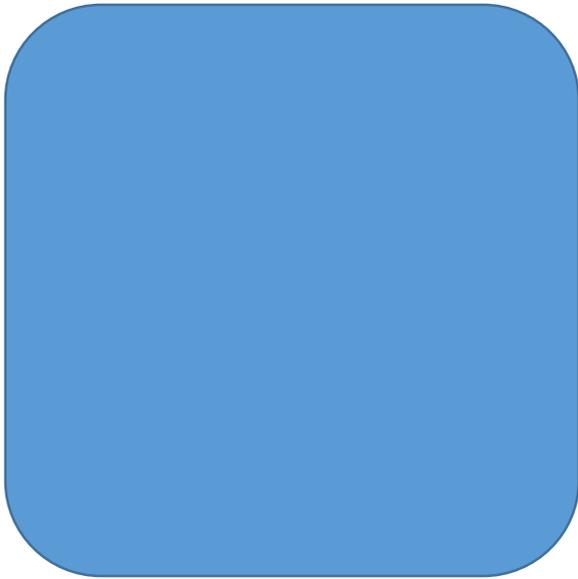


Internet Primer

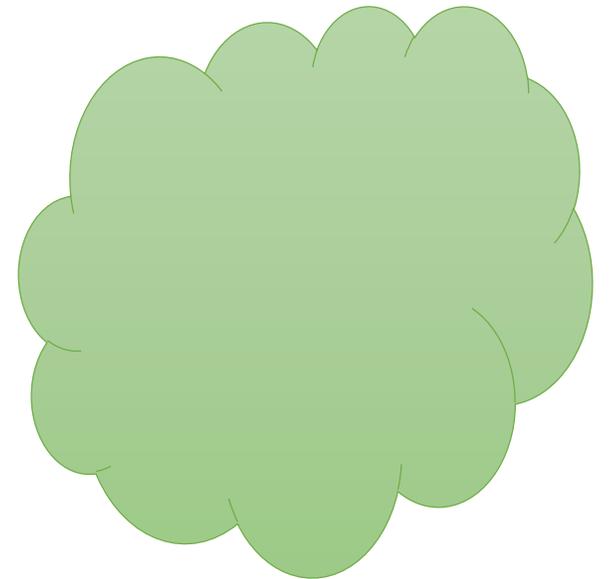
Internet Primer

- We've reached the point in the course where we begin the transition away from the command-line oriented world of C and start considering the web-based world of PHP and the like.
- Before we dive headlong into that world, it's a good idea to have a basic understanding of how humans and computers interact over the internet.

