More CC, DNS

CS 168 – Fall 2022 – Discussion 10

Agenda

- More Congestion control (worksheet Q)
- The Domain Name System (DNS) recap
  - Purpose
  - Records
  - Lookups
- DNS worksheet

DNS

- Map a name to an IP
- Generally: key-value map
- Goals
  - Replacement for HOSTS.TXT
  - Fully distributed maintenance
  - Tolerable performance

DNS

Domains *delegate* to subdomains (forming a tree).

To find eecs.berkeley.edu:

Ask **.** (root)

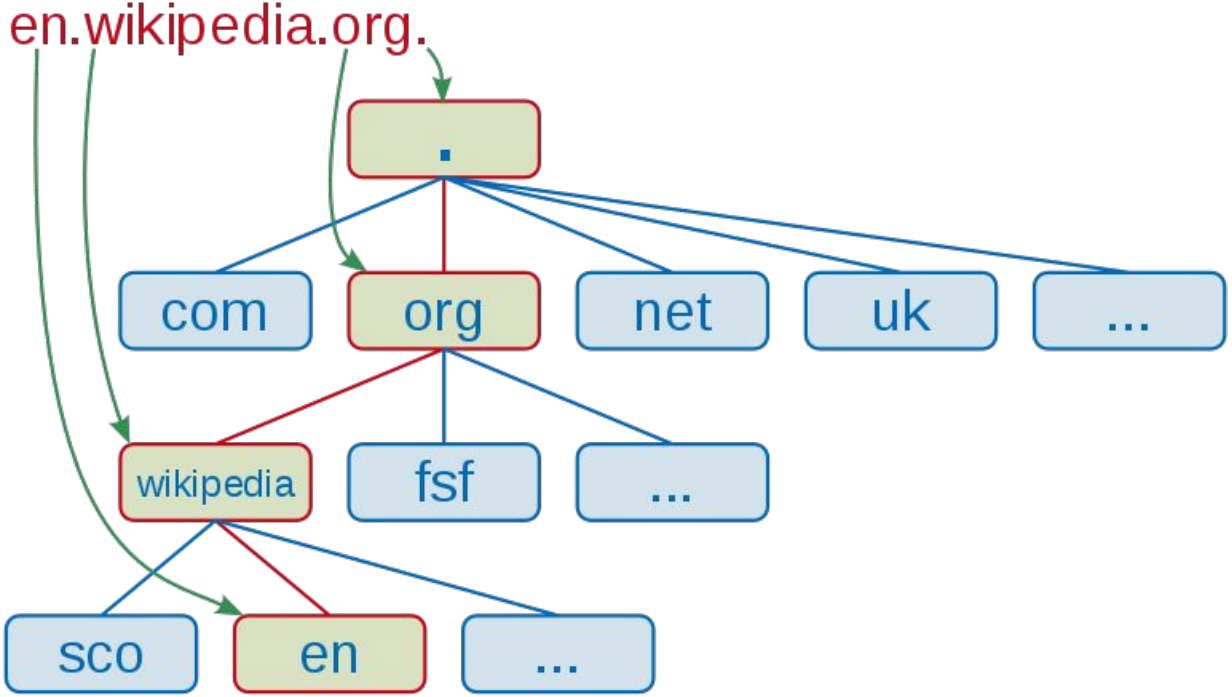
→ .edu (TLD servers)

→ berkeley.edu (domain servers)

→ eecs.berkeley.edu - authoritative server!

DNS name server delegation

Walk through address hierarchy, based on domain name



Source: Wikipedia (https://commons.wikimedia.org/wiki/File:DNS_schema.svg)

DNS root name servers

13 root server addresses:

- a.root-servers.net (198.41.0.4)
- …
- m.root-servers.net (202.12.27.33)

How do 13 servers handle all DNS root queries?

