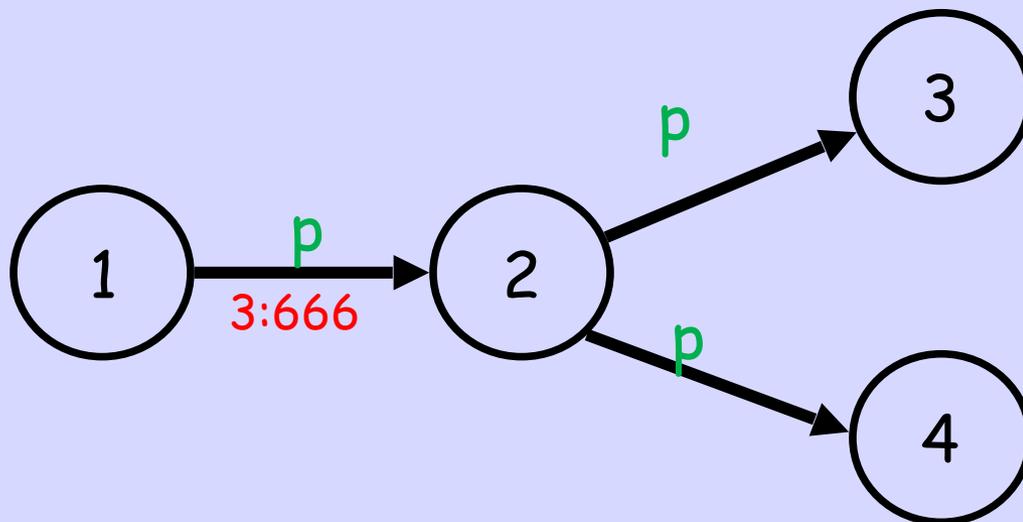
# On/Off Path



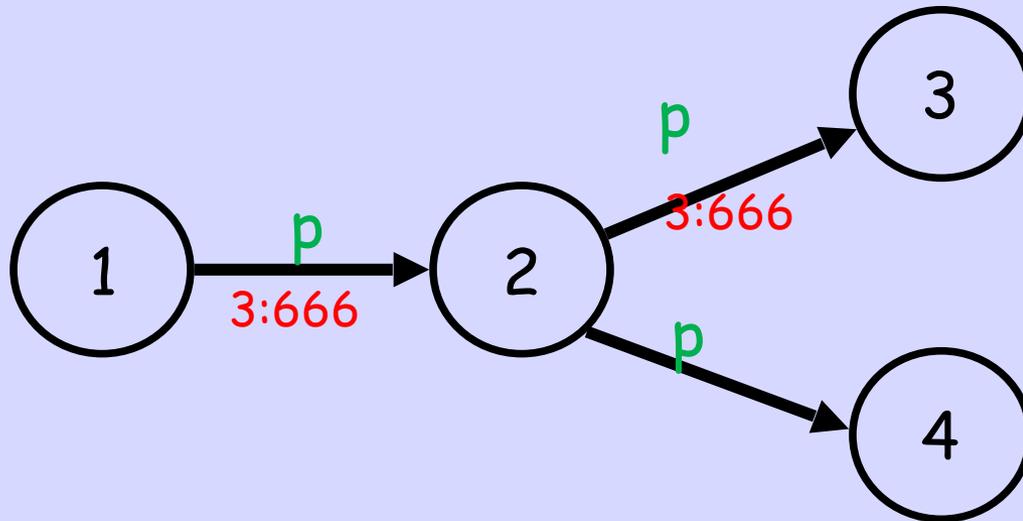
# On/Off Path



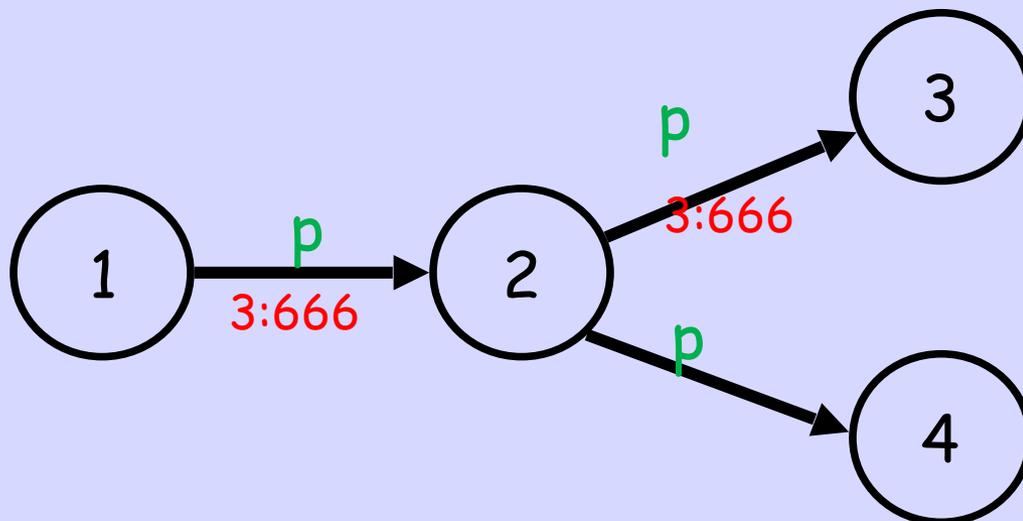
# On/Off Path



# On/Off Path

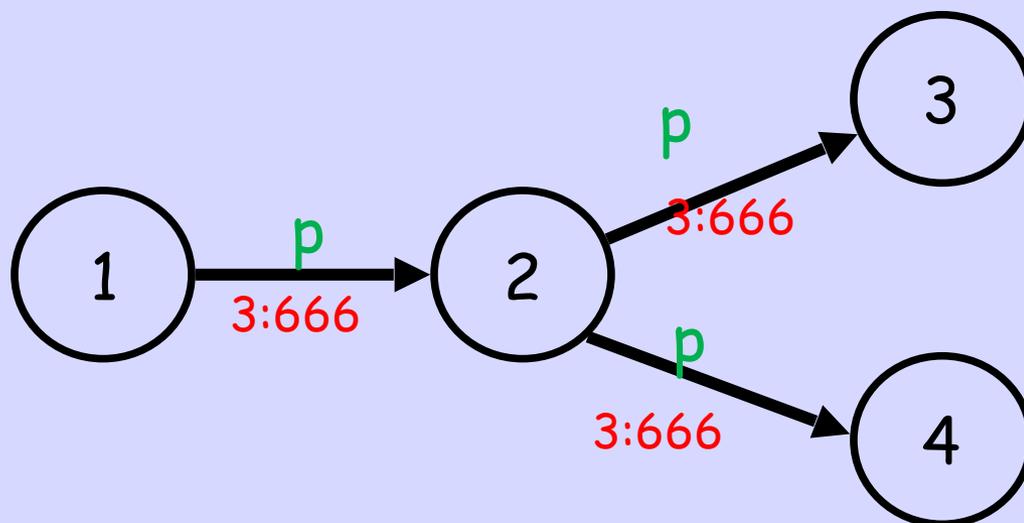


# On/Off Path



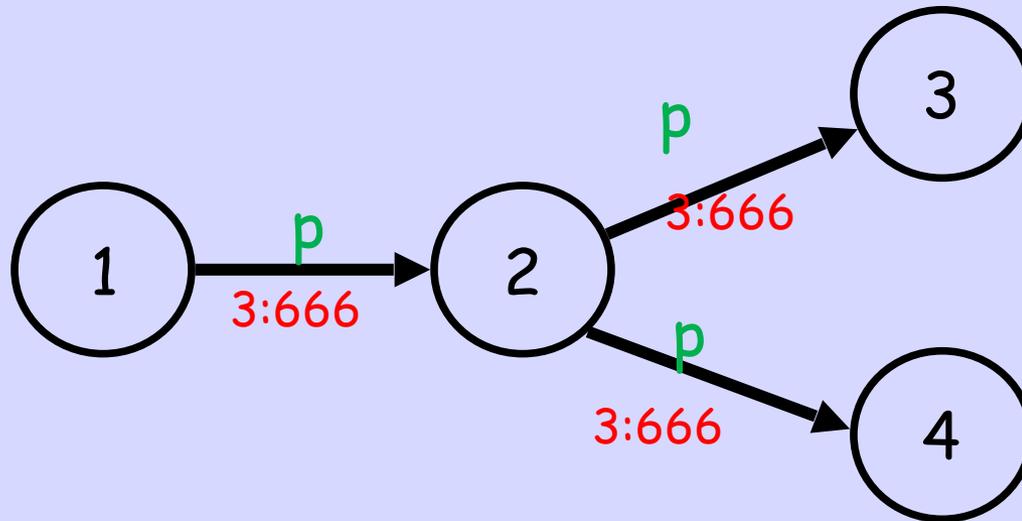
2 and 3 are On Path