Internet Primer



You

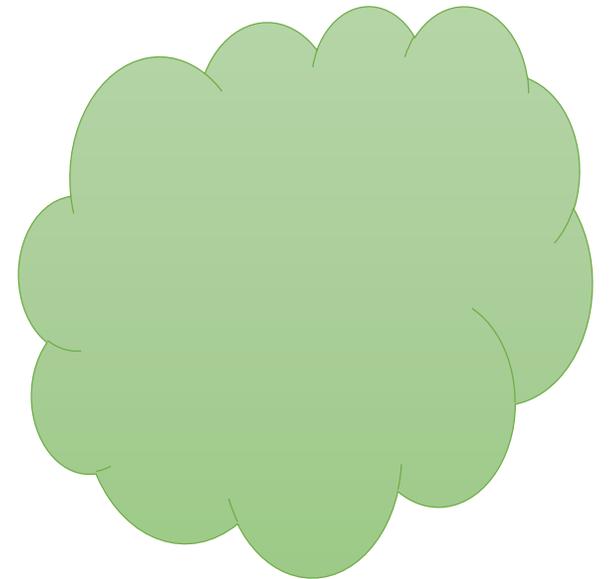


Internet

Internet Primer



You

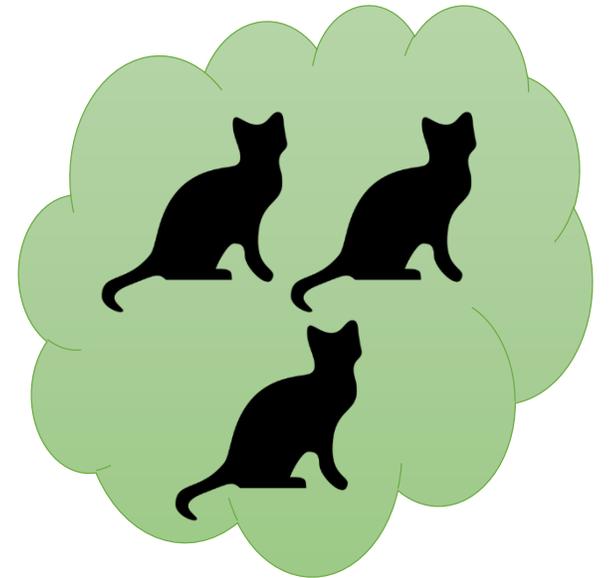


Internet

Internet Primer



You

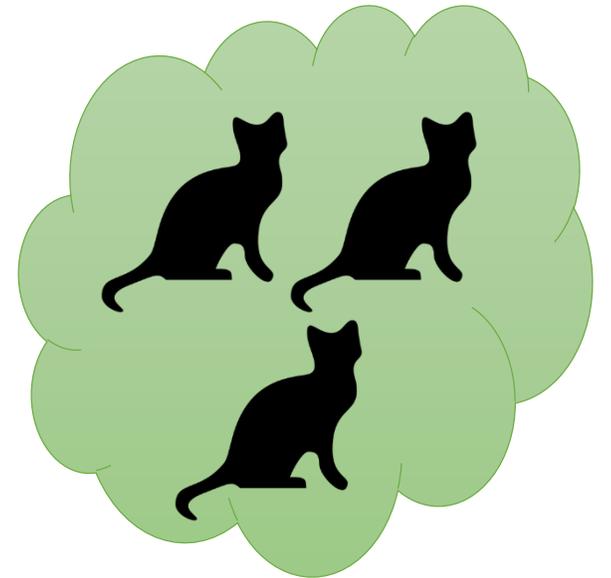


Internet

Internet Primer



You

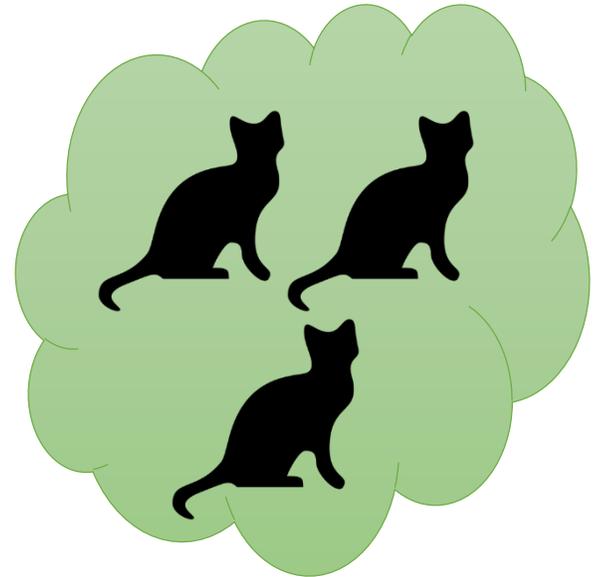
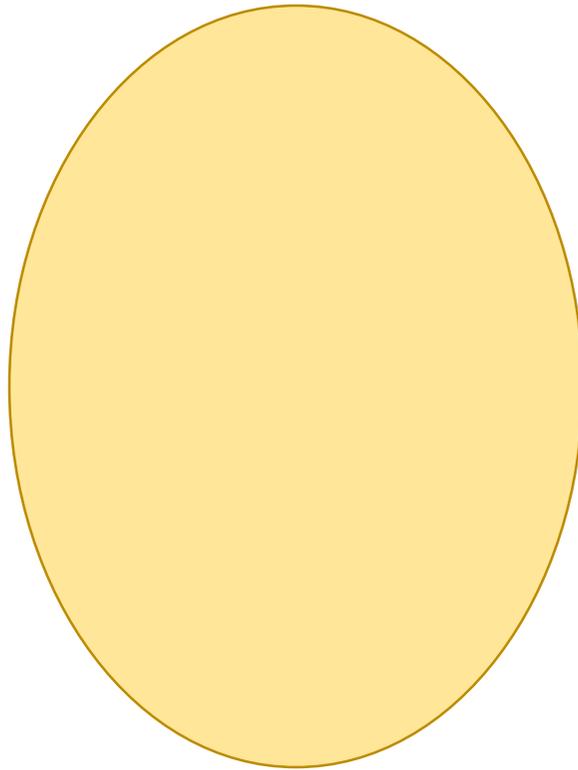


