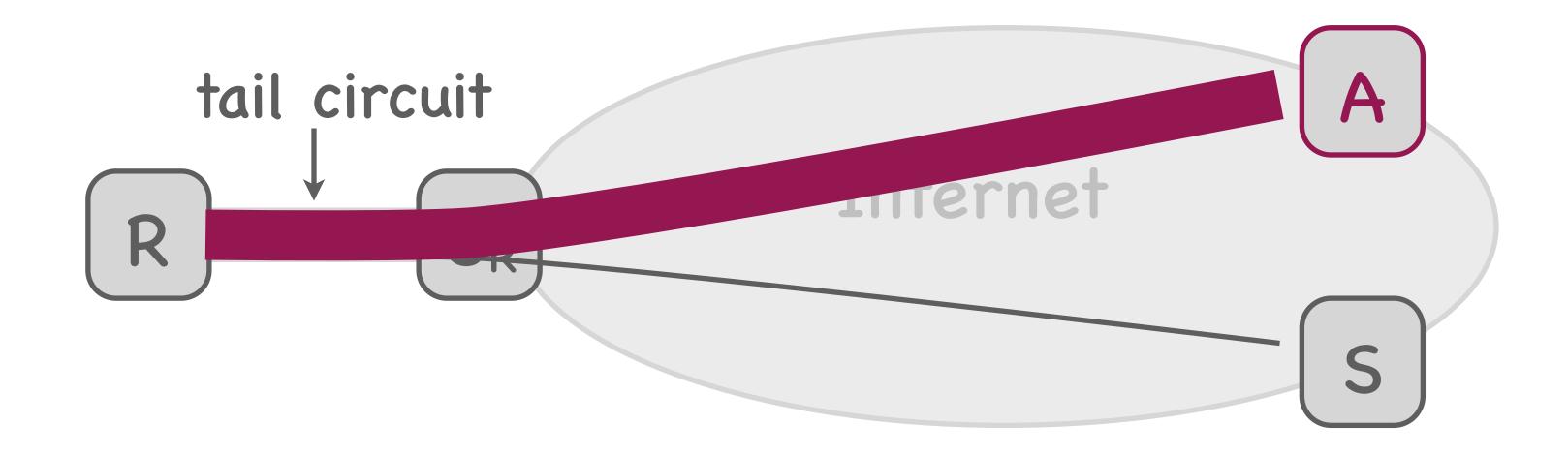


# POCS: Blocking Internet Flooding

Prof. Katerina Argyraki

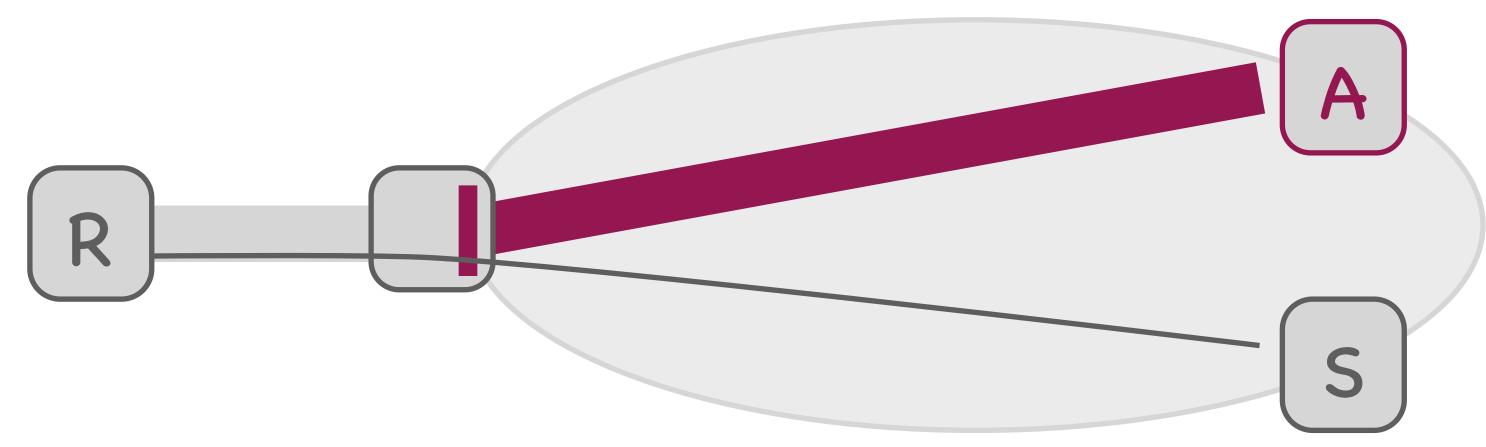
School of Computer & Communication Sciences

# Bandwidth flooding



Target: tail-circuit bandwidth

### Network filtering



State: {A, R}

Functionality: if ({packet.src, packet.dst} in State) block packet;

Block attackers at the receiver's gateway

### State



State: {attacker, receiver} pairs

Where: receiver's gateway

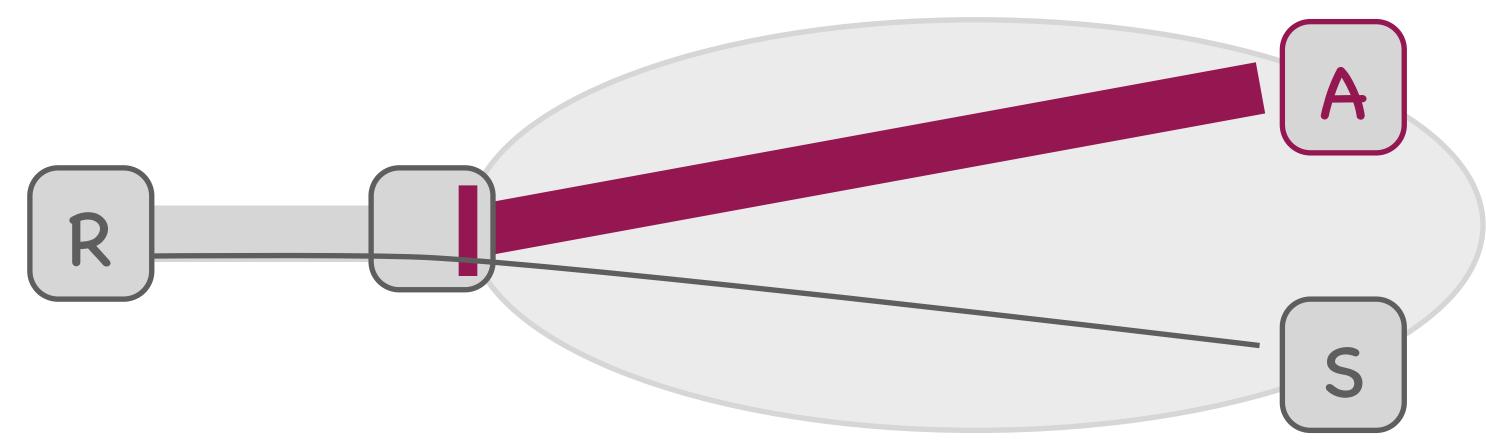
Managed: locally

#### Internet routers



#### Network filtering is expensive

### Network filtering

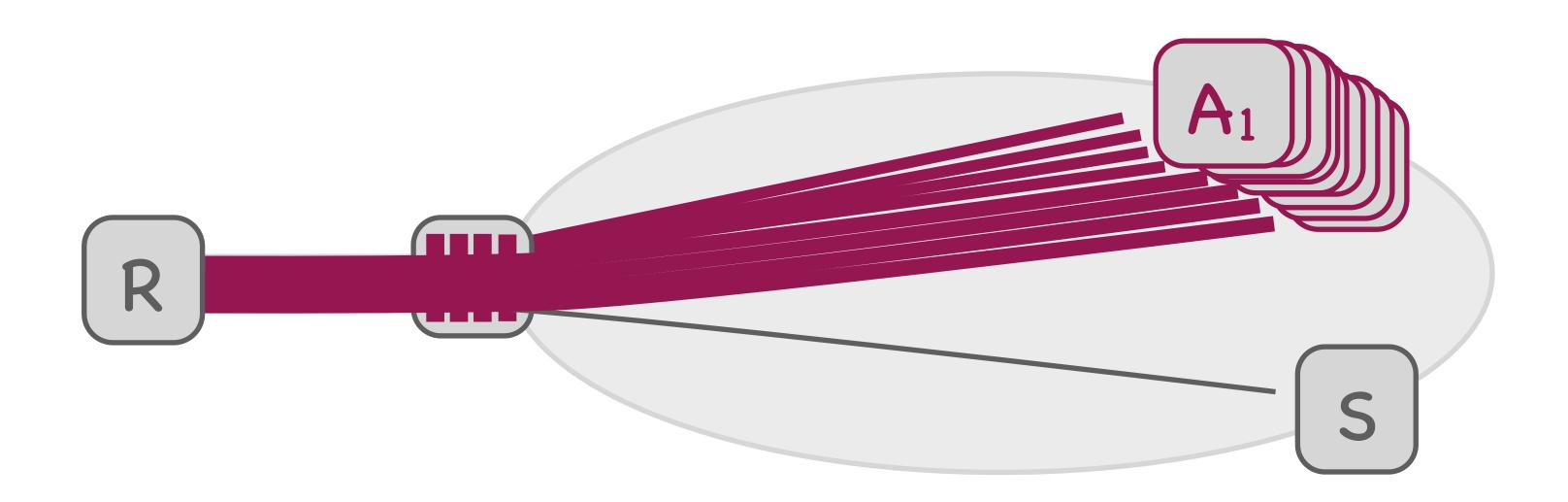


State: {A, R}

Functionality: if ({packet.src, packet.dst} in State) block packet;

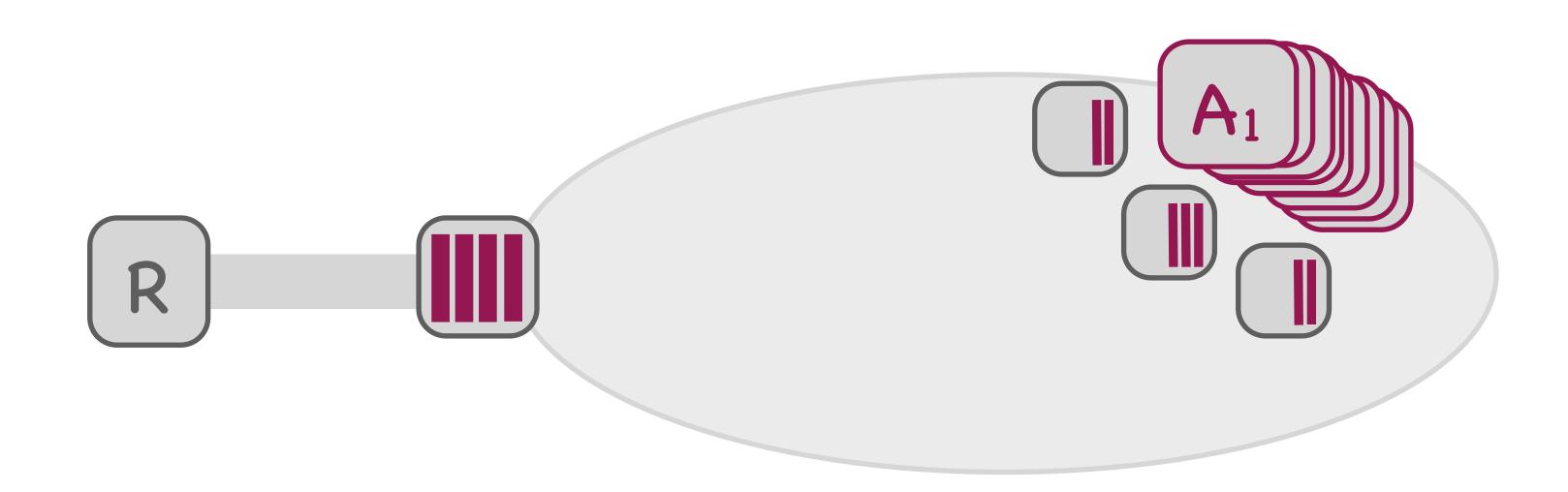
Block attackers at the receiver's gateway