# On/Off Path



2 and 3 are On Path

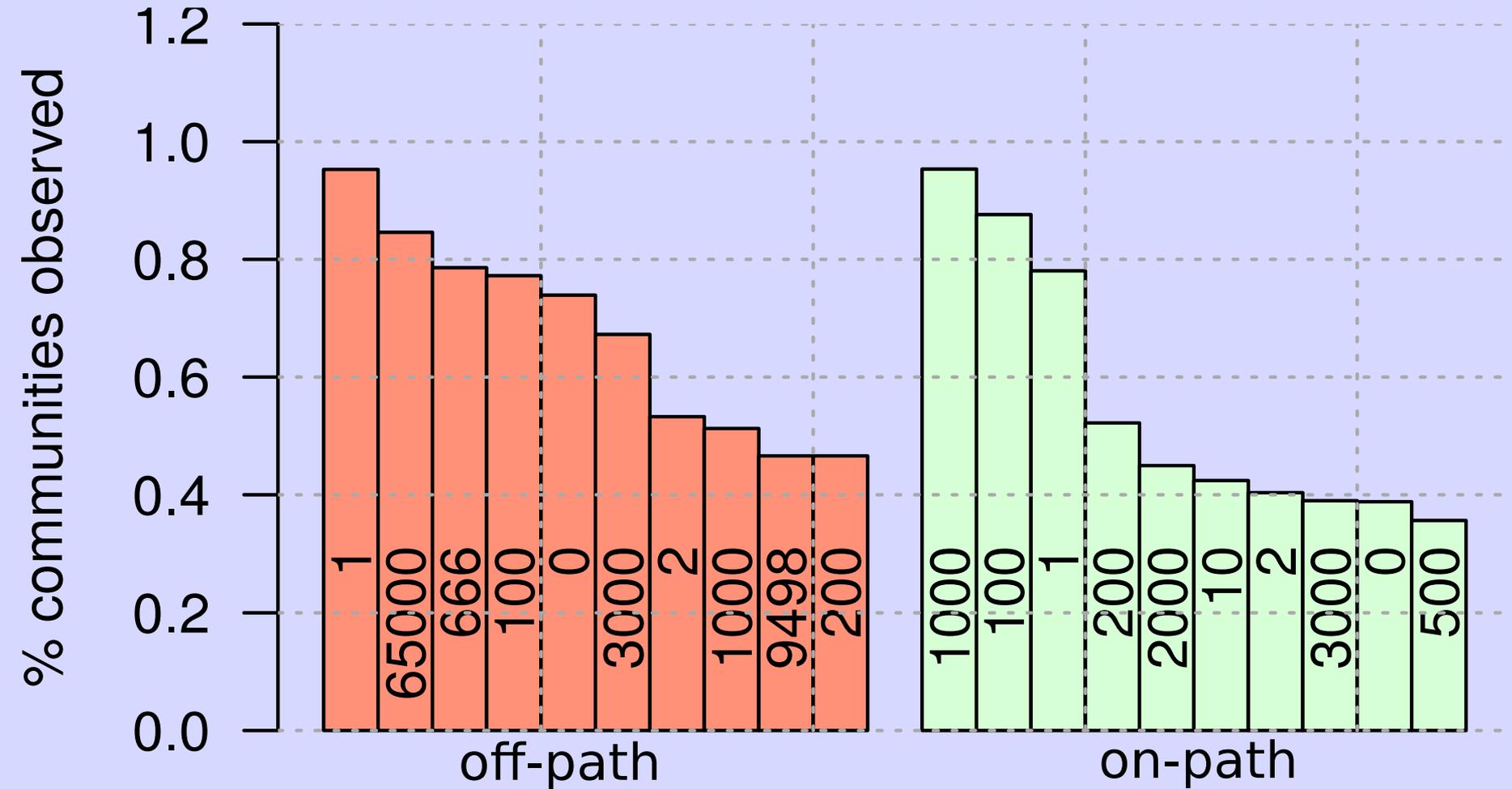
# On/Off Path



2 and 3 are On Path

4 is Off Path

# Observed Communities

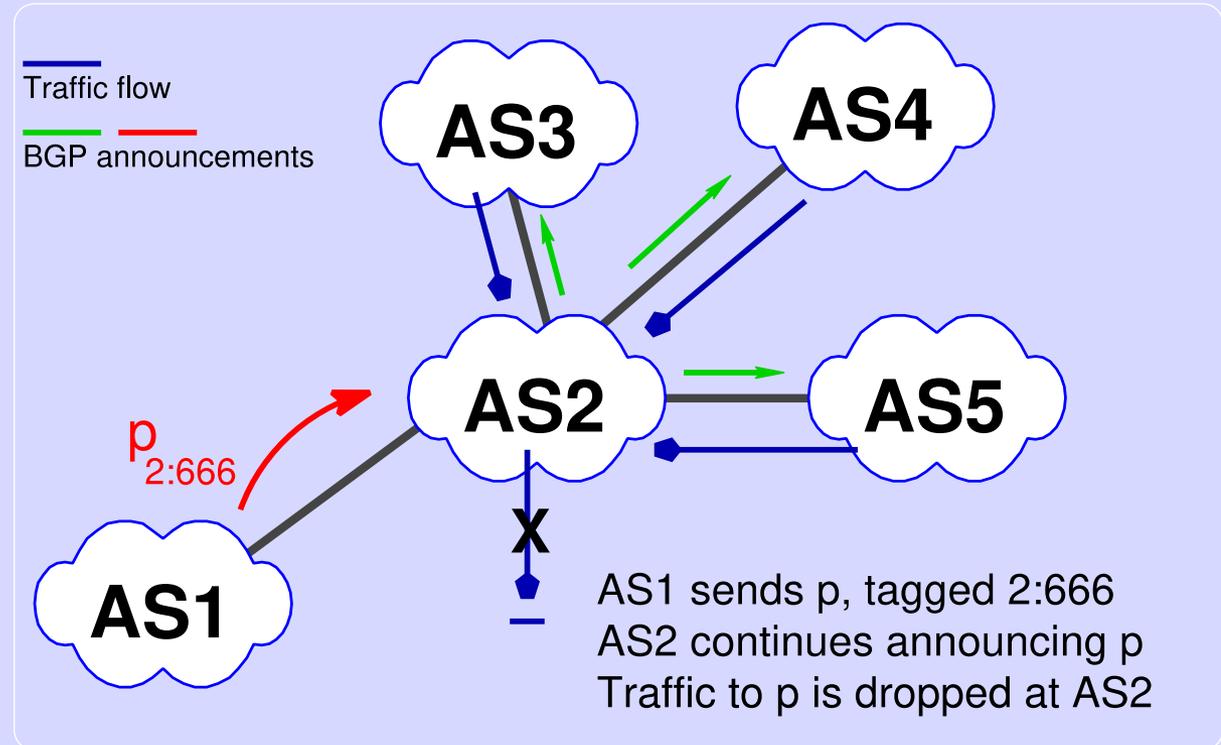


So Let's  
Break Things!

# Method to our Madness

- All experiments first tested in Lab
- Impacts were estimated