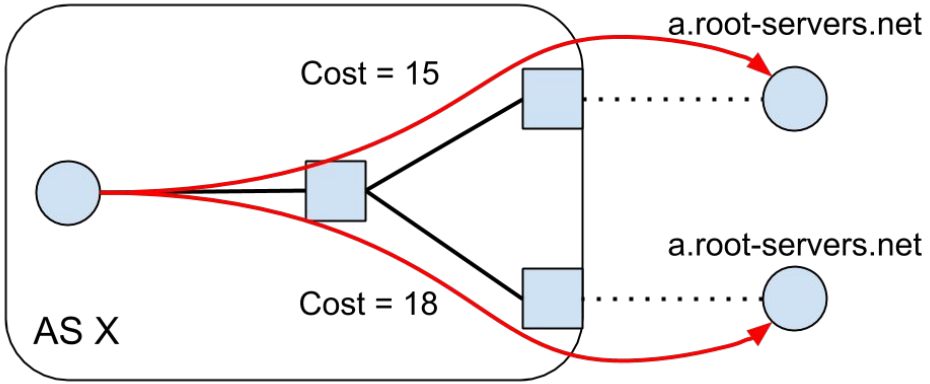
- Multiple *replicates*, all with the same IP
- Caching (will be discussed in lecture 19)

How do we route to different servers with the same IP?

Anycast

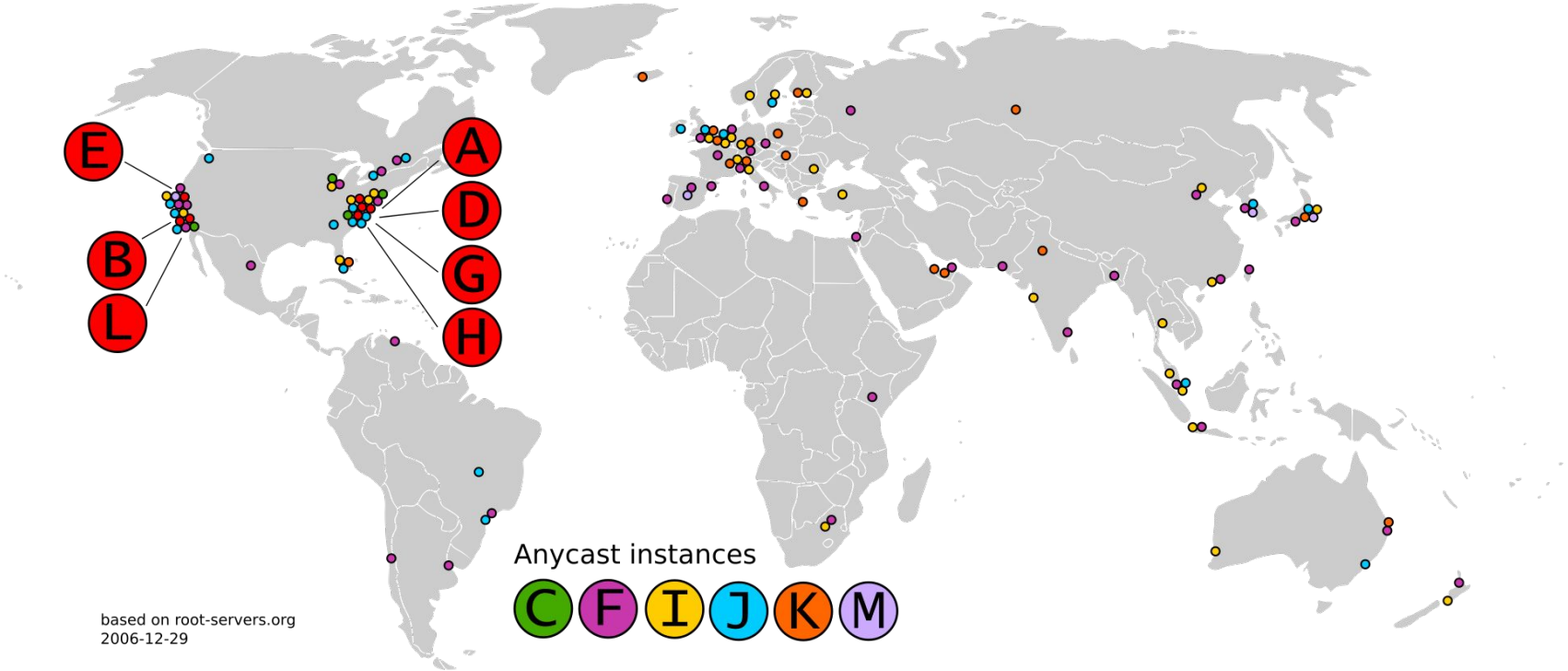
Route to *any* host with this address.