# Distributed flooding



Target: filtering resources + tail circuit

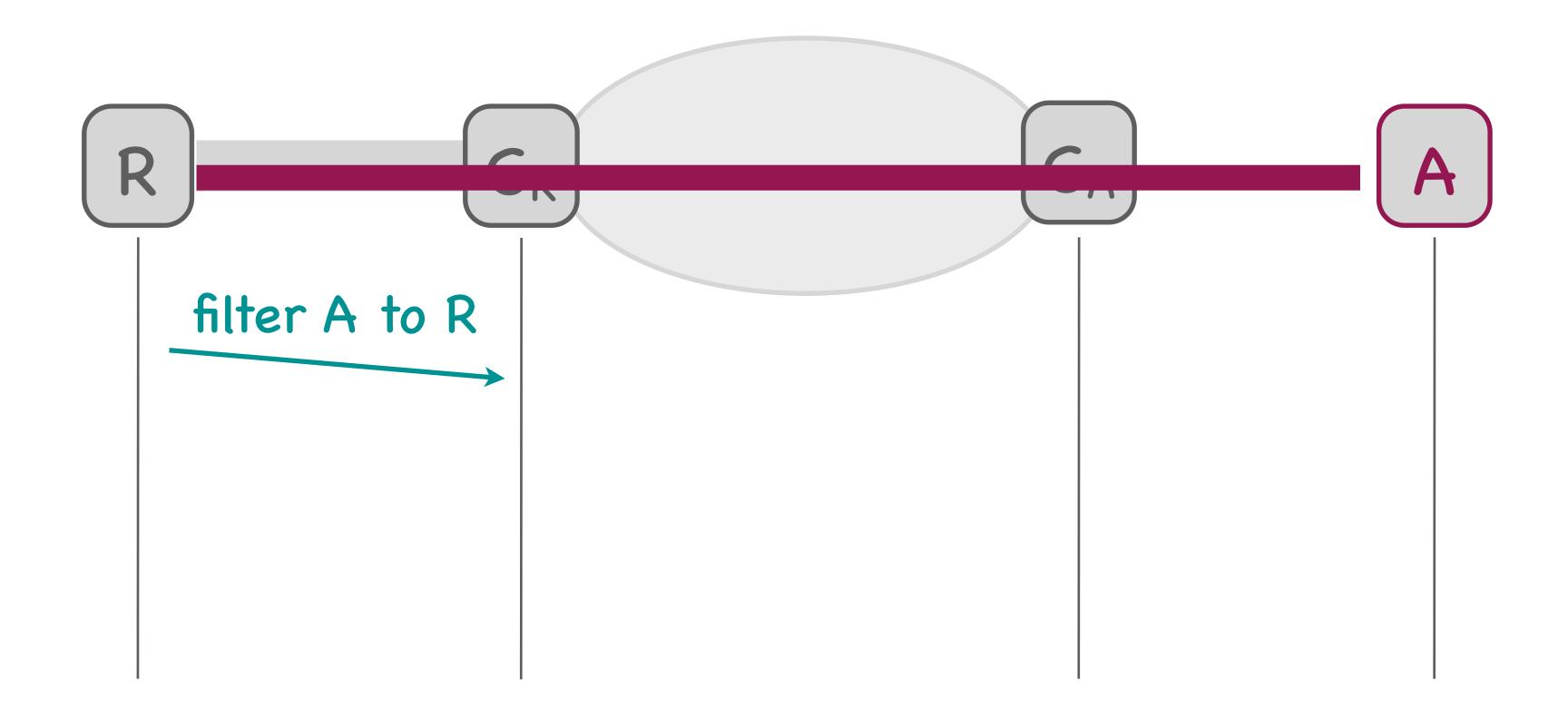
### Distributed filtering



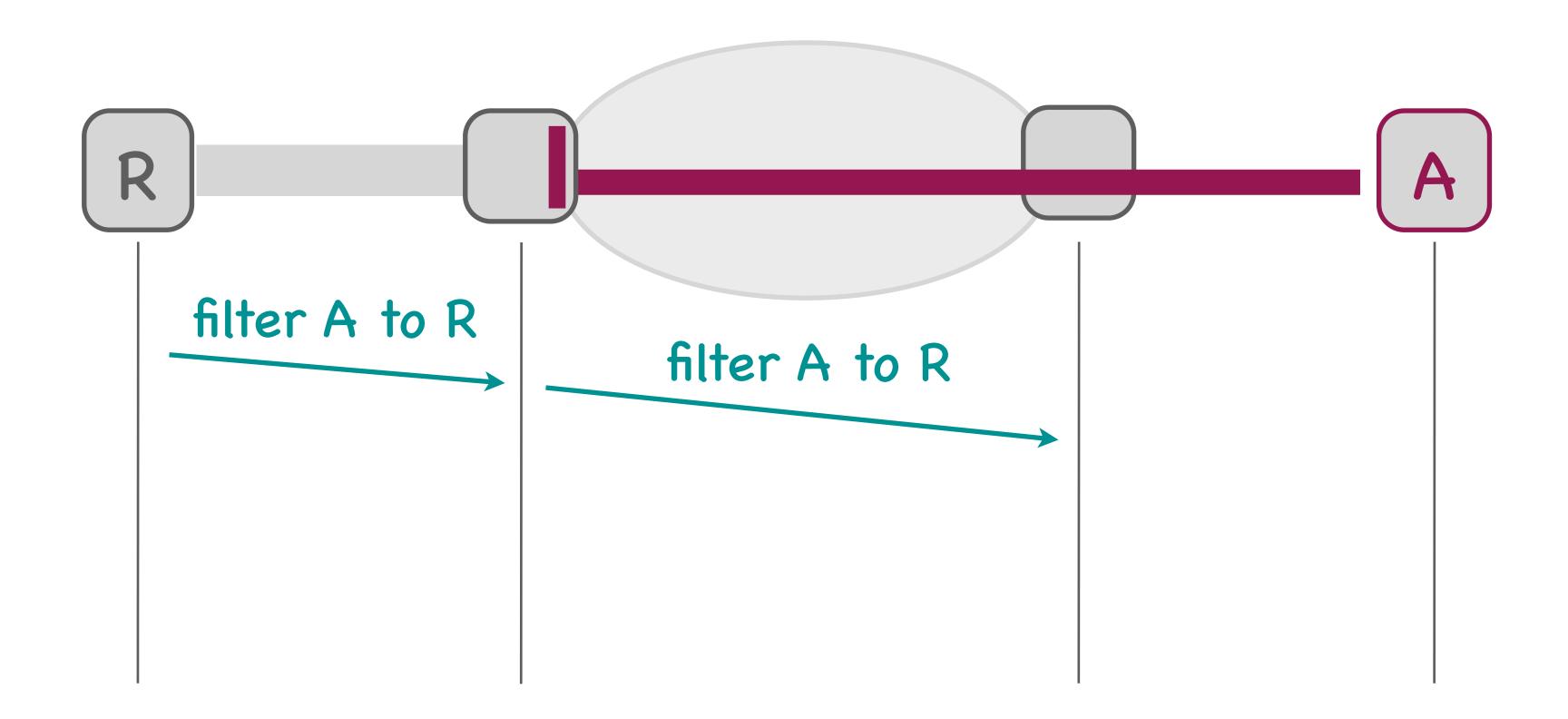
Identify routers close to attack sources
Ask them to block attack traffic