- Validated on the Internet, with operators' consent, e.g. for hijacks

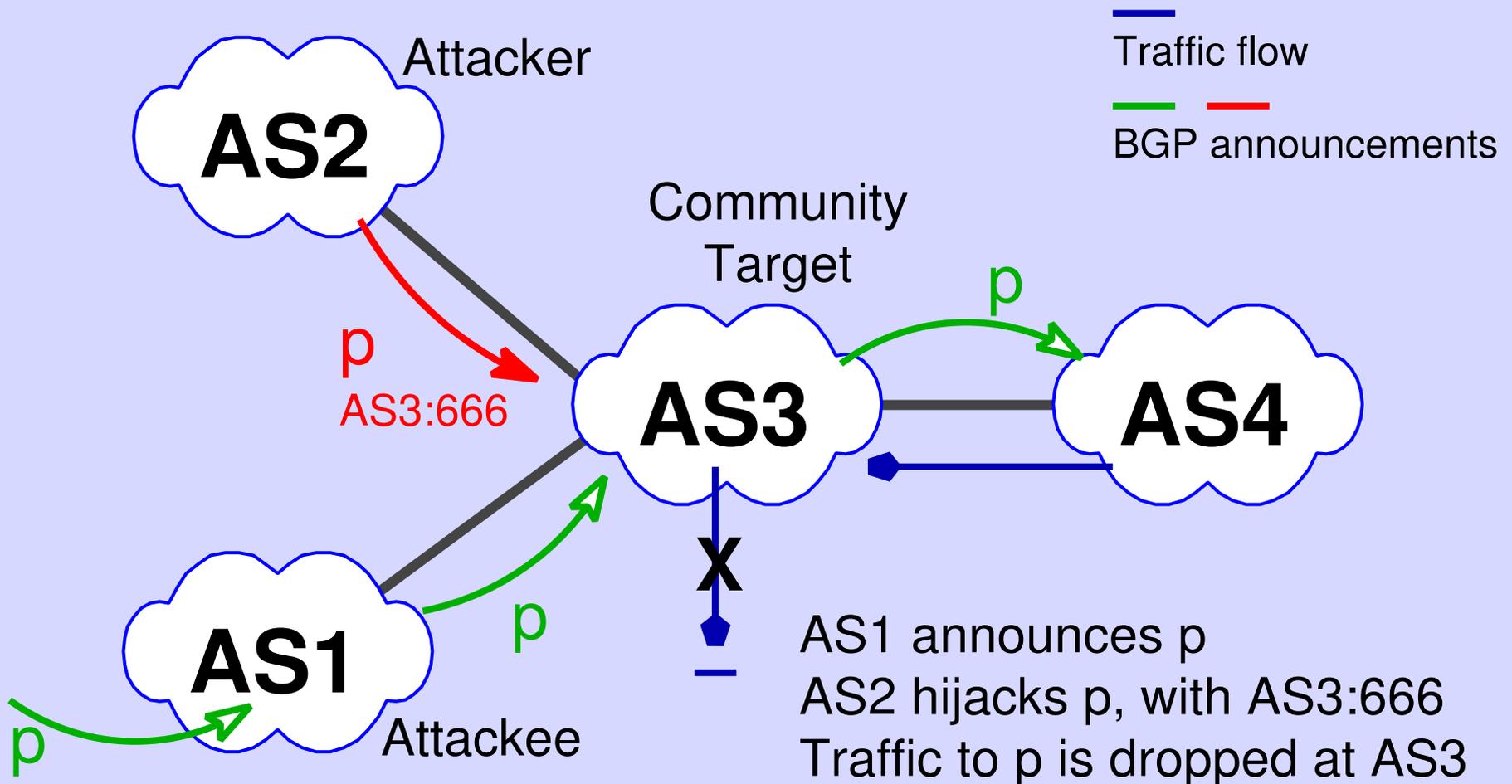
# Remote Triggered Black Hole



## Safeguards:

- Provider should check customer prefix before accepting RTBH
- Customer may only blackhole own prefixes
- Different policies for Customers/Peers
- On receiving RTBH, add no-export