Internet

Internet Primer



You



Internet

Internet Primer

- **IP Address**
- In order for your machine to uniquely identify itself on the Internet, it needs an address.
 - This way, it can send information out and also receive information back to the correct location.
- The addressing scheme used by computers is known as IP addressing.

Internet Primer

- **IP Address**
- As originally developed, the IP addressing scheme would effectively allocate a unique 32-bit address to each device hoping to connect to the internet.
- Instead of representing these 32-bit addresses as hexadecimal, we represent them as four clusters of 8-bits using decimal notation.

Internet Primer

- **IP Address**

$w \cdot x \cdot y \cdot z$

- Each of w , x , y , and z can be a nonnegative value in the range $[0, 255]$.

Internet Primer

- **IP Address**

123.45.67.89

- Each of w , x , y , and z can be a nonnegative value in the range $[0, 255]$.

Internet Primer

- **IP Address**

140.247.223.81

- Each of w , x , y , and z can be a nonnegative value in the range $[0, 255]$.

Internet Primer

- **IP Address**

- If each IP address is 32 bits, that means there are roughly 4 billion addresses to give out.
- The population of the world is somewhere in excess of 7 billion, and most folks in the western world have more than 1 device capable of Internet connectivity.
 - Some workarounds have allowed us to deal with this problem (for now).

Internet Primer

- **IP Address**

- In recent years, we've been slowly phasing out this old scheme (IPv4) and replacing it with a newer scheme (IPv6) that assigns computers 128-bit addresses, instead of 32-bit addresses.

4,294,967,296

Internet Primer

- **IP Address**

- In recent years, we've been slowly phasing out this old scheme (IPv4) and replacing it with a newer scheme (IPv6) that assigns computers 128-bit addresses, instead of 32-bit addresses.

~~4,294,967,296~~

Internet Primer

- **IP Address**

- In recent years, we've been slowly phasing out this old scheme (IPv4) and replacing it with a newer scheme (IPv6) that assigns computers 128-bit addresses, instead of 32-bit addresses.

340,282,366,920,938,463,463,374,607,431,768,211,456

Internet Primer

- **IPv6 Address**

`s:t:u:v:w:x:y:z`

- Each of s, t, u, v, w, x, y, and z is represented by 1 to 4 hexadecimal digits in the range [0, ffff].

Internet Primer

- **IPv6 Address**

1234:5678:90ab:cdef:fedc:ba09:8765:4321

- Each of s, t, u, v, w, x, y, and z is represented by 1 to 4 hexadecimal digits in the range [0, ffff].

Internet Primer

- **IPv6 Address**

2001:4860:4860:0:0:0:0:8844

- Each of s, t, u, v, w, x, y, and z is represented by 1 to 4 hexadecimal digits in the range [0, ffff].