Need a filter-propagation protocol

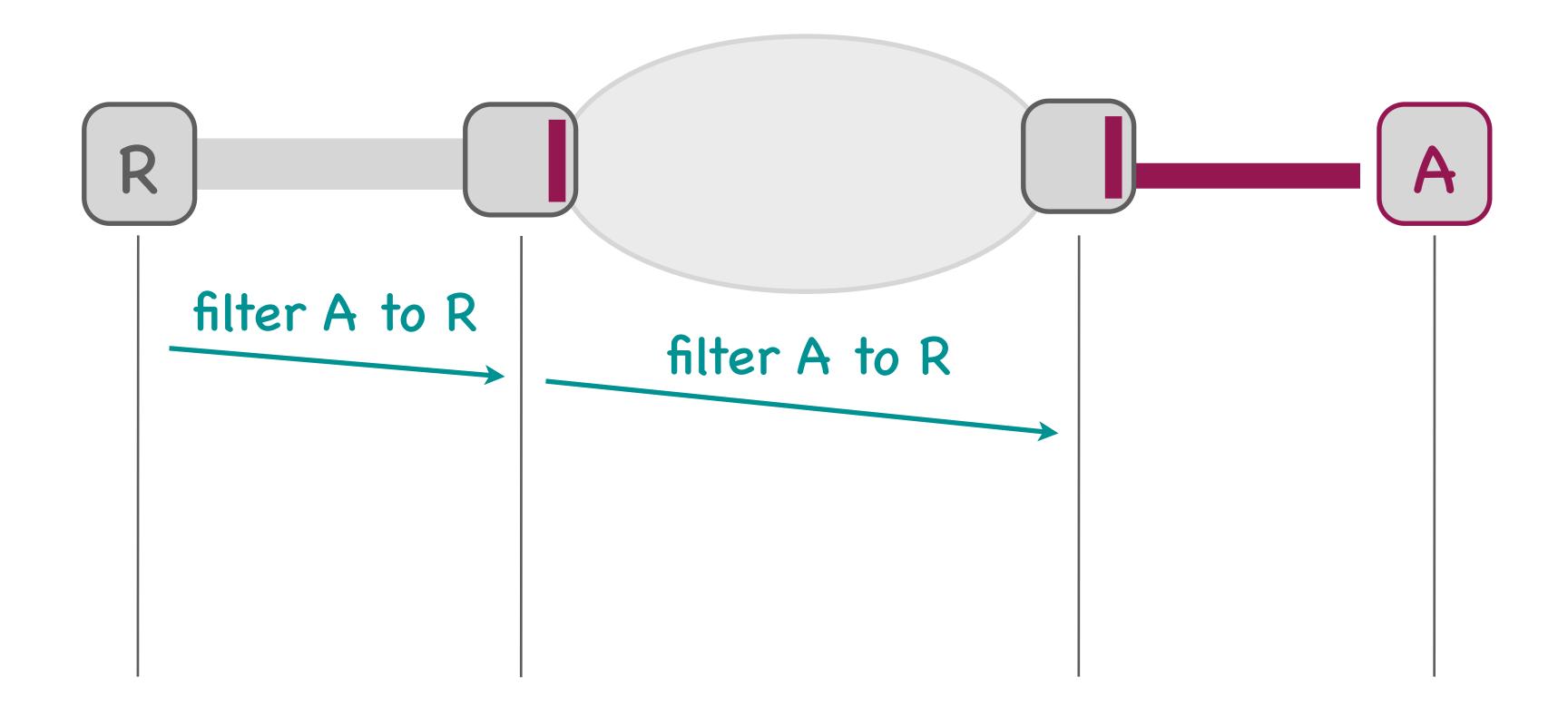
# Filter propagation



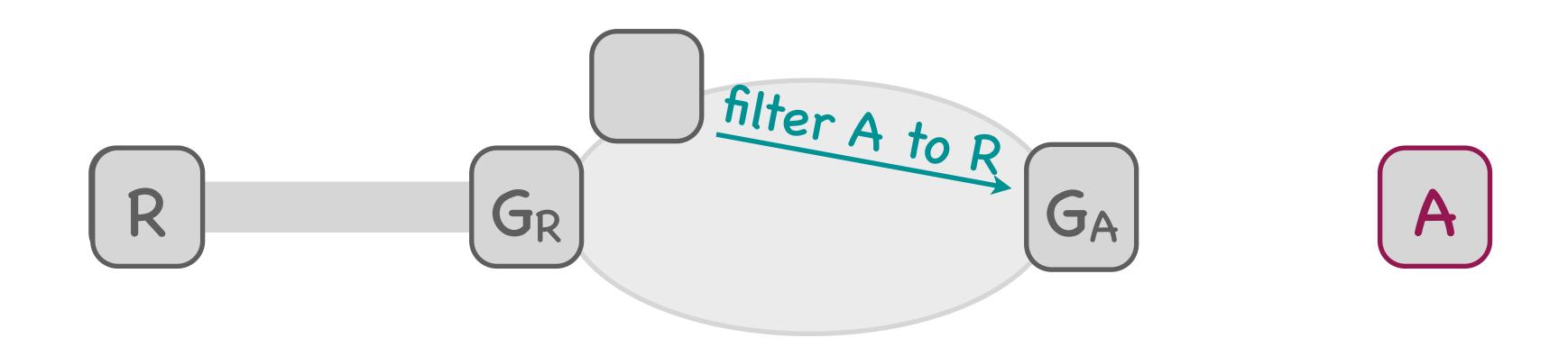
# Filter propagation



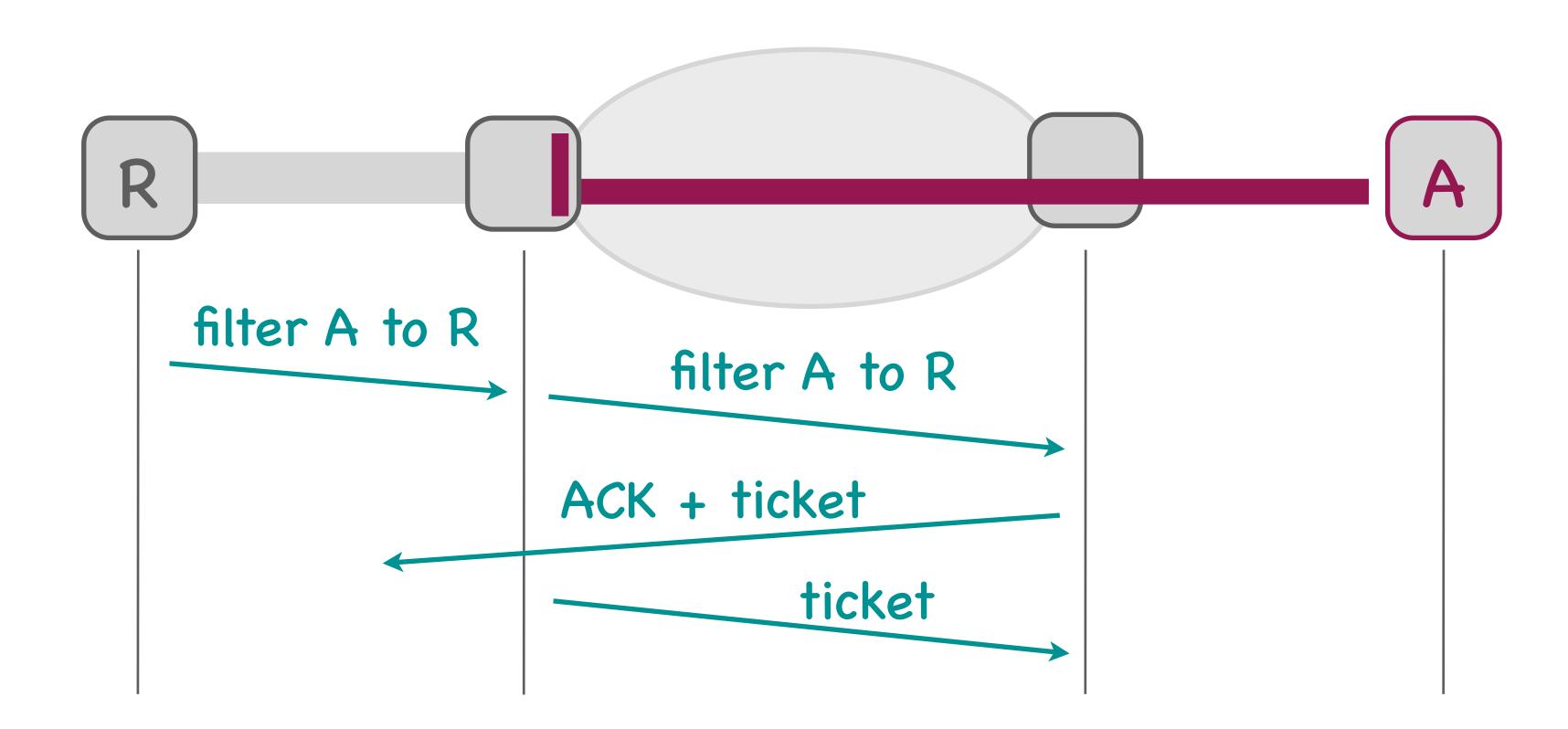
# Filter propagation



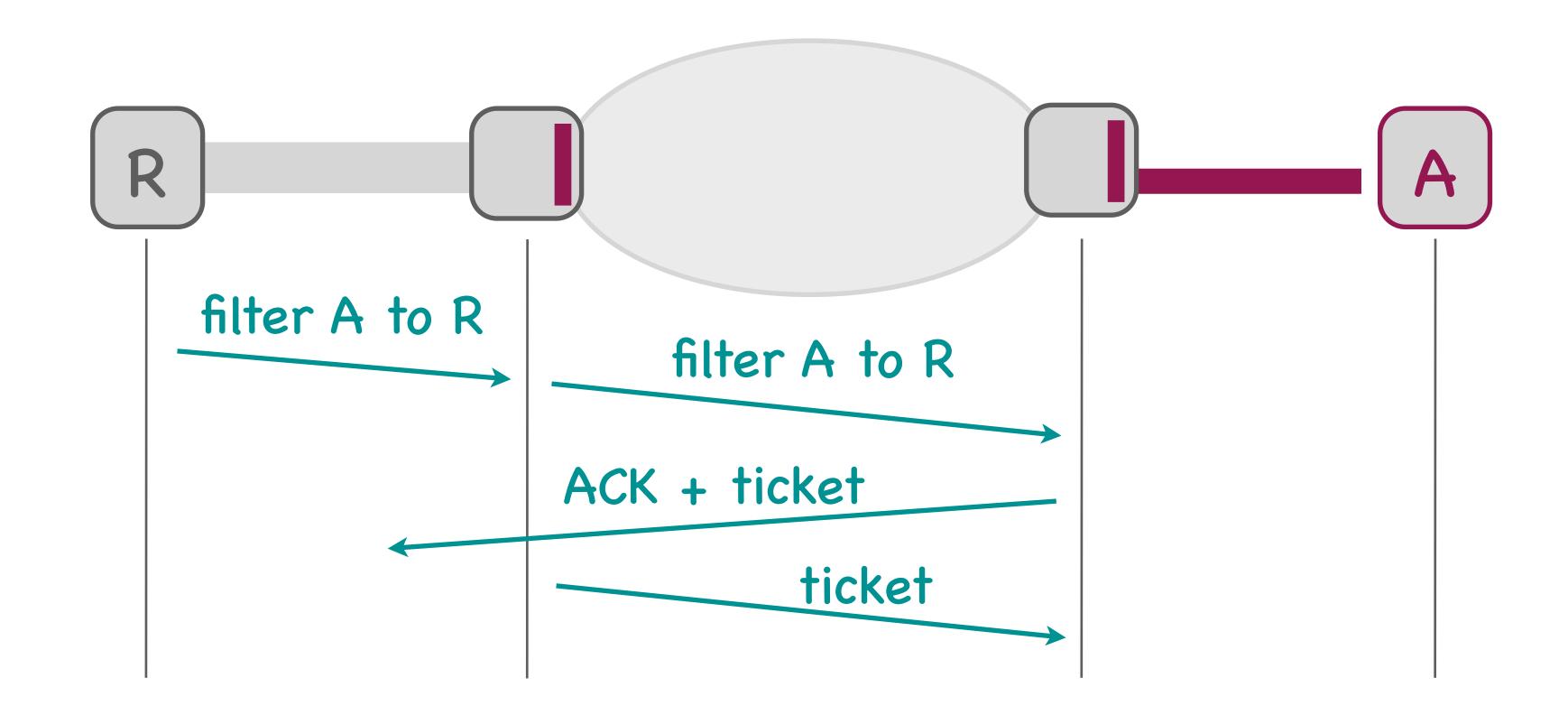
# Malicious filtering requests?



### Filter propagation continued

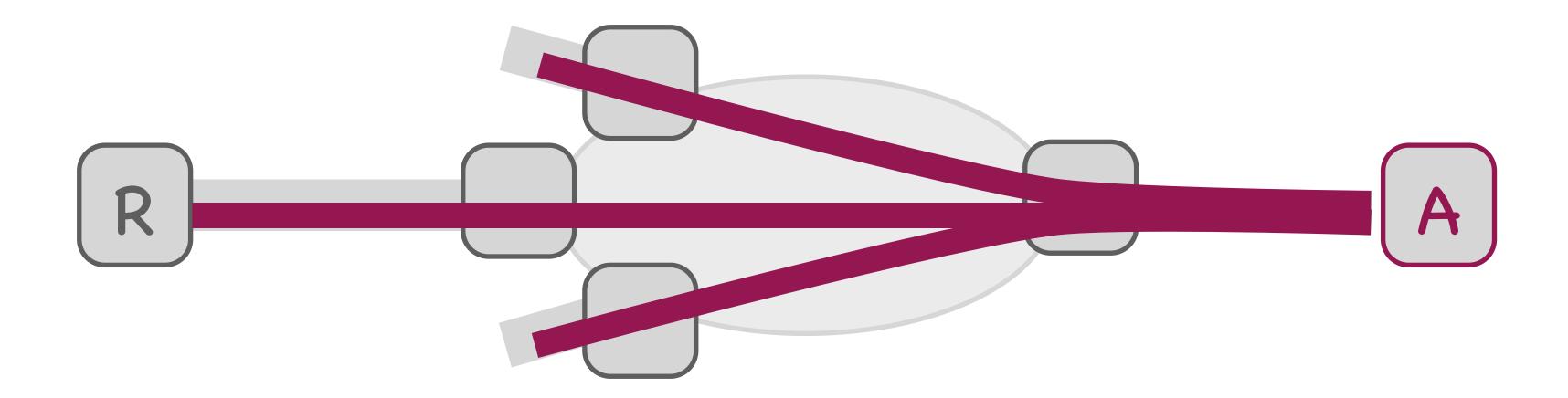


### Filter propagation continued

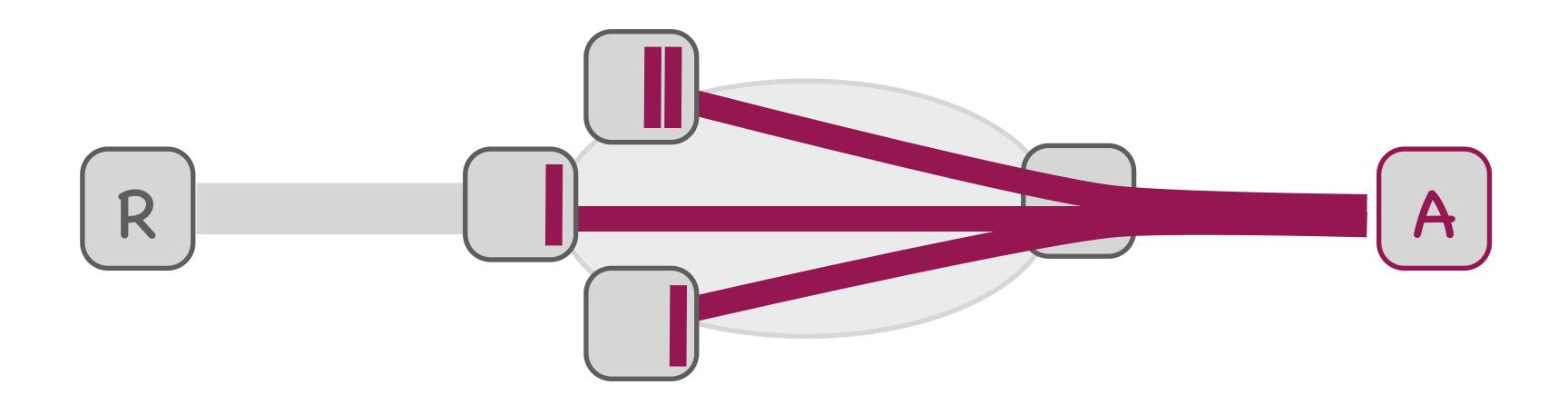


GR proves it is on the path by 3-way handshake

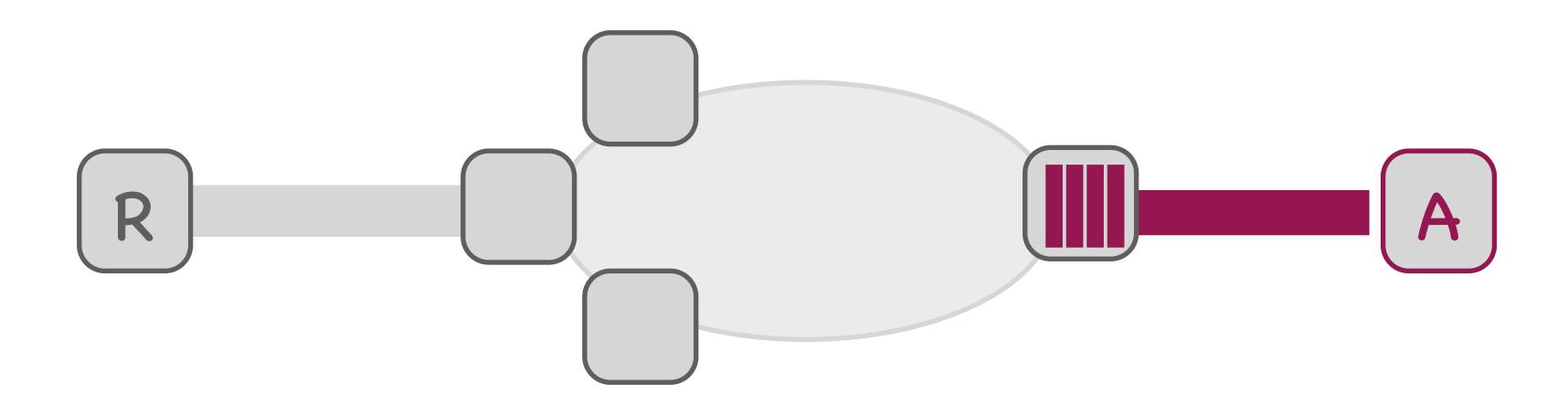
# Busy attackers?