# What Can Happen



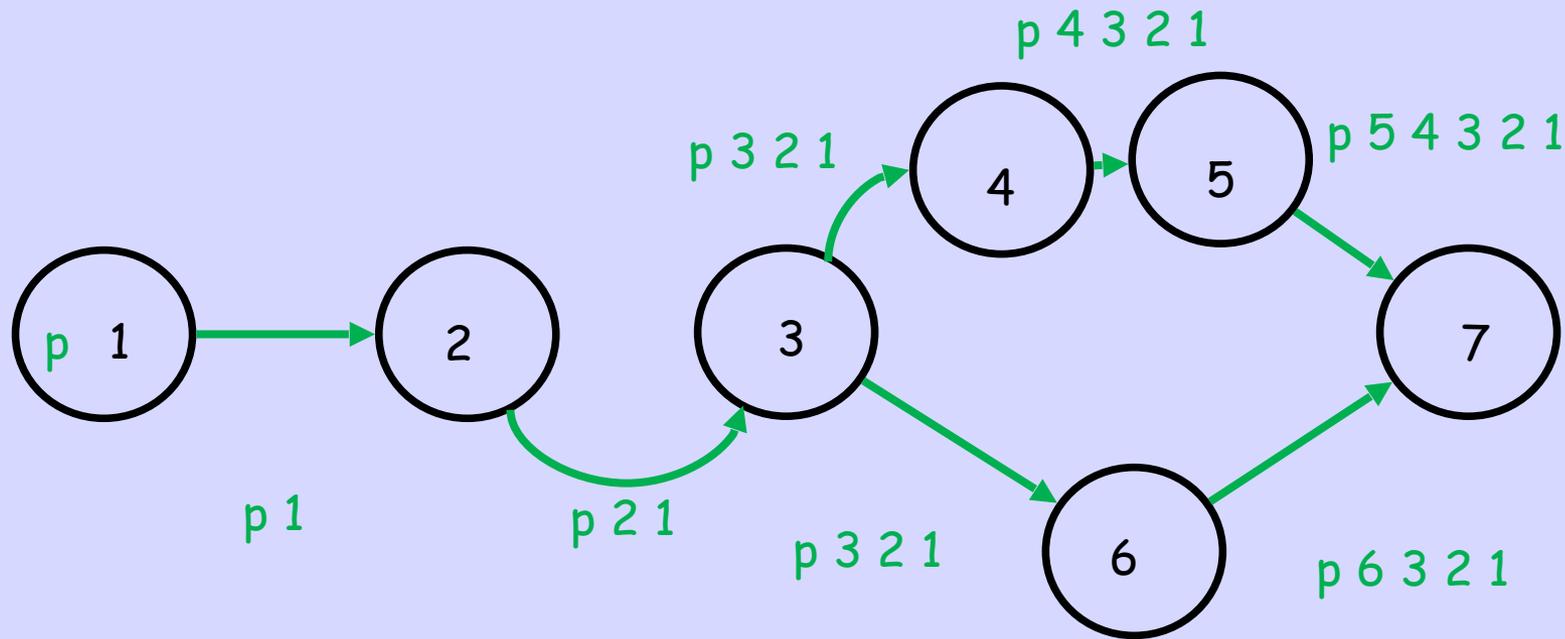
# It Works Well

- Works multi-hop and is hard to spot
- Triggering RTBH is possible for attackers because, e.g.,:
  - BH prefix is more specific, thus accepted via exception
  - Providers check BH community before prefix filters (bug in NANOG recipe)
  - No validation for origin of community is possible