Internet Primer

- **IPv6 Address**

2001:4860:4860::8844

- Each of s, t, u, v, w, x, y, and z is represented by 1 to 4 hexadecimal digits in the range [0, ffff].

Internet Primer

- **DHCP**
- How do we get an IP address in the first place though? Surely we can't just choose any one we want. What if the want we want is already taken?
- Somewhere between your computer and the Internet at large exists a *Dynamic Host Configuration Protocol* (DHCP) server, whose role is to assign IP addresses to devices.

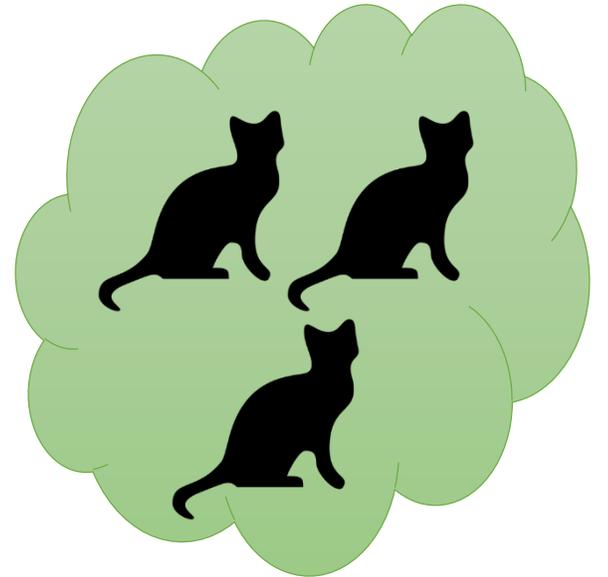
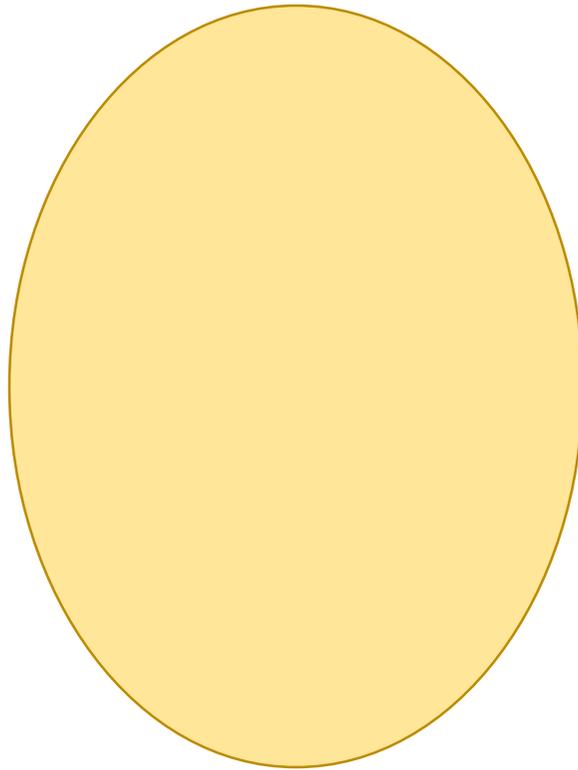
Internet Primer

- **DHCP**
- Prior to the widespread promulgation of DHCP, the task of assigning IP addresses fell to a system administrator, who would need to manually assign such addresses.