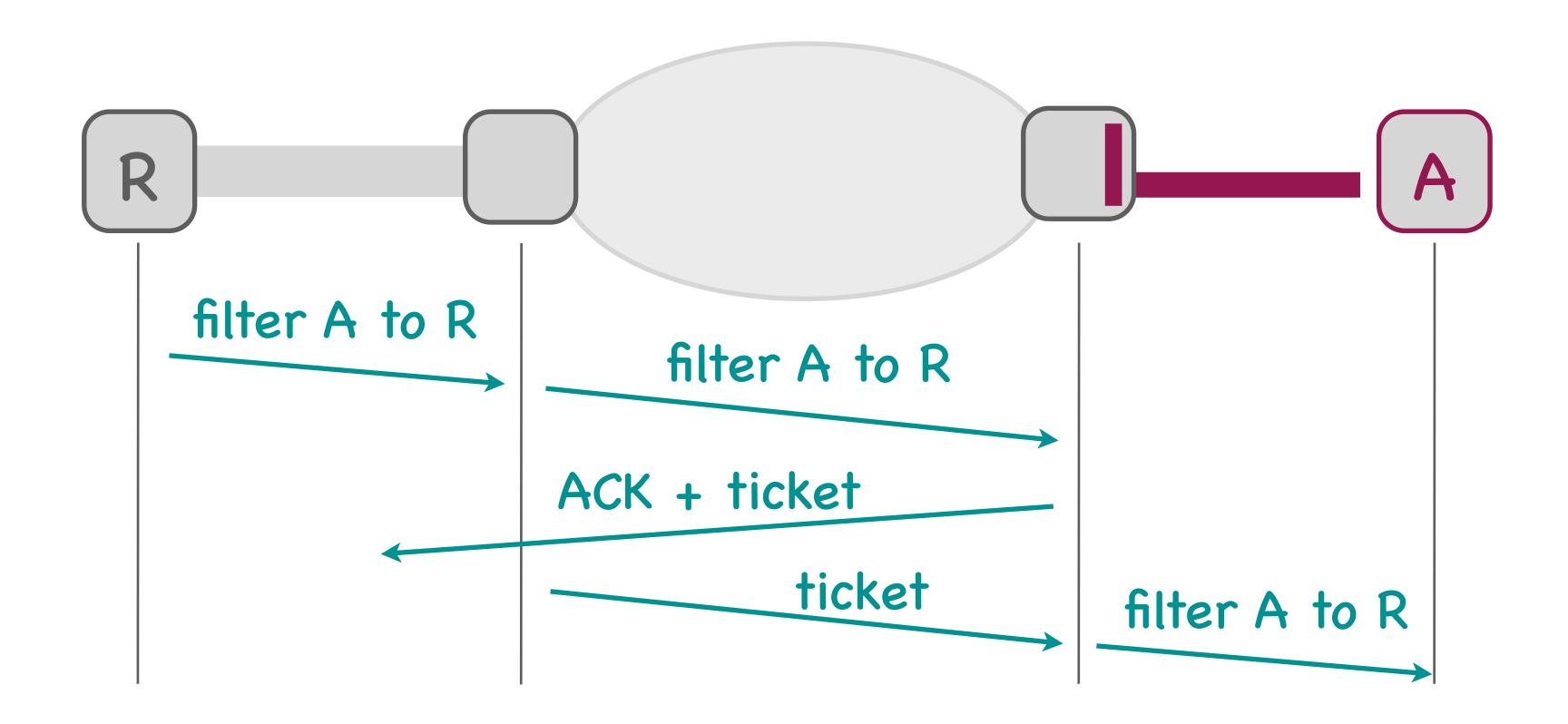
# Busy attackers?