- Route to A (cost 15)
- Route to A (cost 18)
- Looks like route to *same* host with different cost!



(Implemented with BGP cost preferences)

Root server locationing



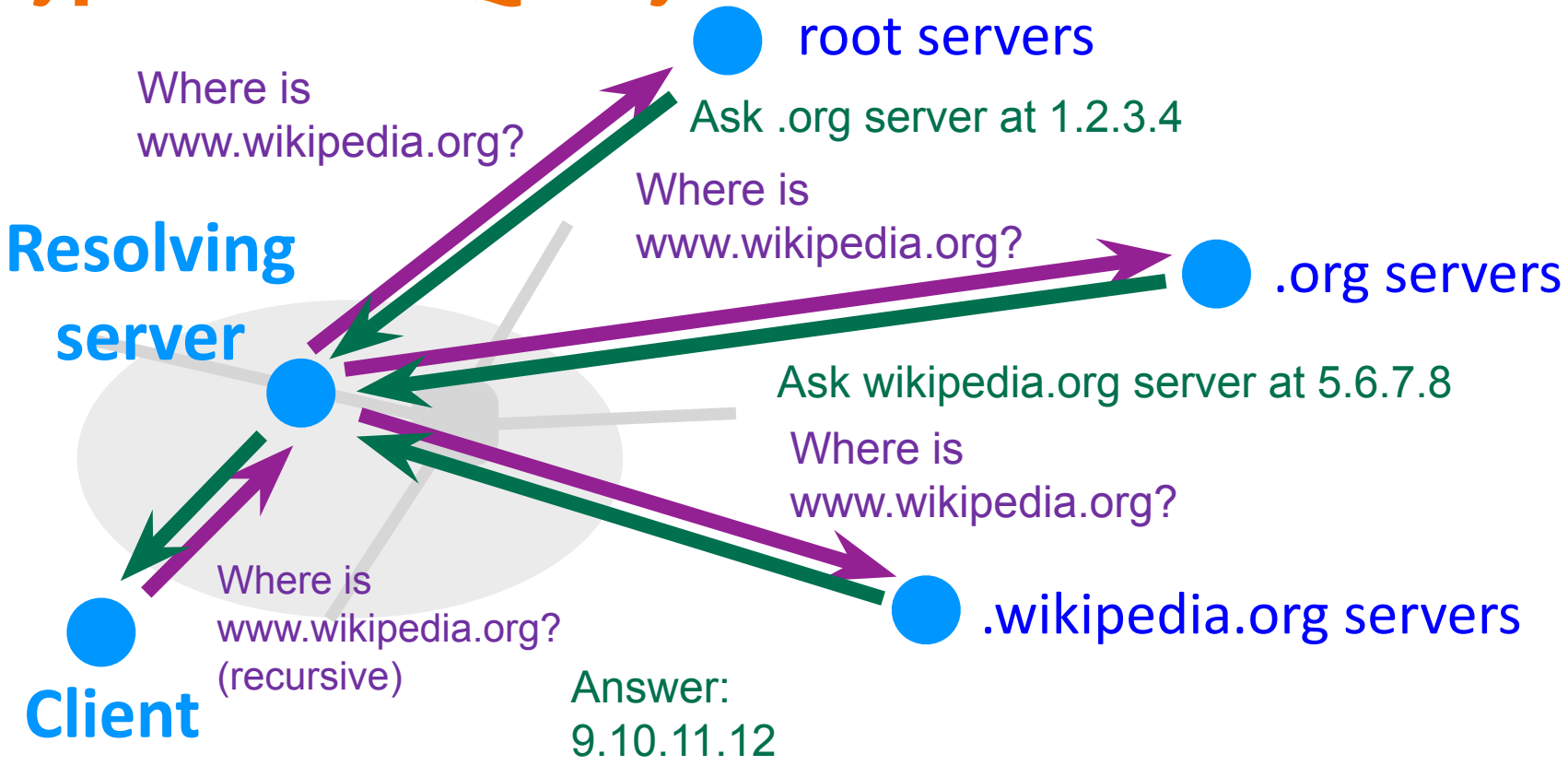
Source: Wikipedia (https://commons.wikimedia.org/wiki/File:Root-current.svg)

Resource Record Types

NS	**name server**	**delegate lookups to name server**
A	**address (IPv4)**	
AAAA	address (IPv6)	
CNAME	canonical name	redo lookup with provided name
MX	mail exchanger	mail server (@gmail.com, etc.)
TXT	text	verification, notes, machine-readable data...
SRV	service	general services
...		(security, keys, location, ...)