Internet Primer

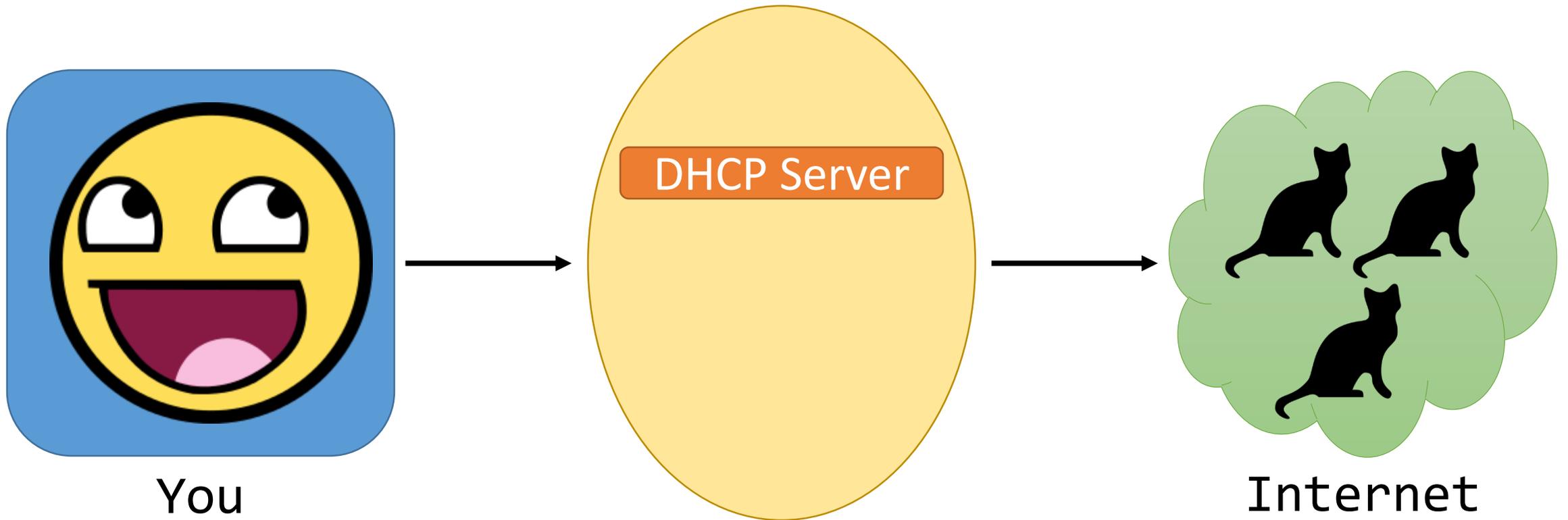


You



Internet

Internet Primer



Internet Primer

- **DNS**

- Odds are, you've never actually tried to visit a website by typing its IP address into your browser.
- The Domain Name System (DNS) exists to help us translate IP addresses to more memorable names that are more human-comprehensible.
- In this way, DNS is somewhat like the yellow pages of the web.

Internet Primer

- **DNS**

Host	IPv4 Address
info.host1.net	0.0.0.0
info.host2.net	0.0.0.1
	...
io-in-f138.1e100.net	74.125.202.138
	...
info.hostn-1.net	255.255.255.254
info.hostn.net	255.255.255.255

Internet Primer

- **DNS**

Host	IPv4 Address
info.host1.net	0.0.0.0
info.host2.net	0.0.0.1
...	
google.com	74.125.202.138
...	
info.hostn-1.net	255.255.255.254
info.hostn.net	255.255.255.255

Internet Primer

- **DNS**

Host	IPv6 Address
info.host1.net	0:0:0:0:0:0:0:0
info.host2.net	0:0:0:0:0:0:0:1
...	
lk-in-x93.1e100.net	2a00:1450:4010:c09:0:0:0:93
...	
info.hostn-1.net	ffff:ffff:ffff:ffff:ffff:ffff:ffff:fffe
info.hostn.net	ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff

Internet Primer

- **DNS**

Host	IPv6 Address
info.host1.net	0:0:0:0:0:0:0:0
info.host2.net	0:0:0:0:0:0:0:1
...	
google.ie	2a00:1450:4010:c09:0:0:0:93
...	
info.hostn-1.net	ffff:ffff:ffff:ffff:ffff:ffff:ffff:fffe
info.hostn.net	ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff

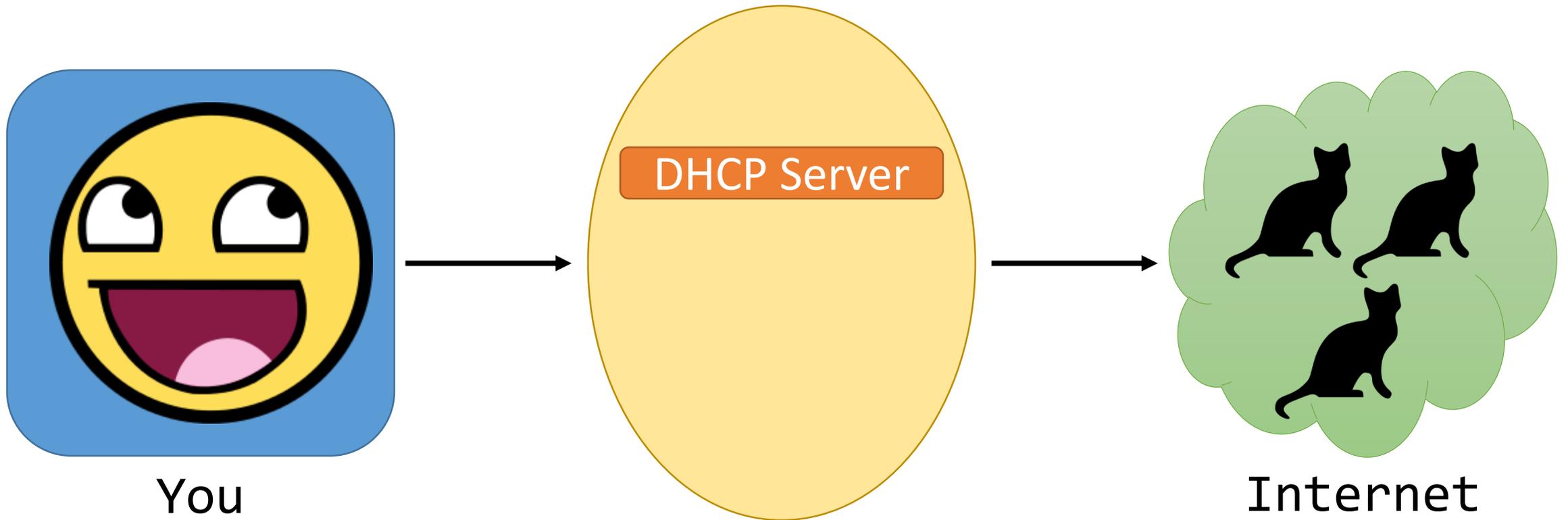
Internet Primer

- **DNS**
- Much like there is no yellow pages of the world, there is really no DNS record of the entire internet.
- Rather, large DNS server systems (like Google's own) are more like aggregators, collecting smaller sets of DNS information and pooling them together, updating frequently.