# Busy attackers?

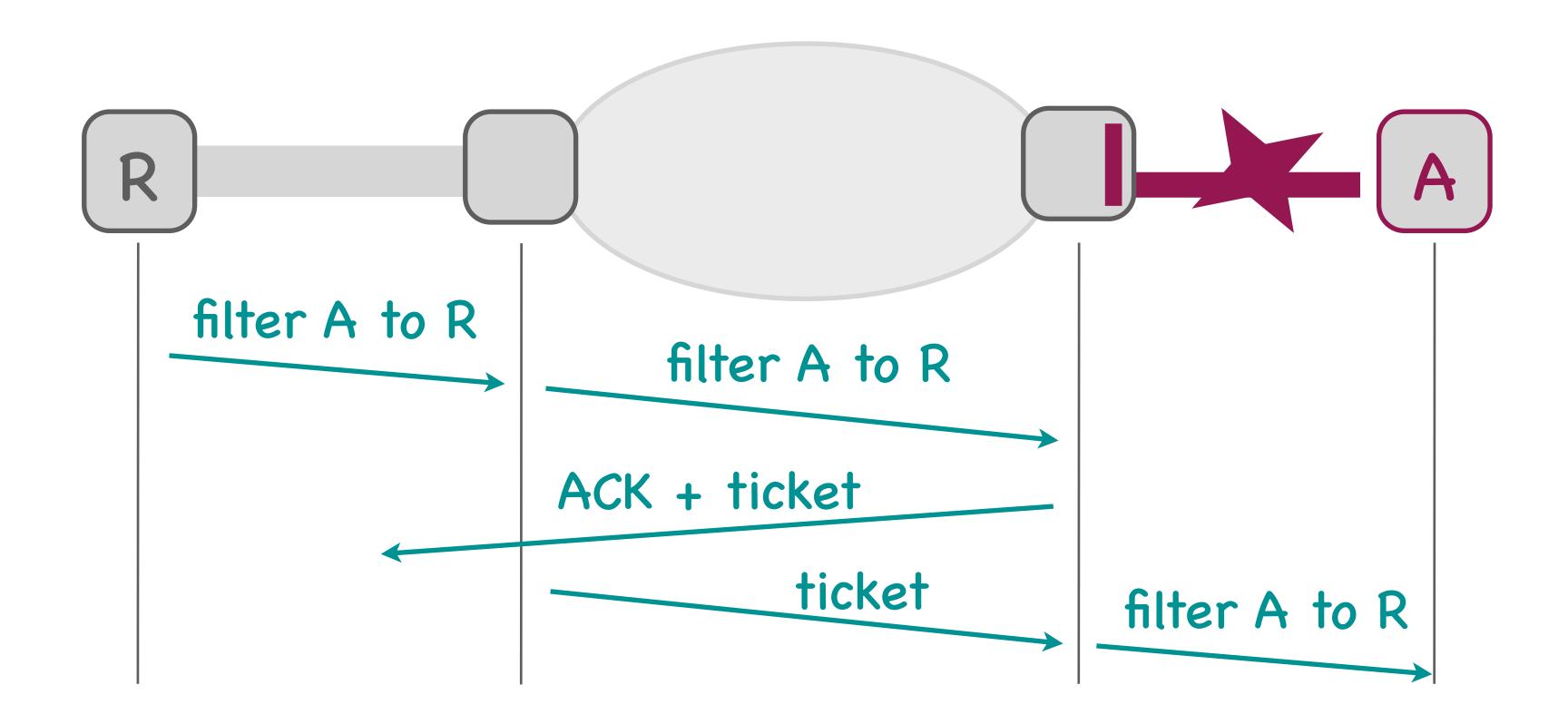


### Filter propagation continued

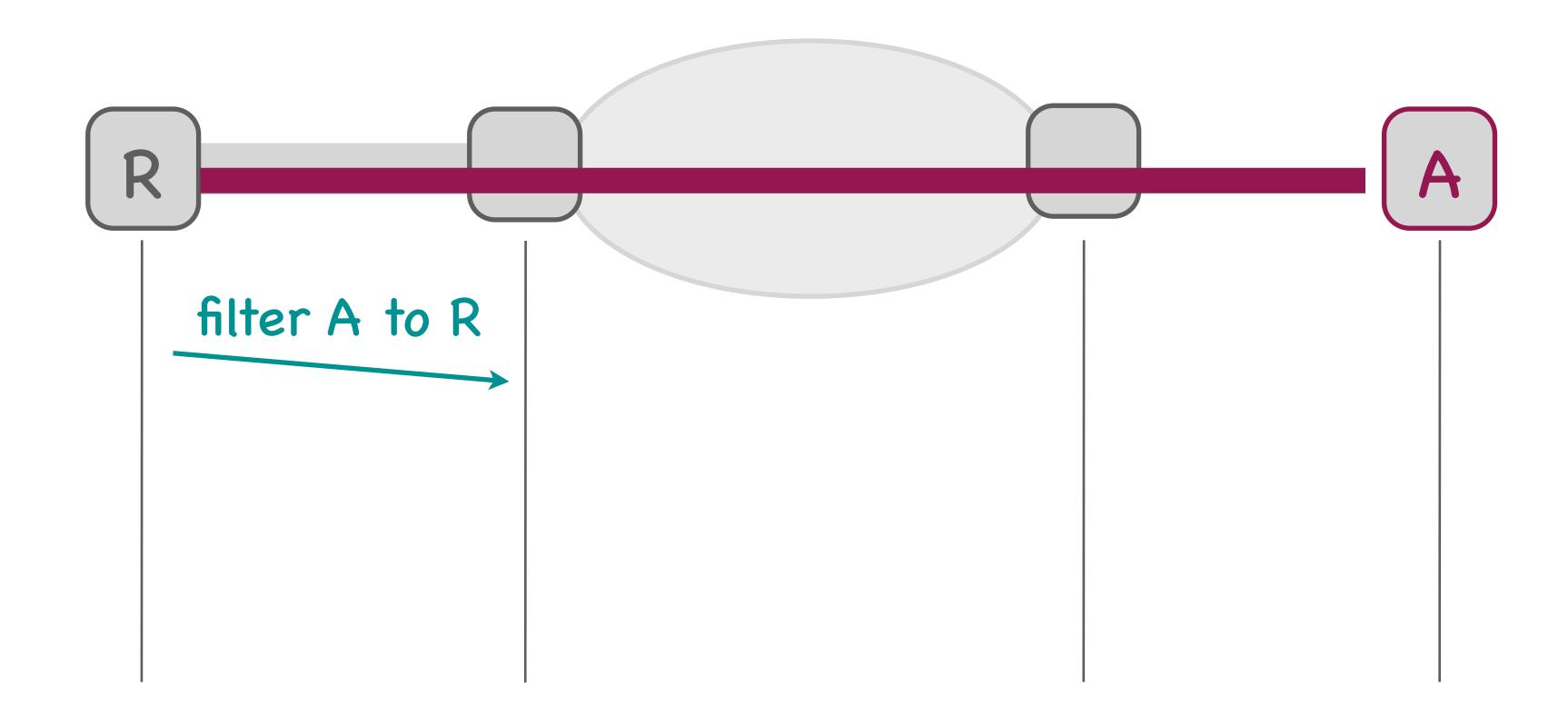


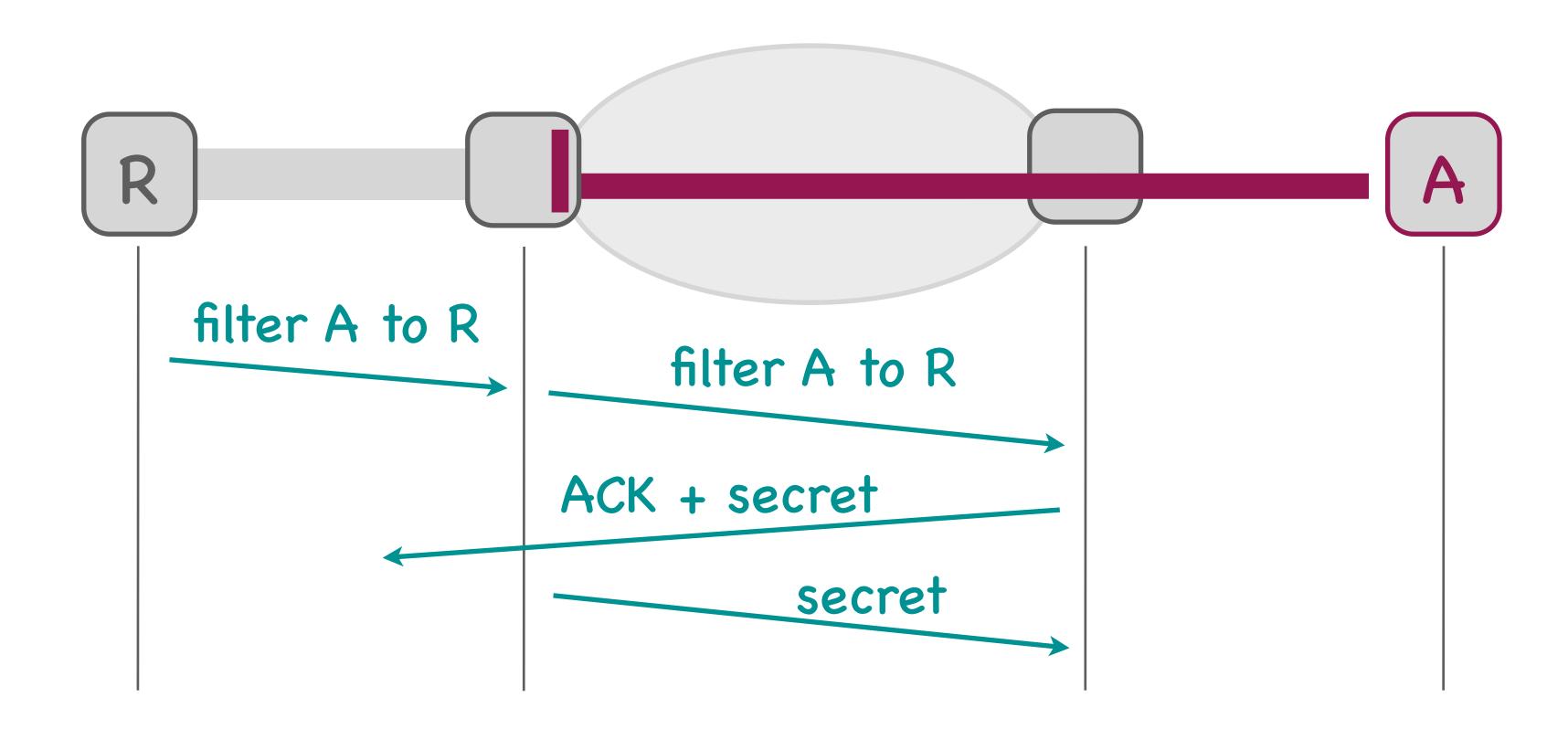
Keep in-network filters temporarily

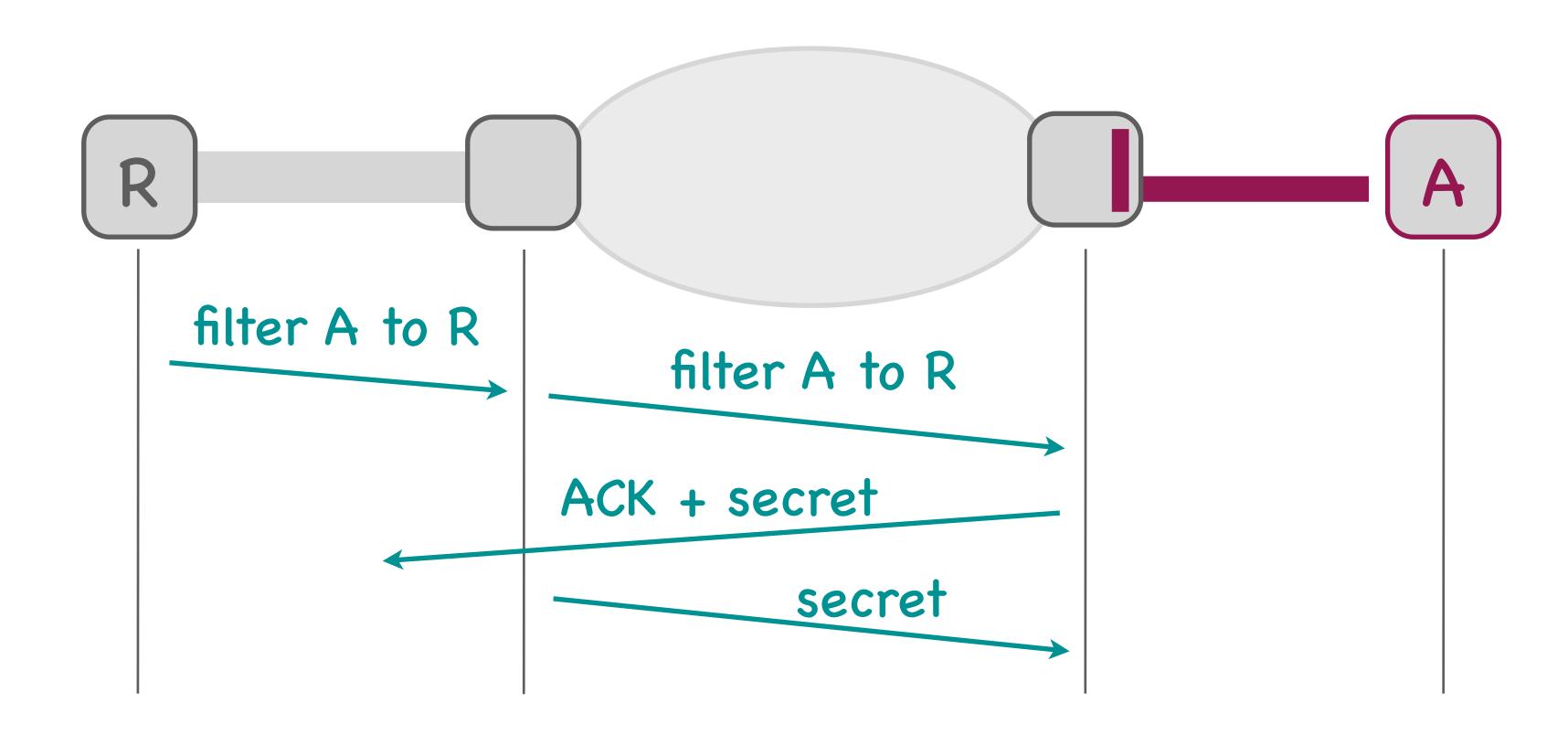
### Filter propagation continued

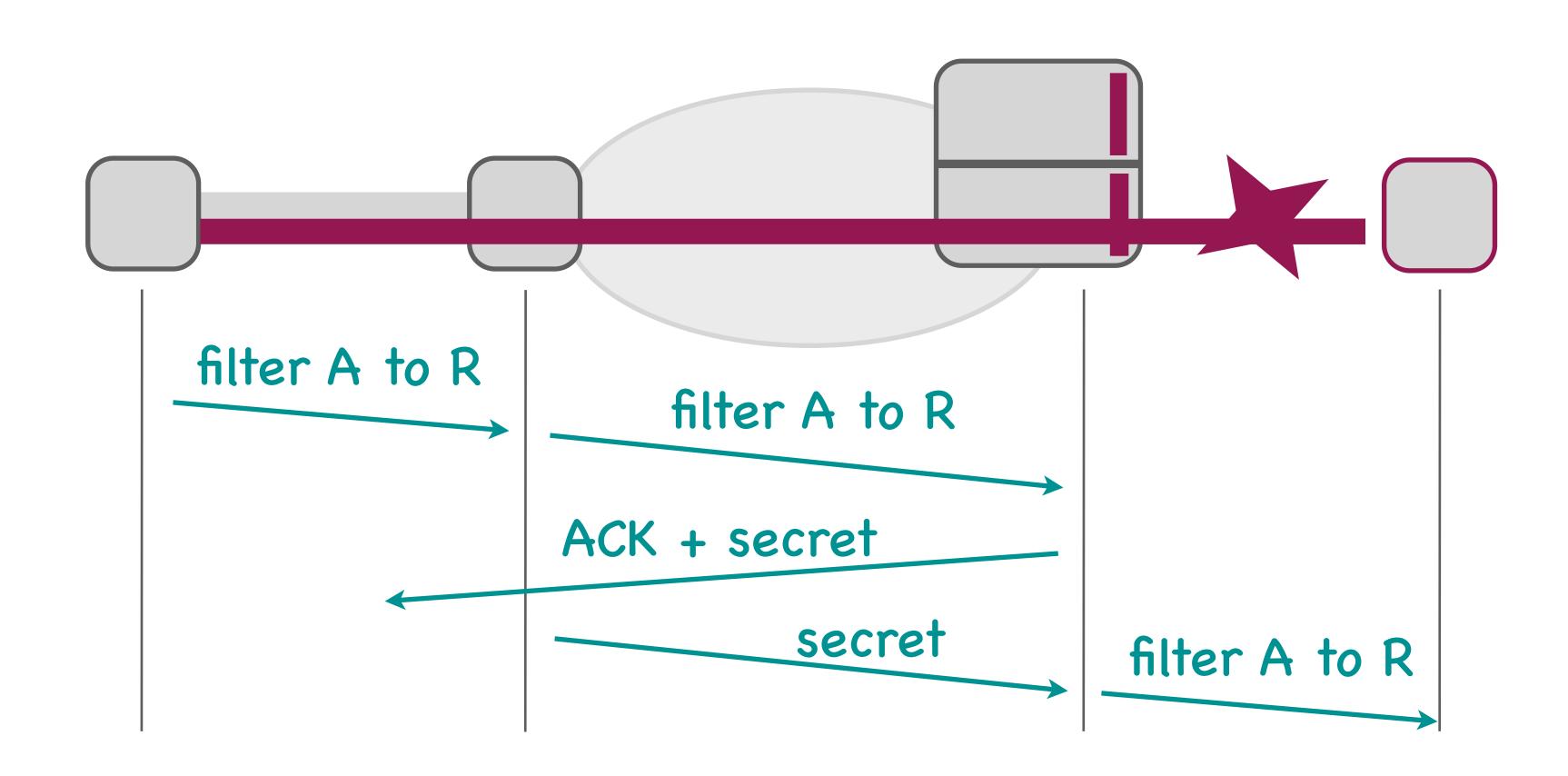


#### Disconnection = cheap filtering



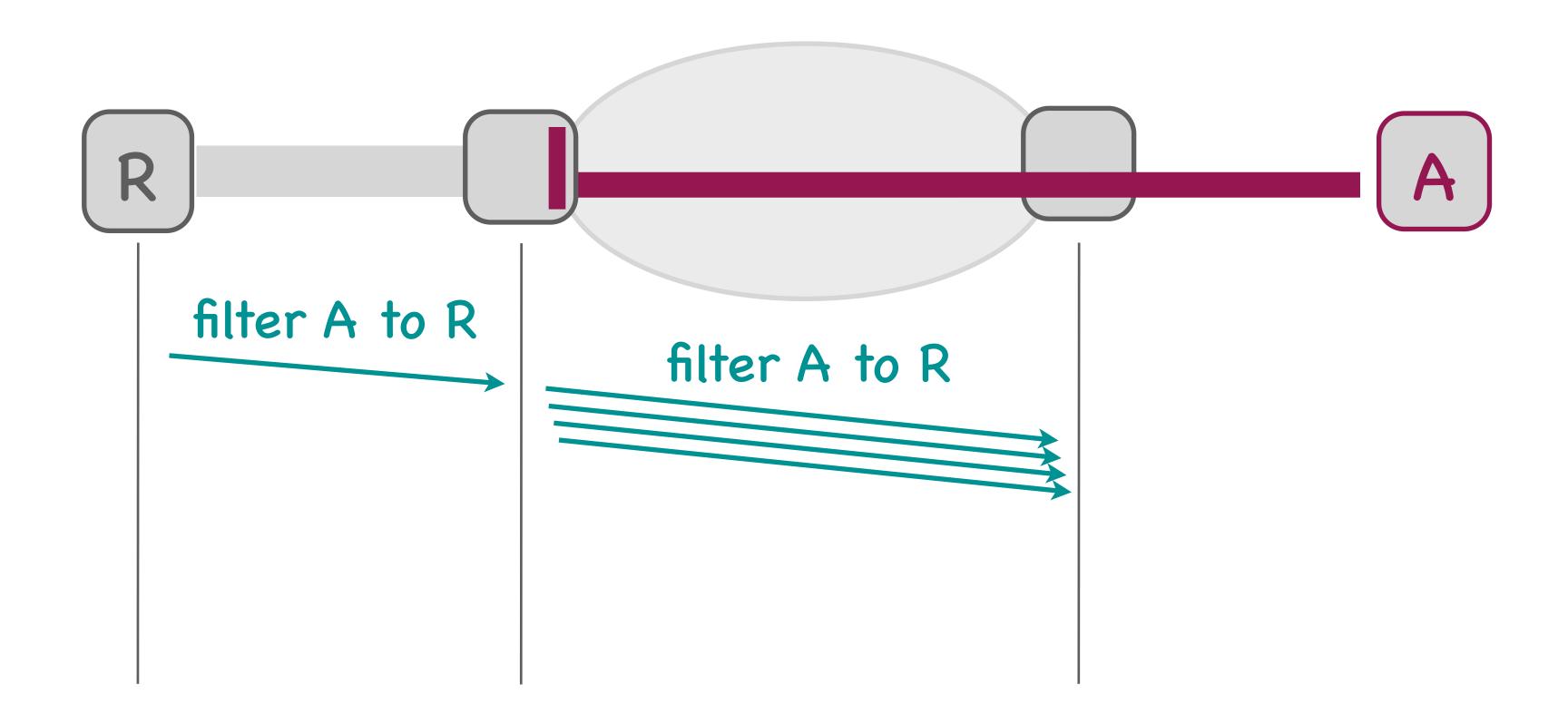




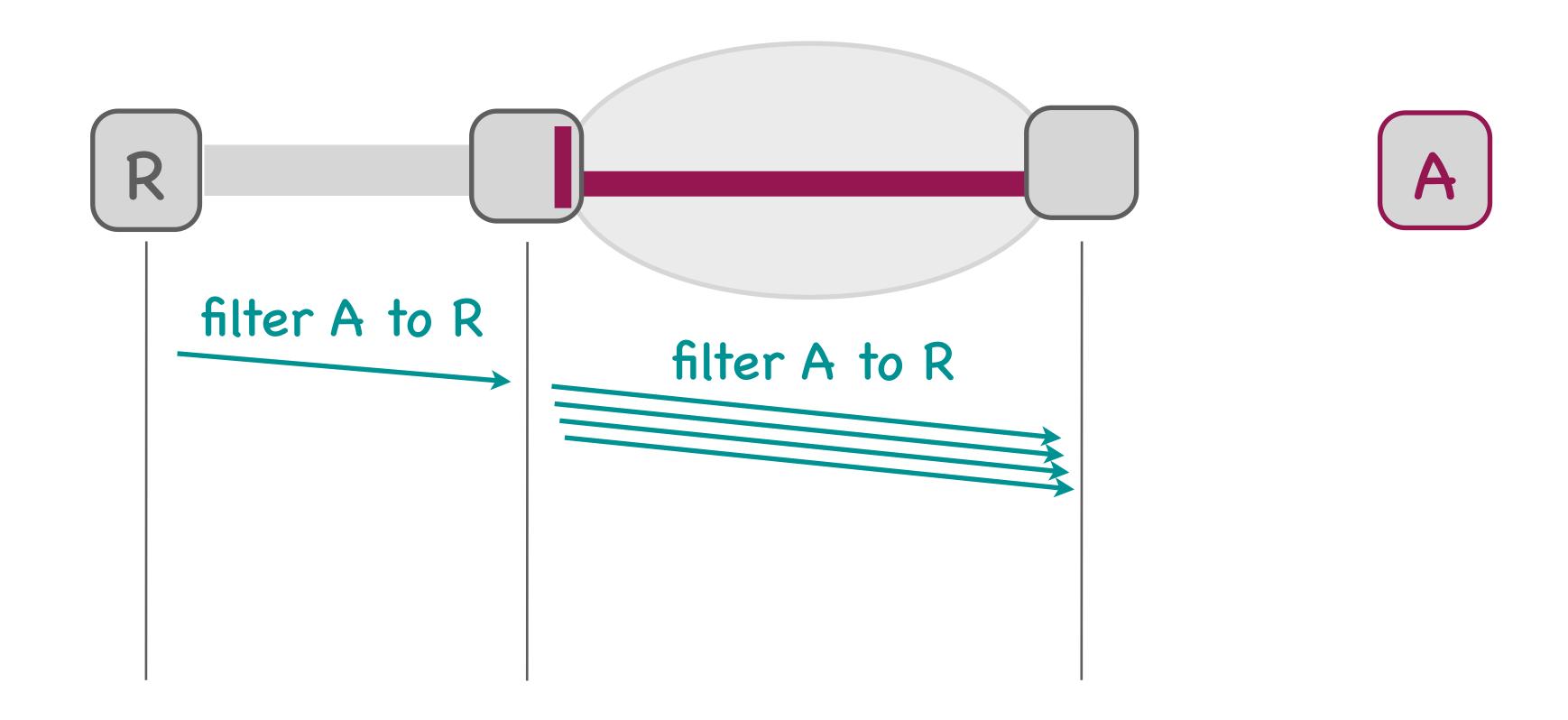