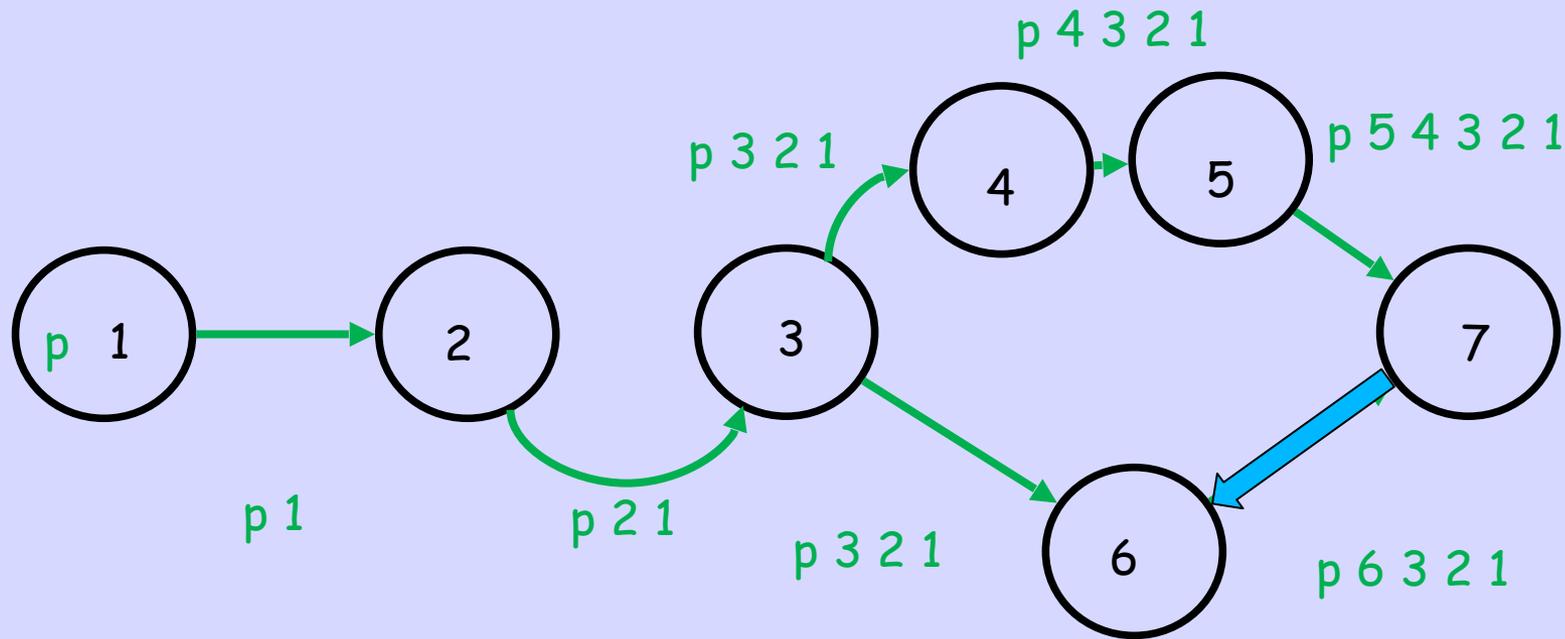
# Traffic Steering

p 4 3 2 1

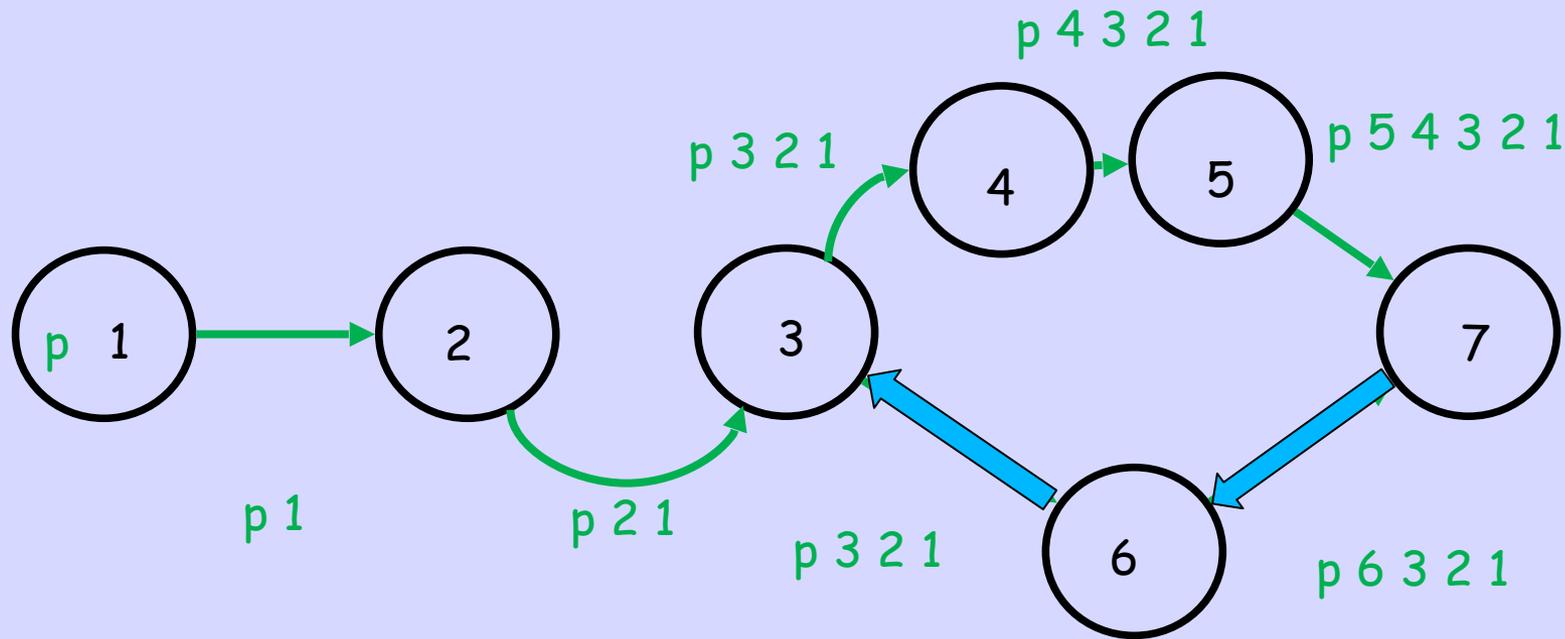
# Traffic Steering



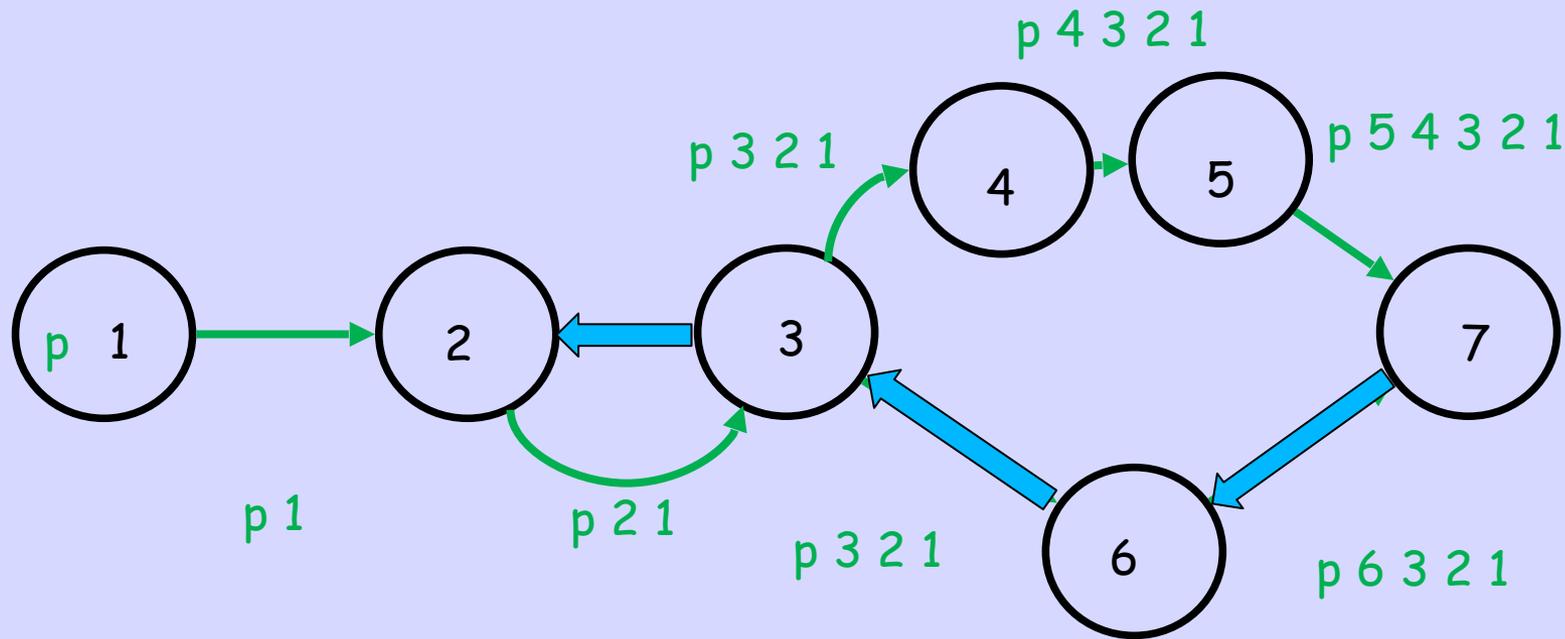
# Traffic Steering



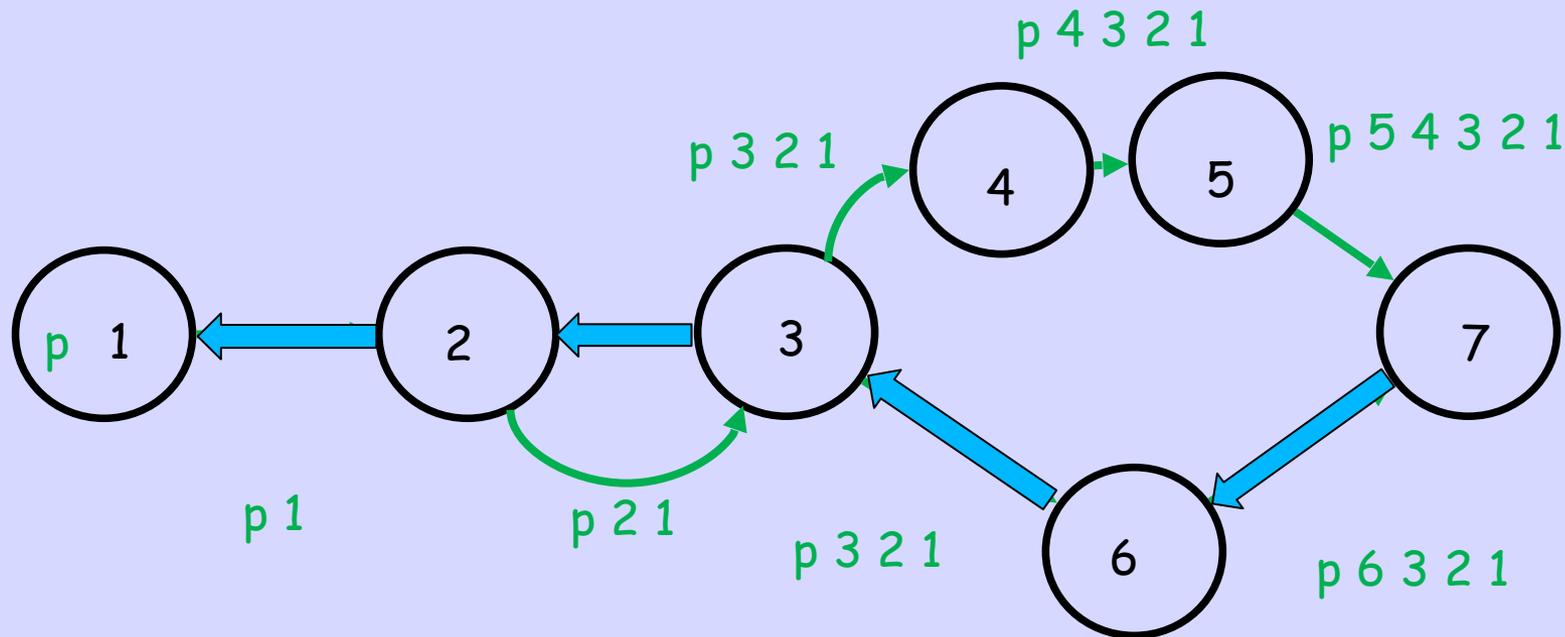
# Traffic Steering



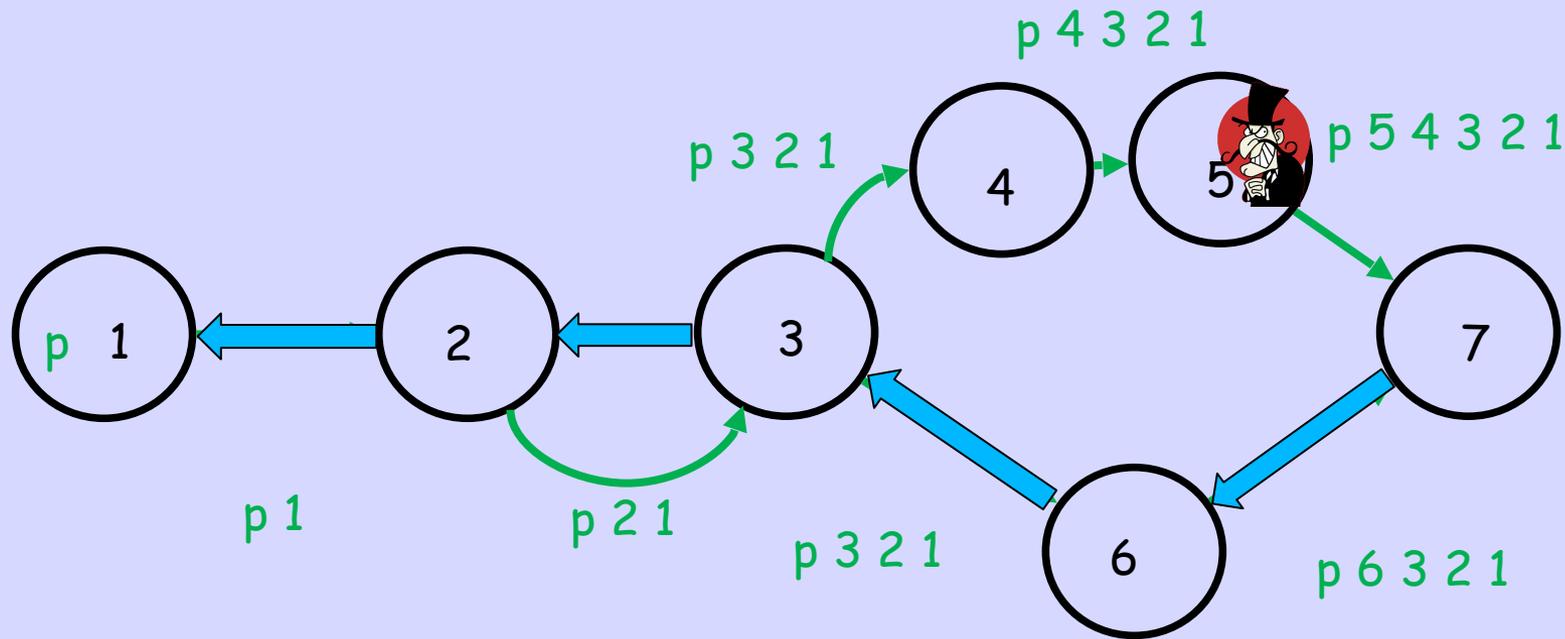
# Traffic Steering



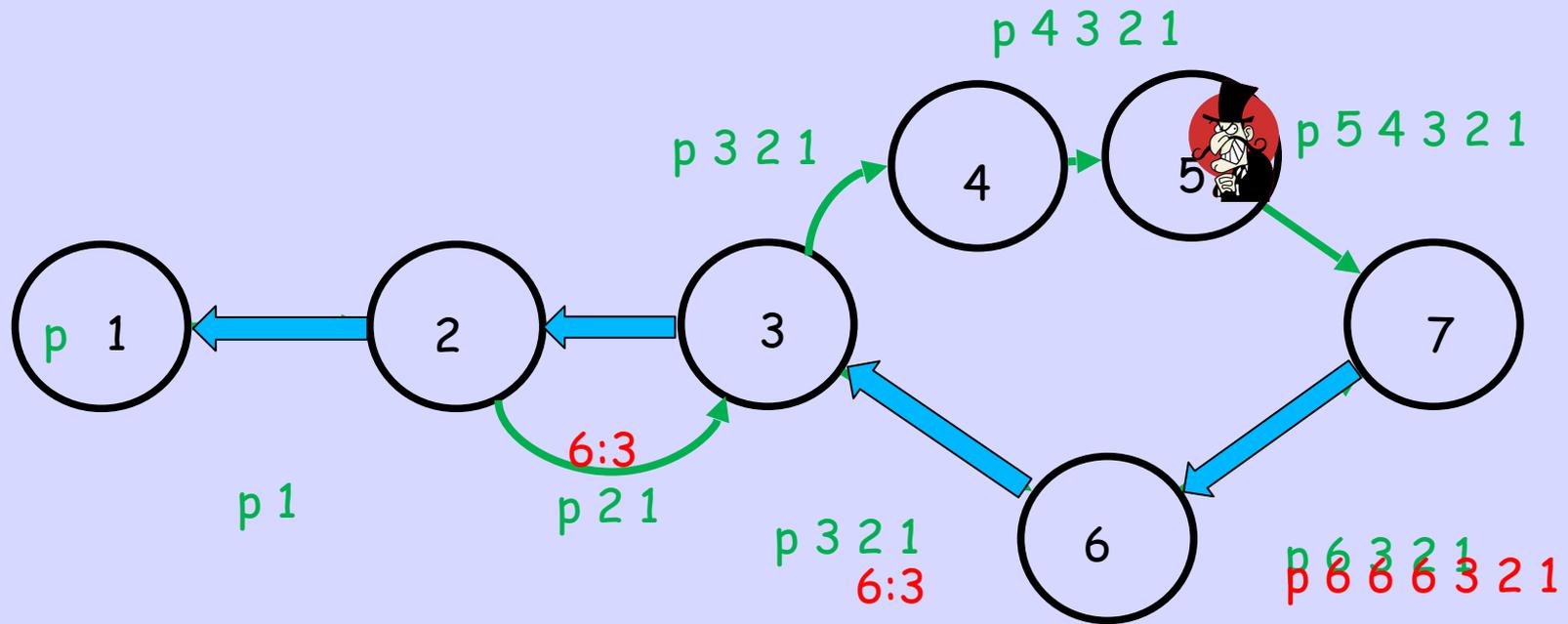
# Traffic Steering



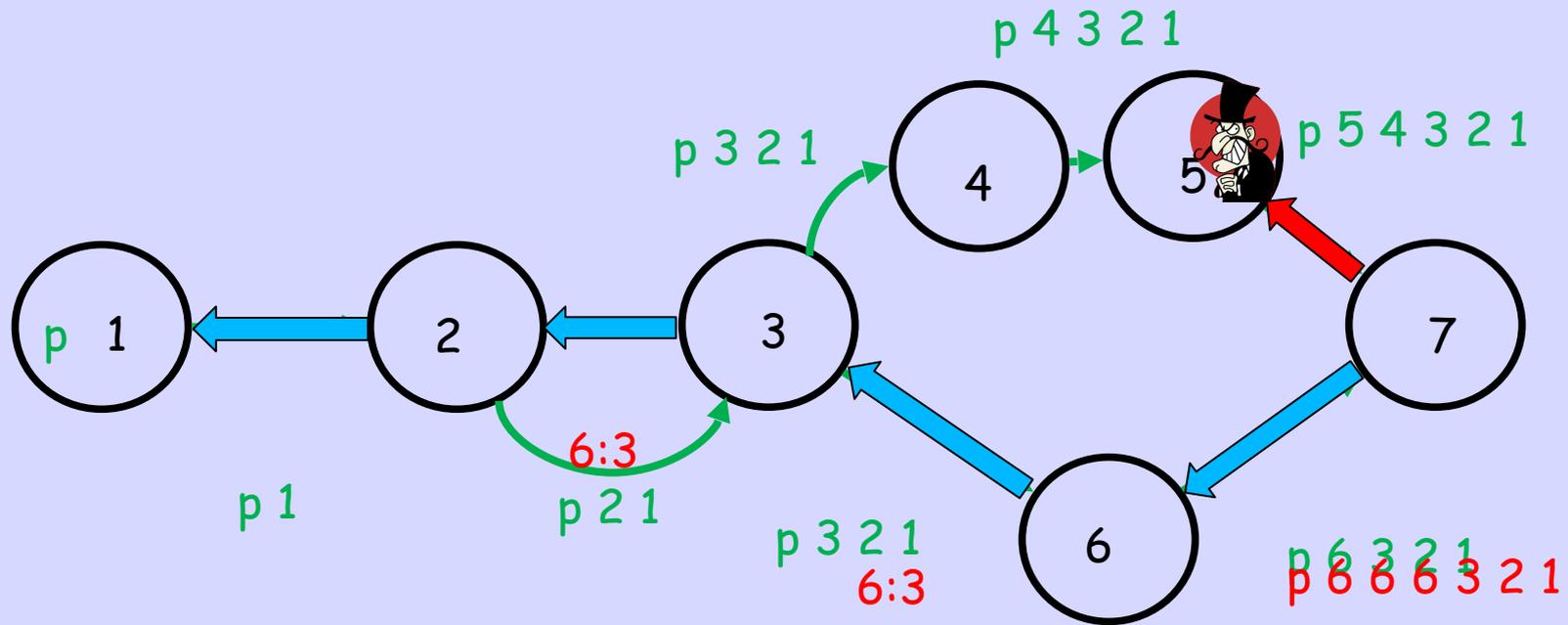