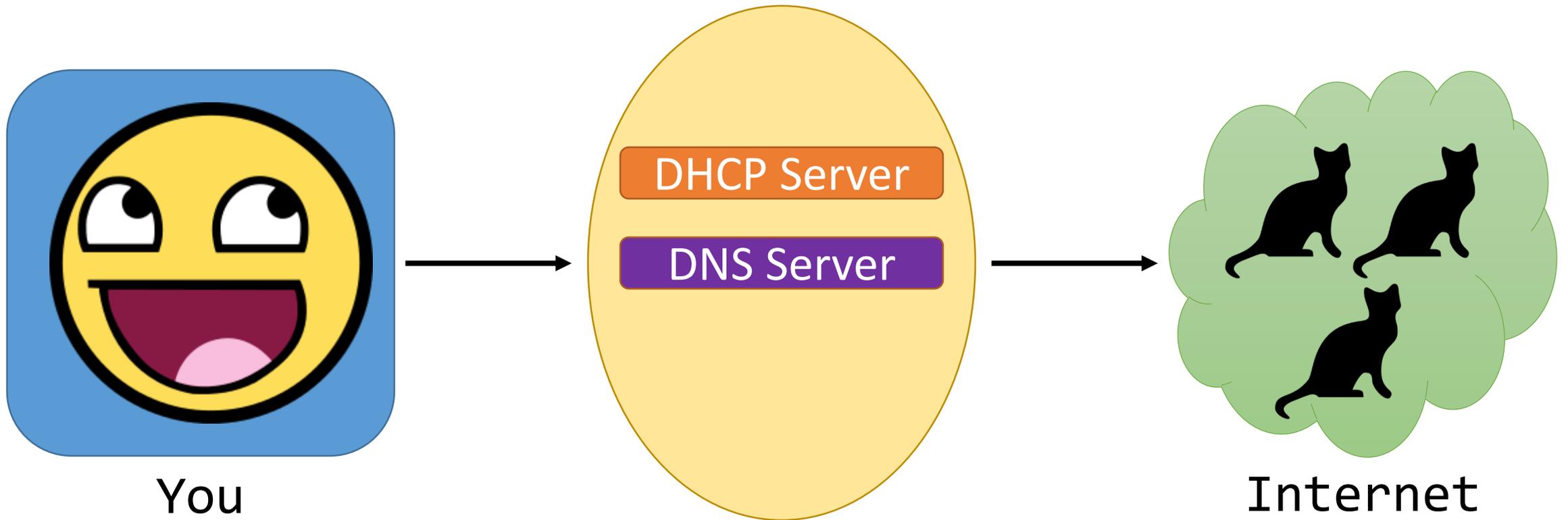
Internet Primer

- **DNS**
- In that way, large DNS servers are like libraries that stock many different sets of local yellow page books. In order to have the most up-to-date phone numbers for businesses, libraries must update the books they have on hand.
- DNS record sets are thus fairly decentralized.