Keep filtering state in the control plane

# Non-cooperative networks?

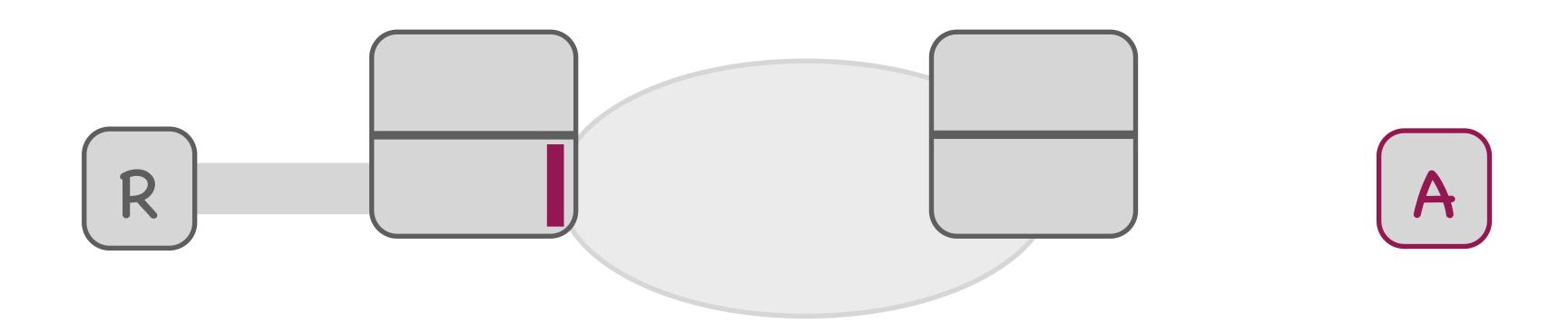


### Non-cooperative networks?



### ... get disconnected from R

#### State



State: {attacker, receiver} pairs

Where: control plane of attacker's gateway

Managed: filter-propagation protocol

### Distributed flooding



Target: filtering resources + tail circuit

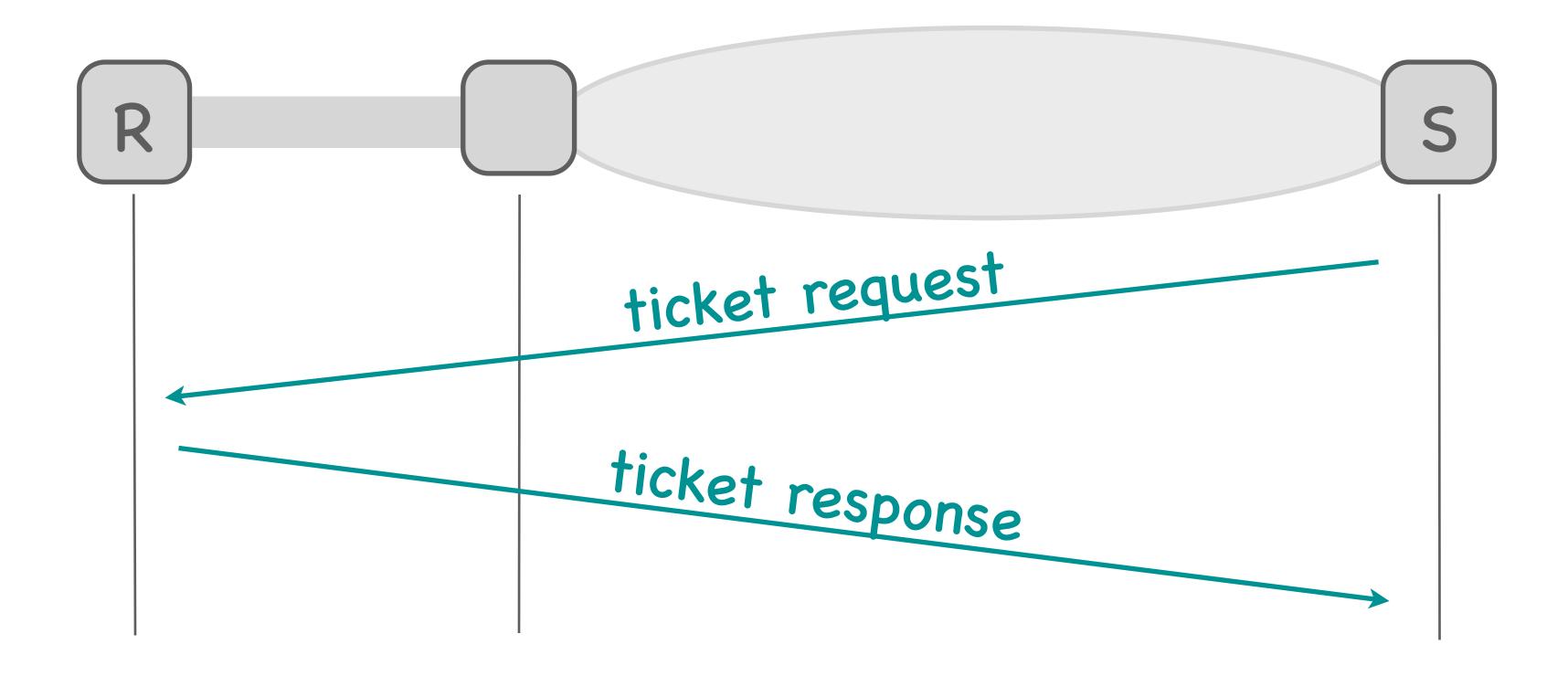
# Ticket-based authorization

Give tickets to well behaved senders