# Traffic Steering



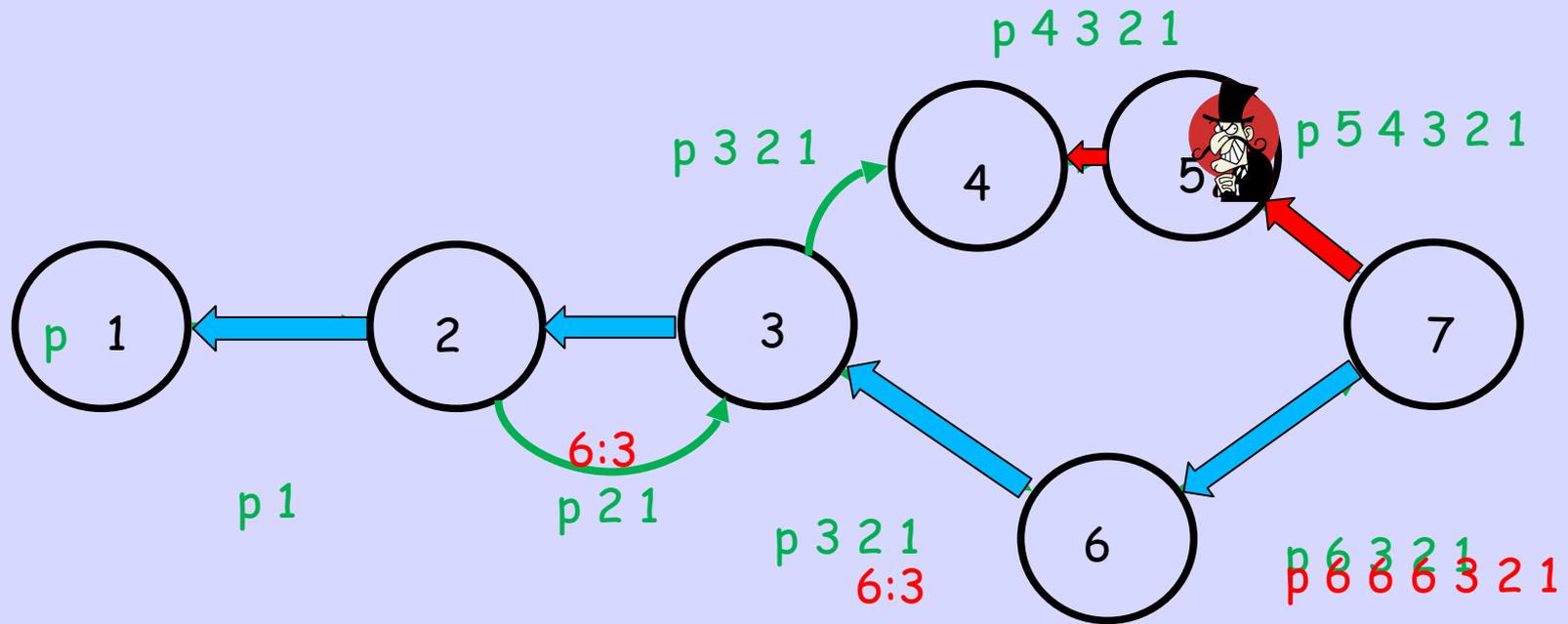
# Traffic Steering



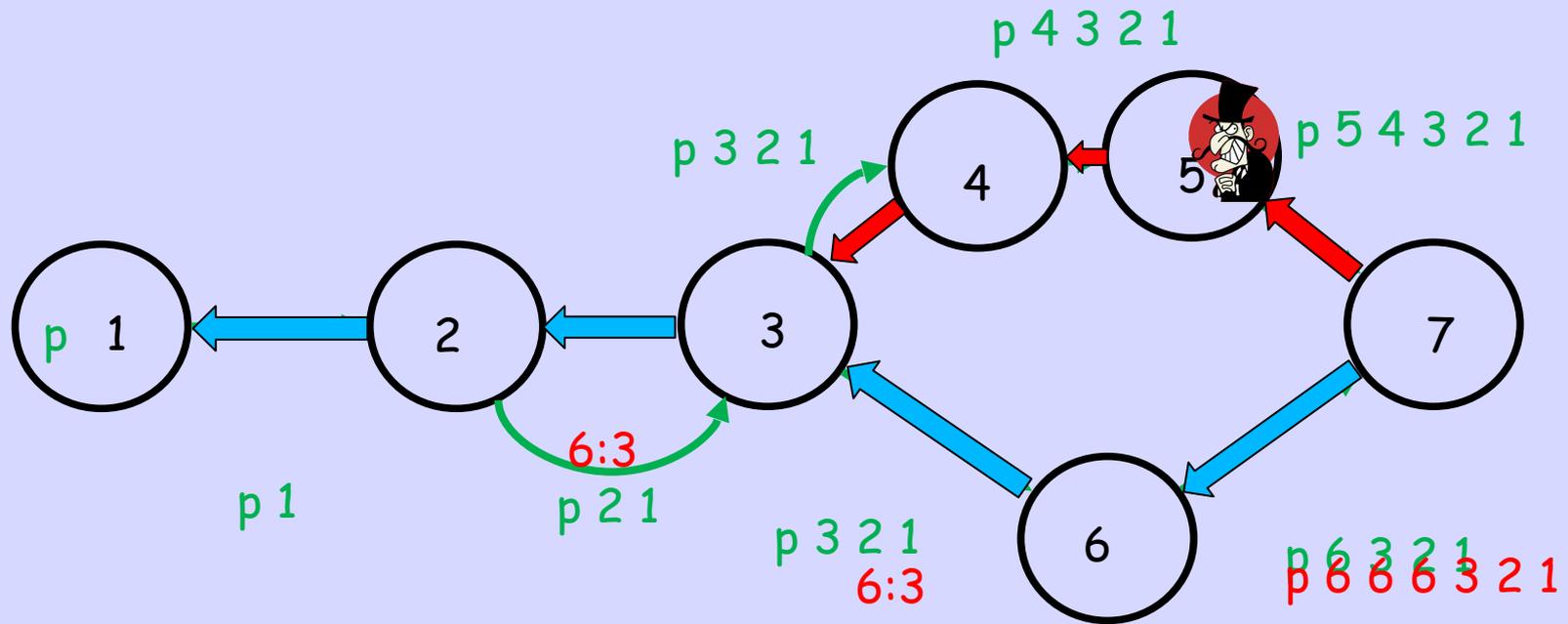
# Traffic Steering



# Traffic Steering



# Traffic Steering



That's Not  
Realistic

# Oh Yeah?

<https://dyn.com/blog/bgp-dns-hijacks-target-payment-systems/>

"BGP hijacks made use of BGP communities to shape route propagation. Although they also changed origins, which was the giveaway."

# It's the Cloud, Man

- ASN value ambiguous: who is "sender", "recipient"
- No defined semantics, values can mean anything
- Used both for signaling and triggering of actions
- No cryptographic protection
- Attribution is impossible
- It is hard to apply filters or understand what is going on

# I Read it on the Internet

- Communities can be modified, added, removed by every AS
- No attribution is possible
- No cryptographic protection
- Yet operators bet on their 'correctness'
- Large communities partially improve the situation

# Don't Propagate Without Thinking Very Deeply

- On Input - Drop anything not addressed to you, unless special agreement
- On Output - Drop everything except signals from you to the direct peer
- And Beware Cisco 'mis-feature' re well known communities

draft-ietf-grow-wkc-behavior-00

# ONLY **YOU** CAN PREVENT WILDFIRES

Ad Council  U.S.   
SMOKEYBEAR.COM