[Demo] DNS

Typical DNS Query



Note: recursive queries

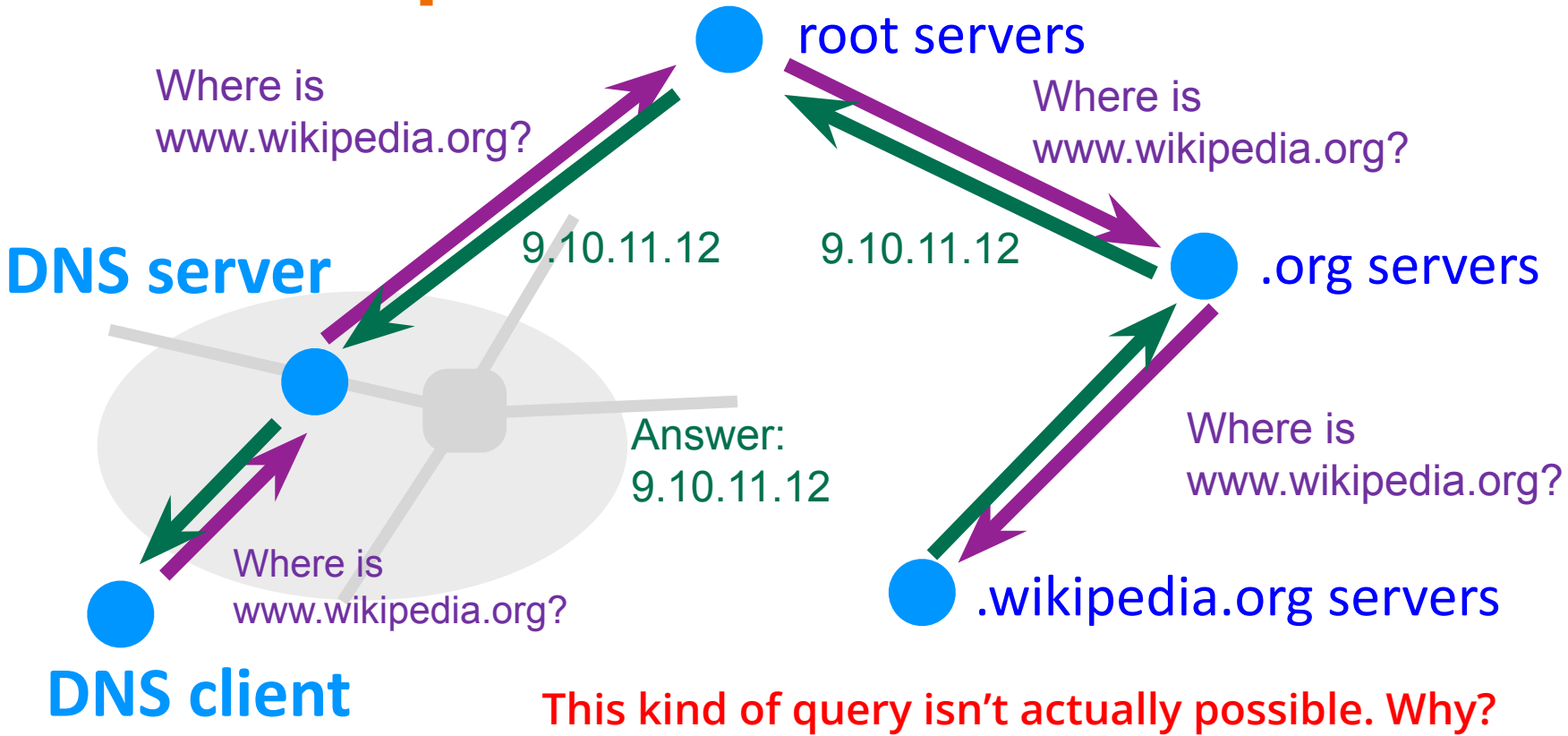
Most queries are *iterative*: the response is either

- An address record if the name server knows the answer
- A referral to another nameserver otherwise

In a *recursive query*, the server does the full query for you.