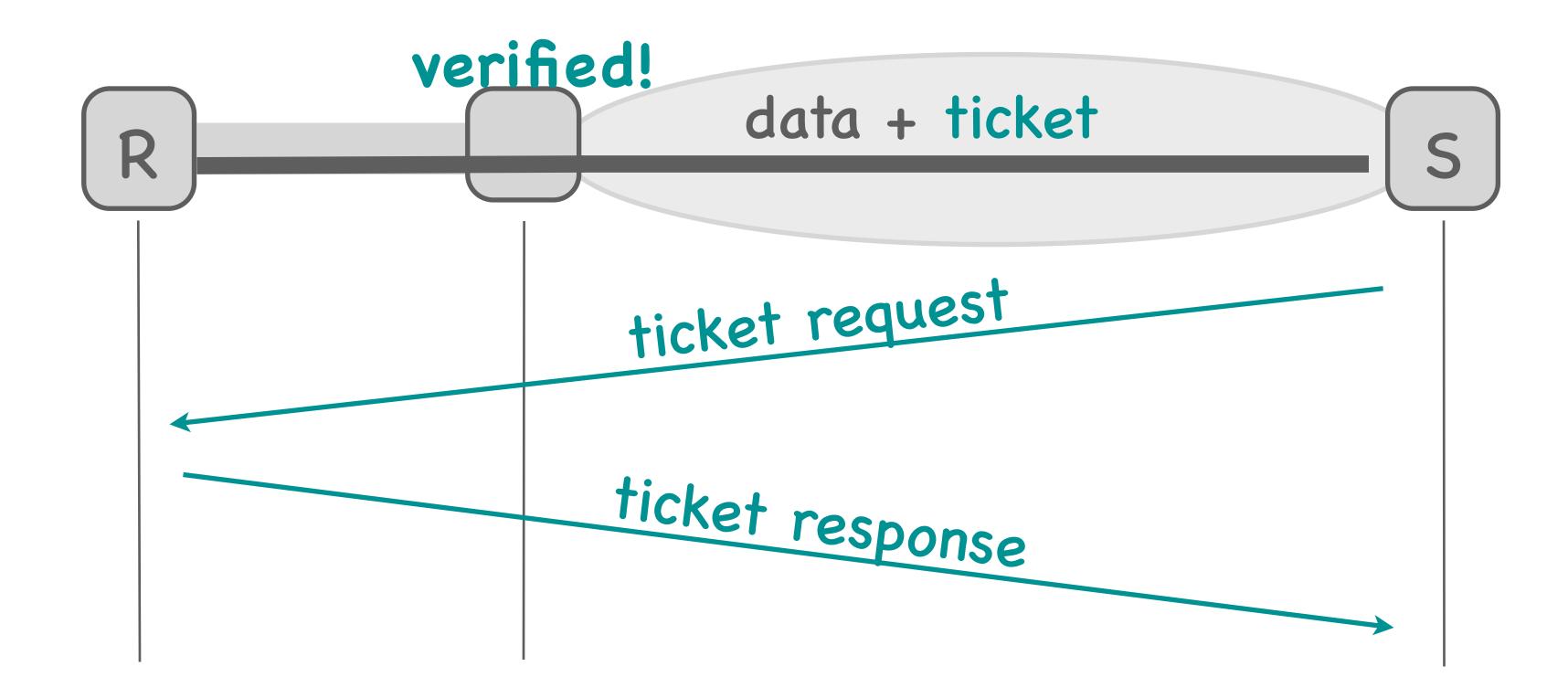
Verify tickets inside the network

Need ticket distribution and verification

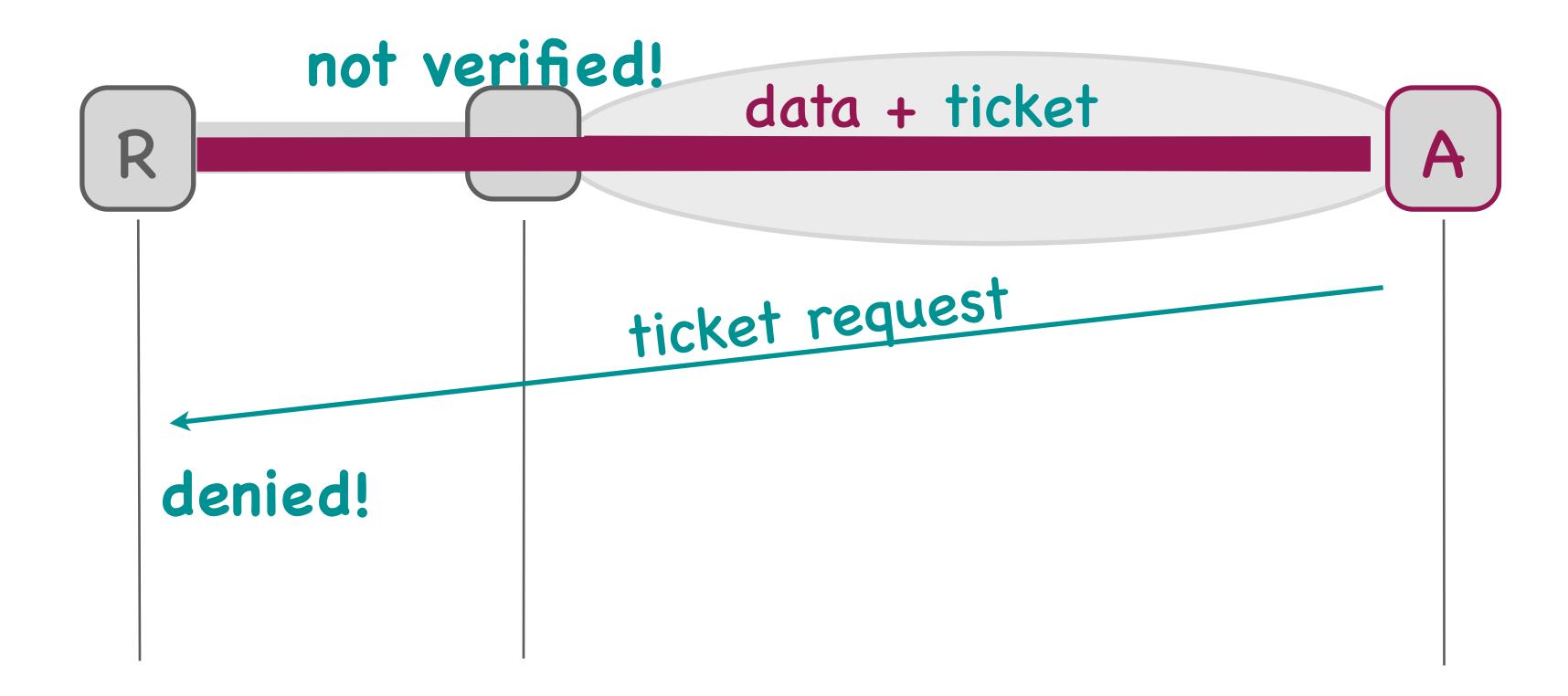
### Ticket distribution



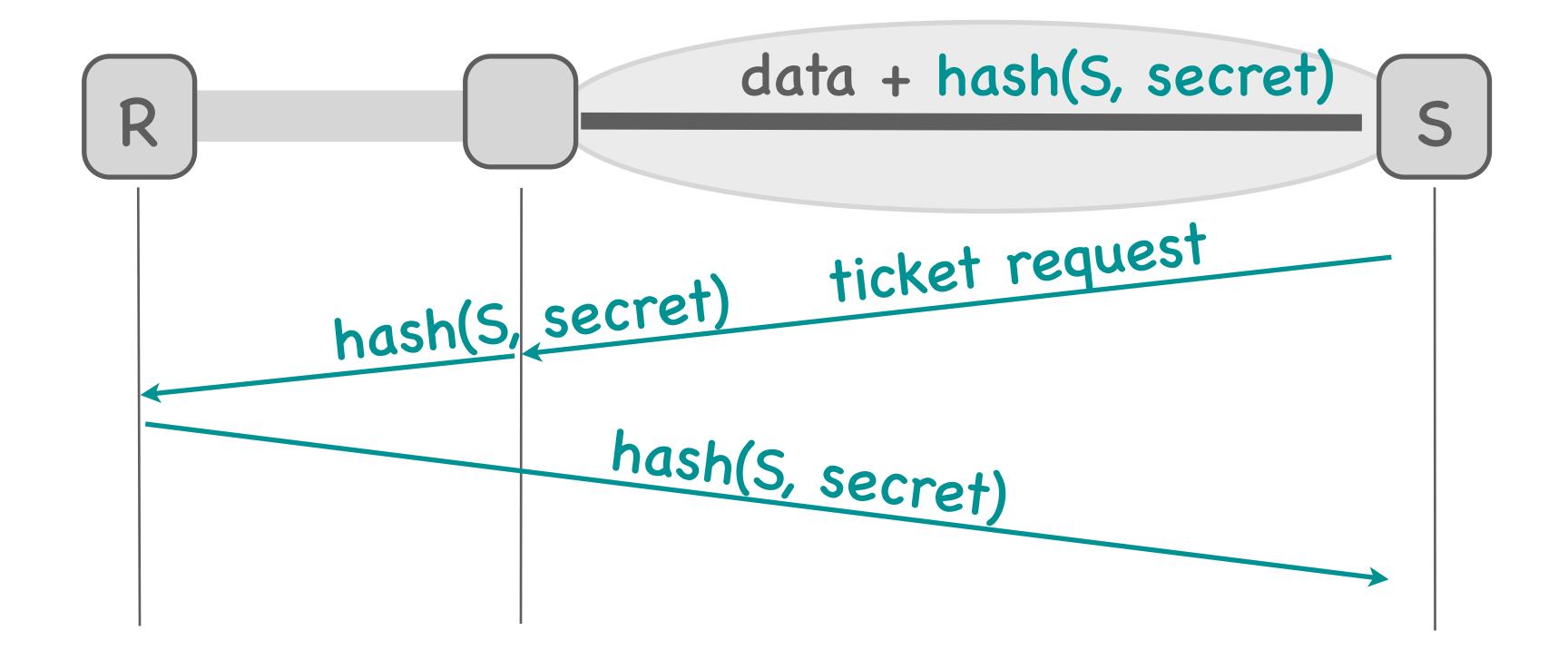
### Ticket verification



### Ticket verification



#### Ticket construction



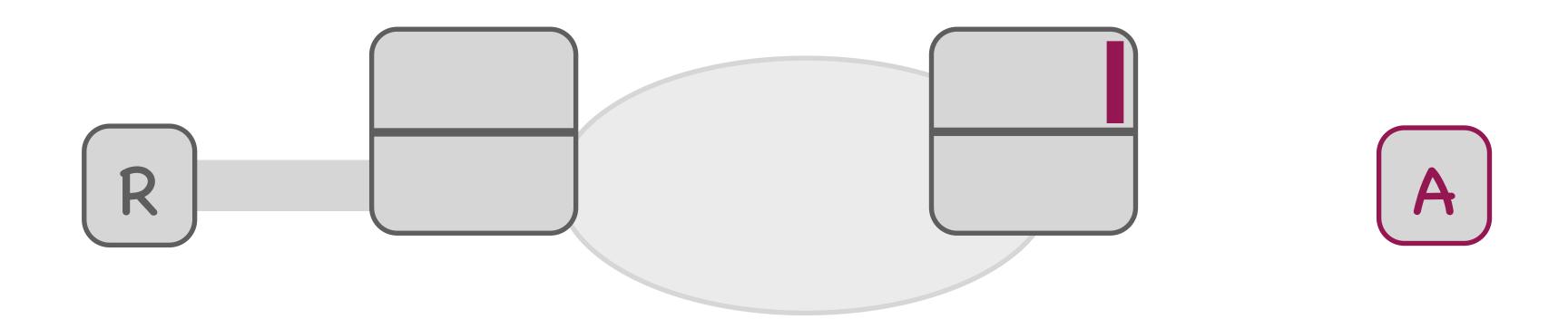
S cannot guess the value of a valid ticket

### Stateless filtering



State: Functionality: if ( not verify(ticket) )
block packet;

#### State

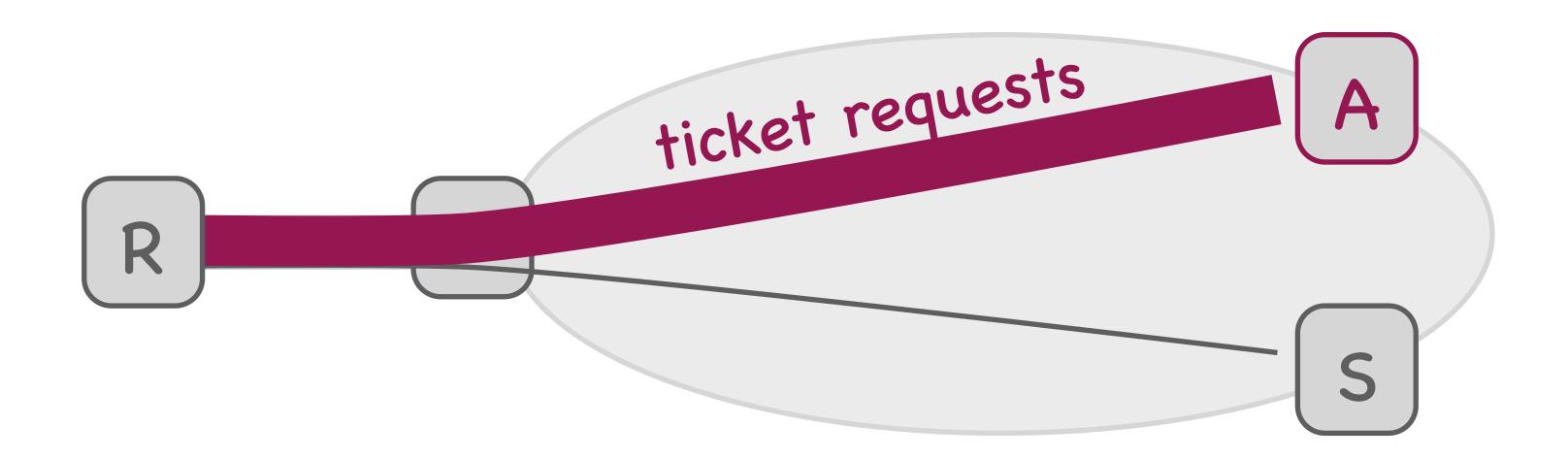


State: {sender, receiver} pairs

Where: senders

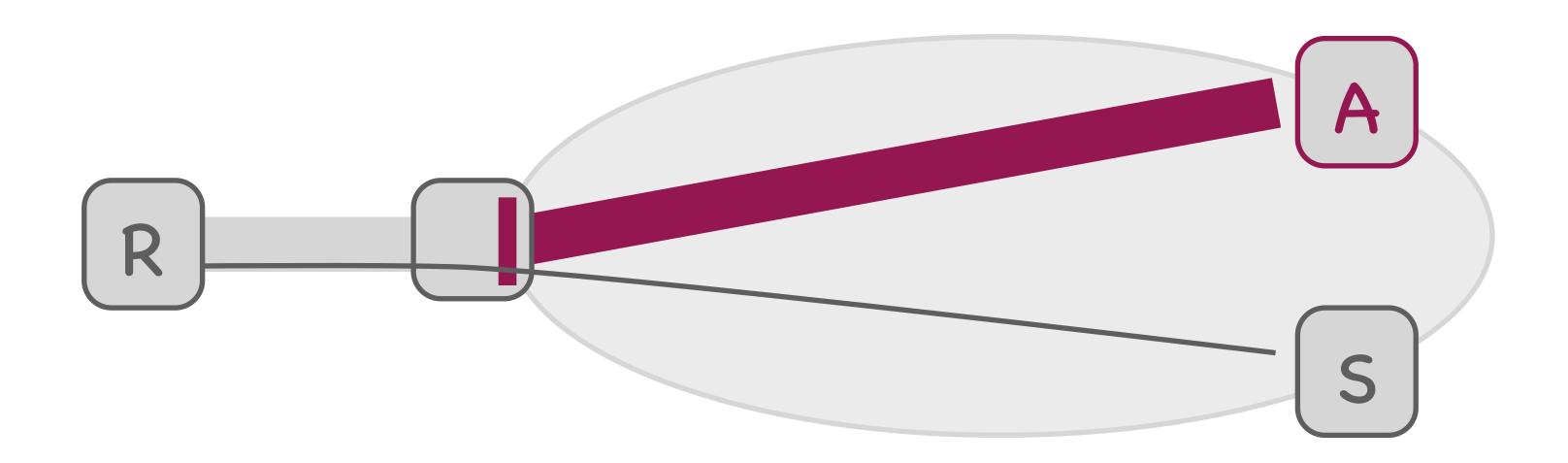
Managed: ticket-distribution protocol

#### Denial of ticket



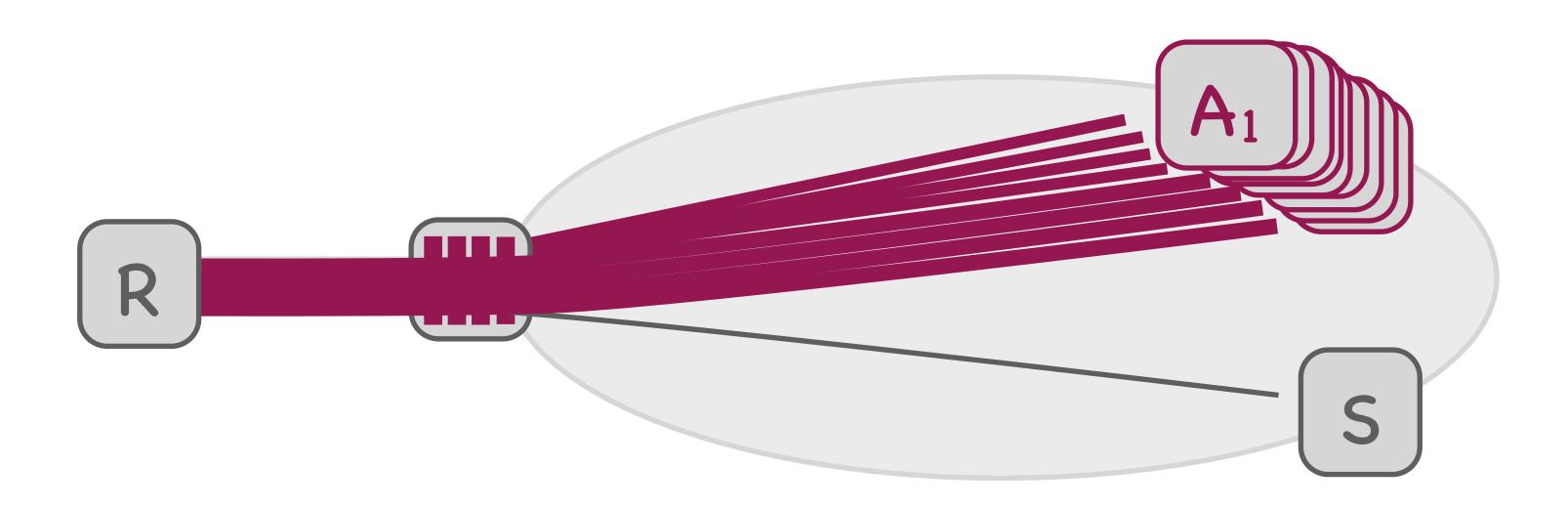
Target: tail circuit + ticket distribution

### Tickets + network filtering



#### Block attackers in the network

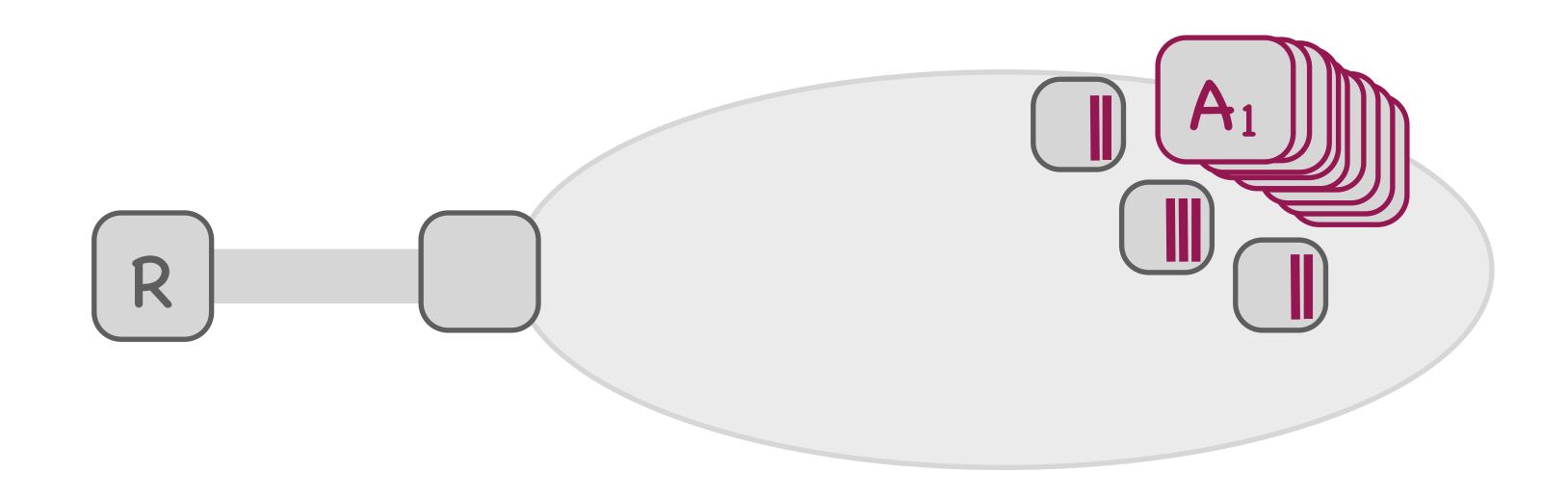
#### Distributed denial of ticket



#### Target: filtering resources

- + tail circuit
- + ticket distribution

### Tickets + distributed filtering



#### Need a filter-propagation protocol

#### State

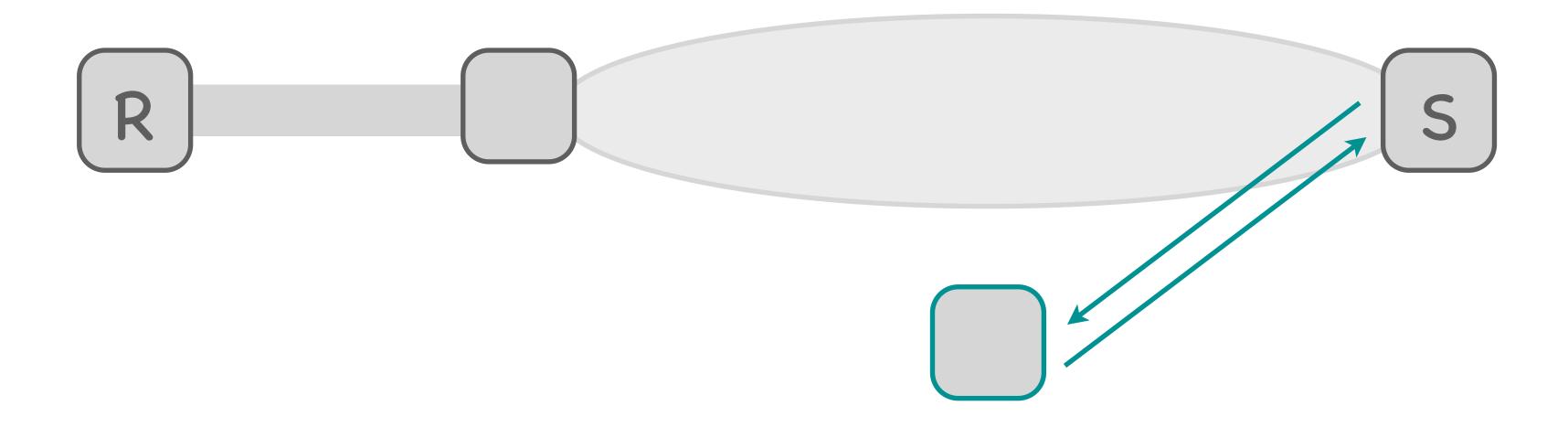


State: {sender/attacker, receiver} pairs

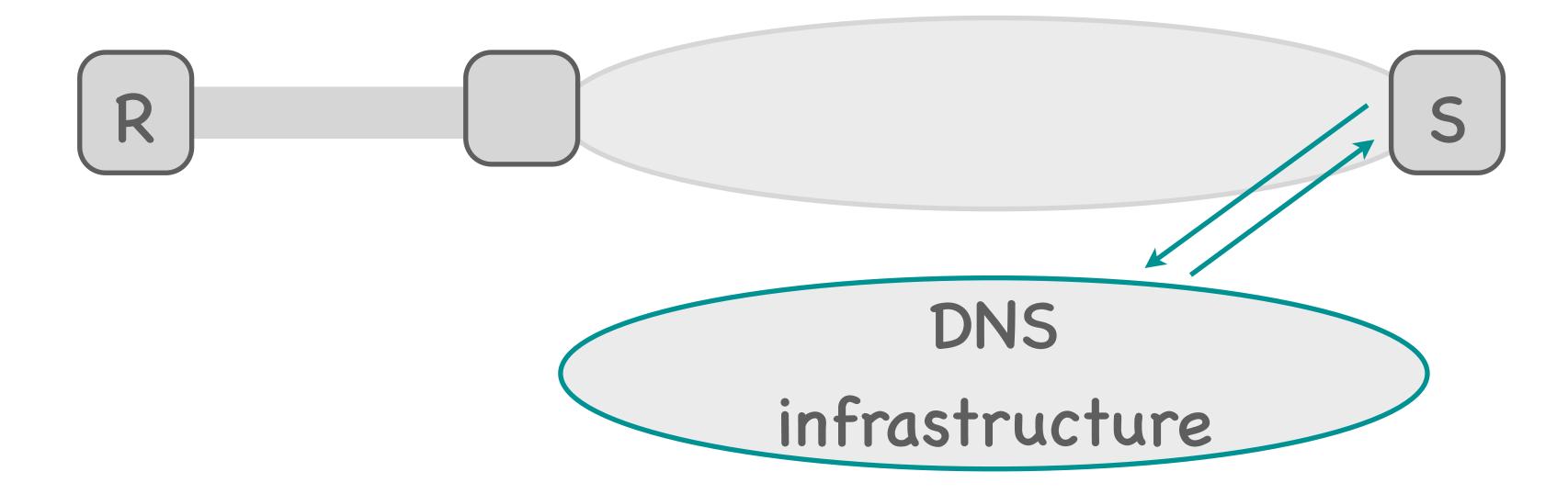
Where: senders + network

Managed: ticket distribution + filtering propagation

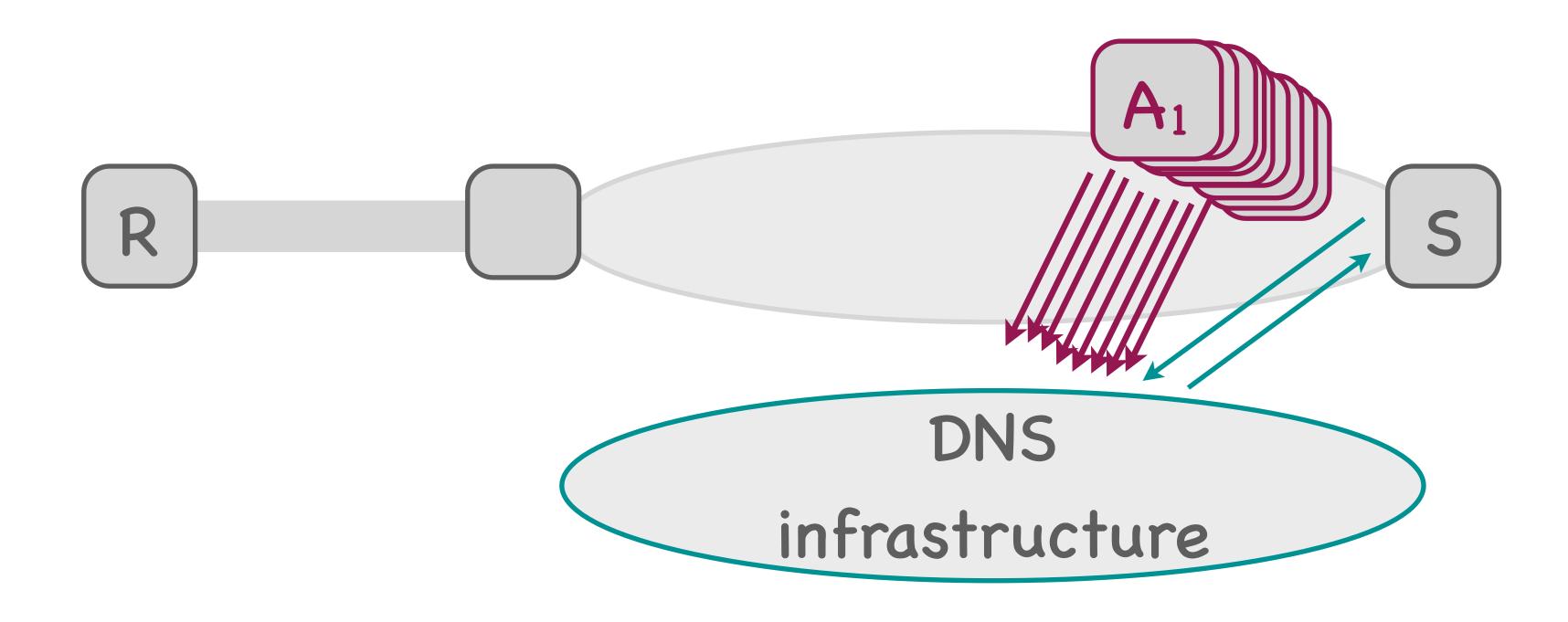
### Outsource ticket distribution



### Outsource ticket distribution



#### Outsource ticket distribution



Target: the DNS infrastructure

#### Fair-share the Internet

- Fixed number of connections per sender
- Reduces filtering state

Changes the nature of the Internet

Katerina Argyraki Principles of Computer Systems Fall 2019