- Clients do less work
- ISPs can cache better
- Large CDNs can offer faster resolution
  - Google, Cloudflare, Cisco, …

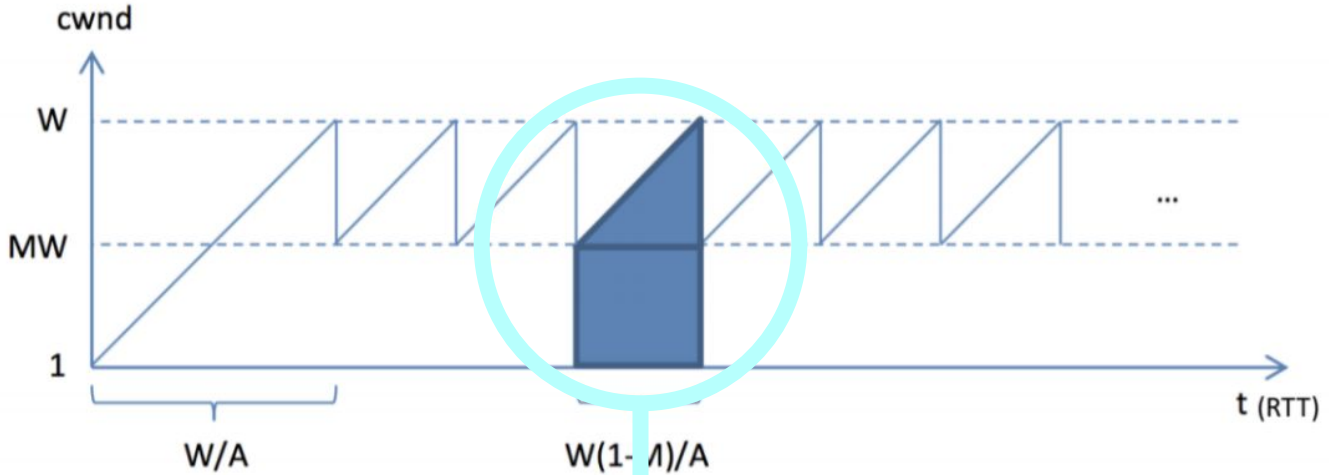
DNS Lookup



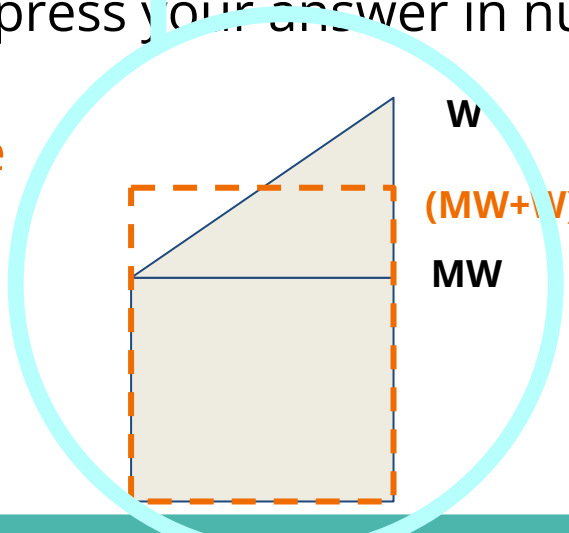
This kind of query isn't actually possible. Why?

Worksheet

Q1

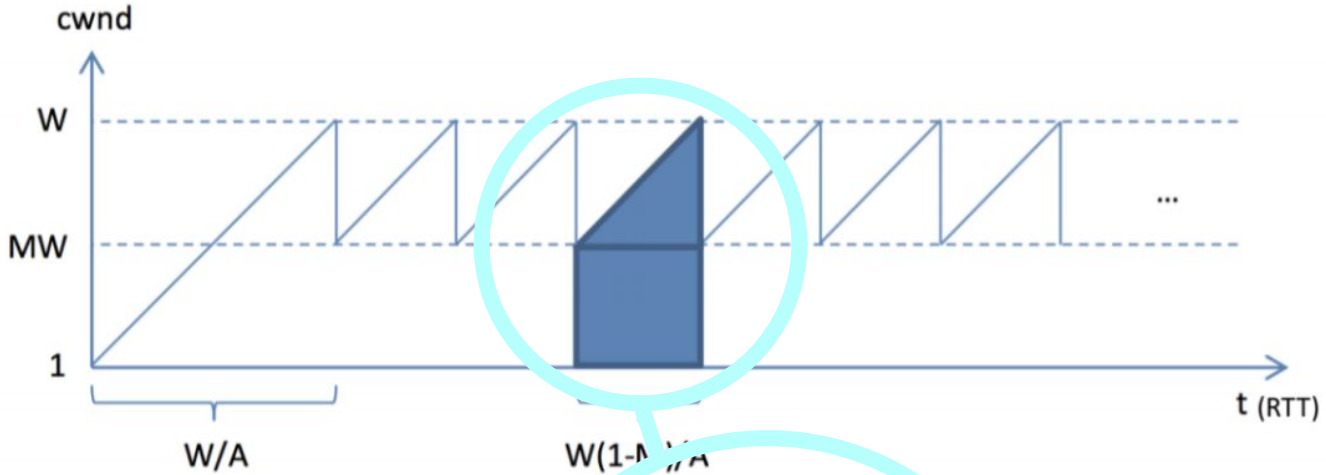


1. What is the average throughput? Express your answer in number of packets, not MSS.
   - Hint: Think of average window size



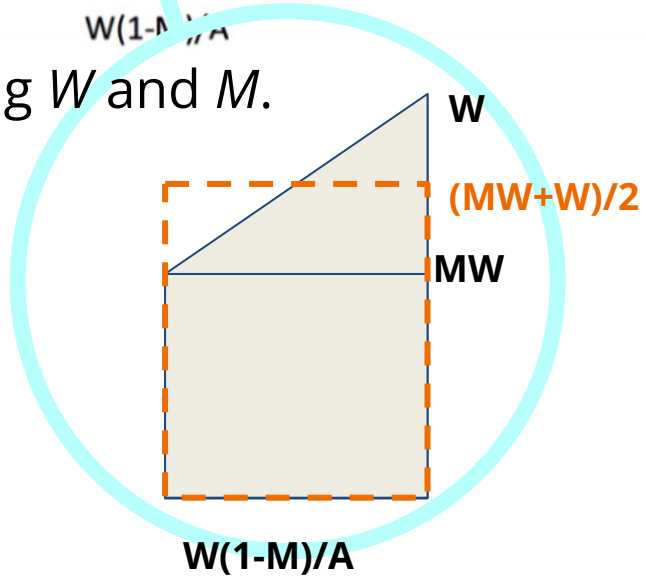
Window/RTT = Throughput
(MW+W)/(2*RTT)

Q1

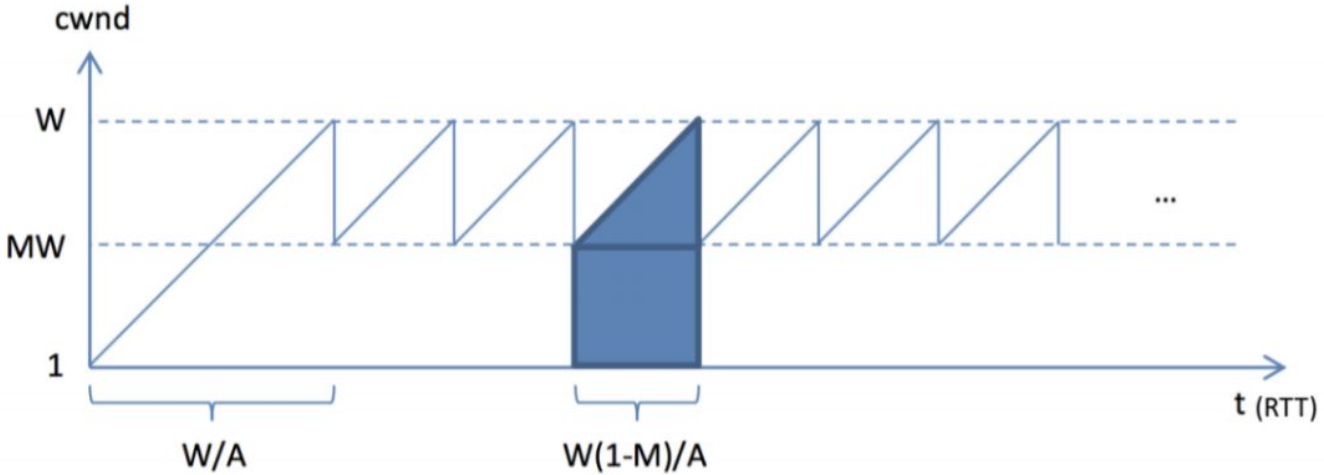


2. Calculate the loss probability *p*, using *W* and *M*.
   - Hint: Use your result from Q1.

(MW+W)/2 * W(1-M)/A



Q1



2. Calculate the loss probability *p*, using *W* and *M*.

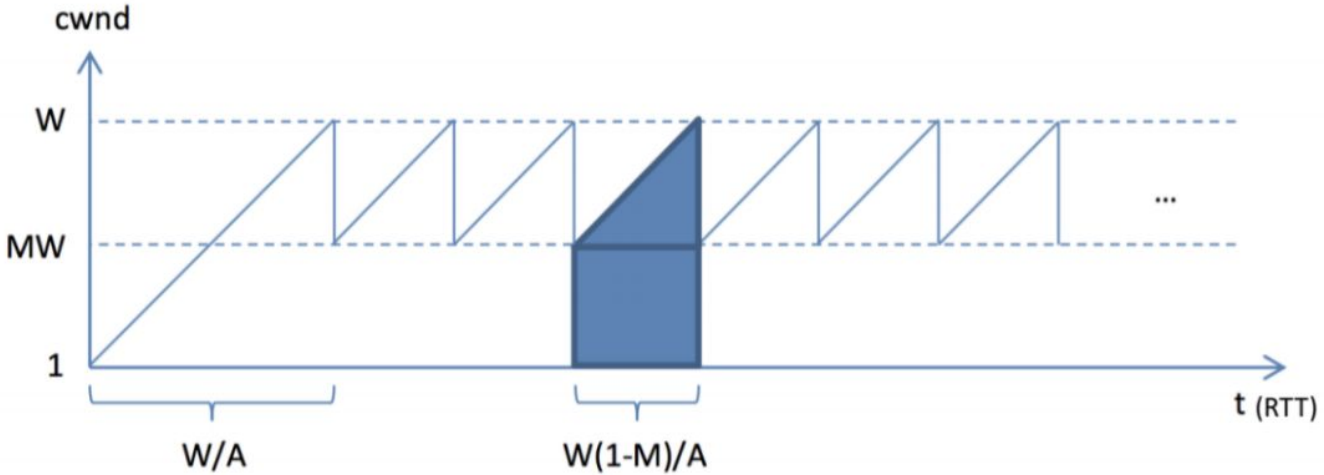
- Hint: Use your result from Q1.

Total Packets:
$W^2(1-M^2)/2A$

1 drop per total packets:

$p = 1/[\text{Total Packets}] = \mathbf{2A / [\, W^2 (1 - M^2) \,]}$

Q1



3. Derive the formula for throughput in part 1 when *M = 0.5* and *A = 1* (try to only use *p* and *RTT*).

$$Throughput = \frac{1.5W}{2RTT}$$

$$p = \frac{2}{.75W^2}$$

$$W = \sqrt{\frac{8}{3p}}$$

$$Throughput = \frac{1.5\sqrt{\frac{8}{3p}}}{2RTT} = \frac{.5\sqrt{\frac{3*8}{p}}}{2RTT} = \frac{\sqrt{\frac{3}{2p}}}{RTT}$$

Q1

1 True or False

1. Hosts usually perform the iterative DNS resolution process themselves.

2. Every zone always has at least 2 name servers.

3. When looking up a root server, BGP will use unicast to find the correct root server.

4. A client can establish a TCP connection with a root server.

5. Most queries to DNS root servers are for nonexistent TLDs.

Q2

Information	Record Type
Name to IPV4 Address Mapping	
Name to IPV6 Address Mapping	
Name Server	
Human Readable Information (Often Used for Site Verification)	
General Name-to-Service Mapping	
Mail Exchanger	
Canonical Name	