Internet Primer



Internet Primer



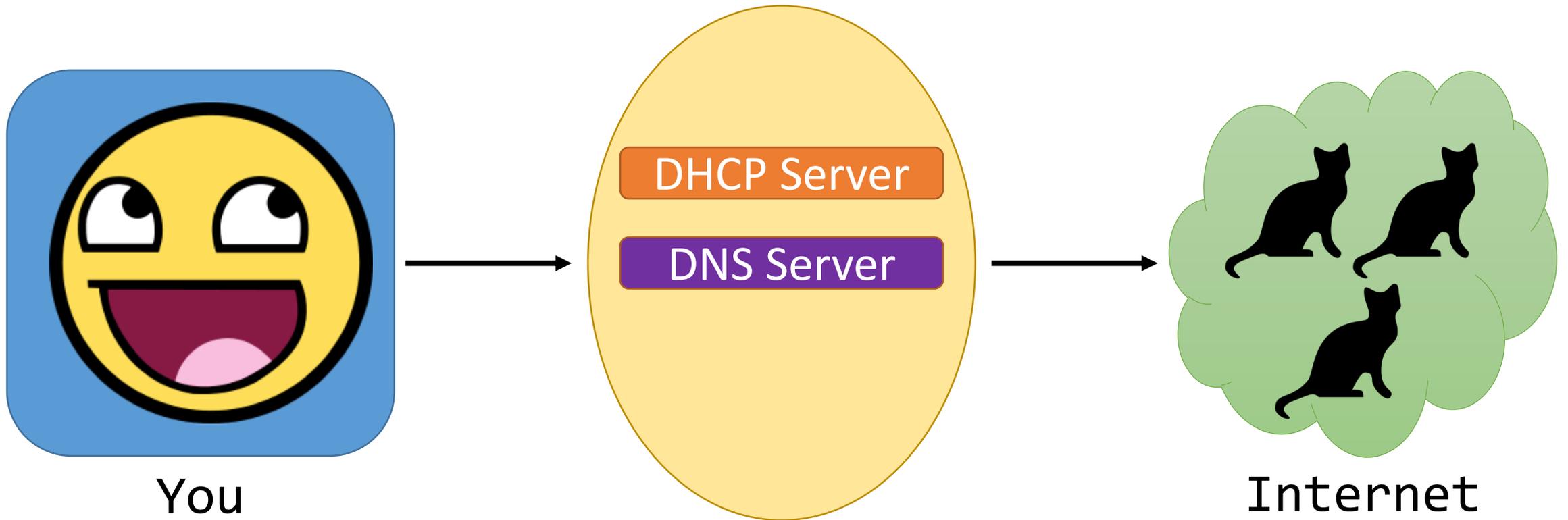
Internet Primer

- **Access Points**
- One of the ways we've dealt with the IPv4 addressing problem is to start assigning multiple people to the same IP address.
- The IP address is assigned to a *router*, whose job it is to act as a traffic cop that allows data requests from all of the devices on your local network (your home or business, e.g.) to be processed through a single IP address.

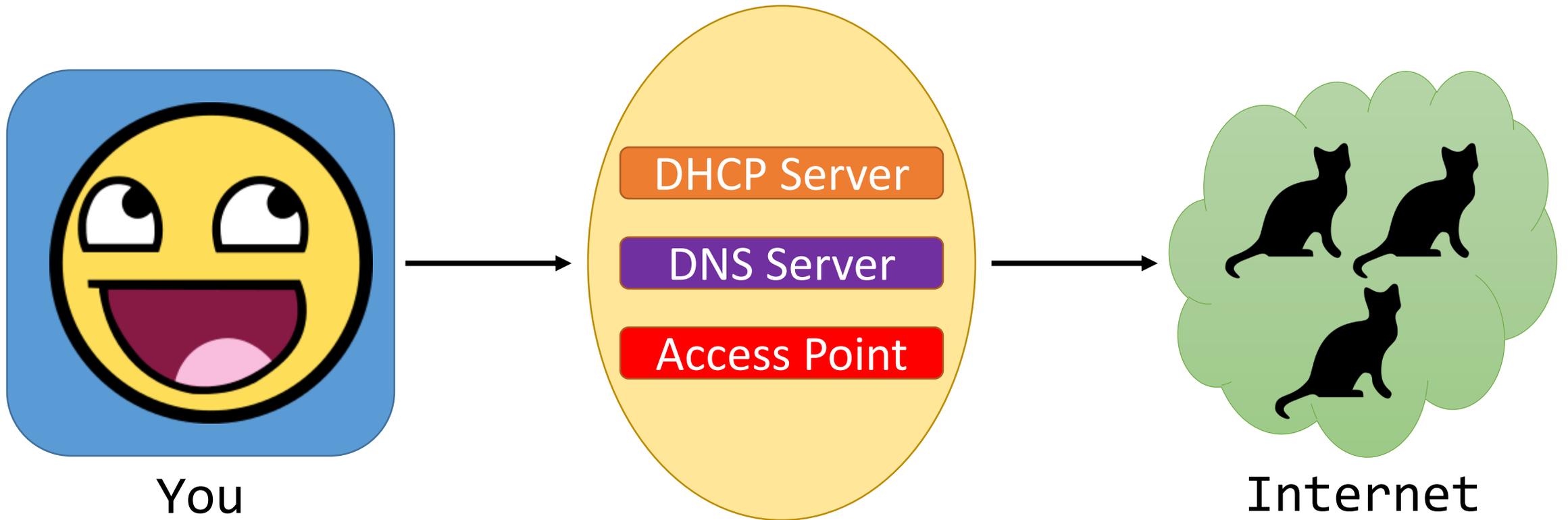
Internet Primer

- **Access Points**
- Modern home networks consist of access points that combine a router, a modem, a switch, and other technologies together into a single device.
- Modern business networks or large-scale wide-area networks (WANs) still frequently have these as separate devices to allow the size of their network to scale more easily.

Internet Primer



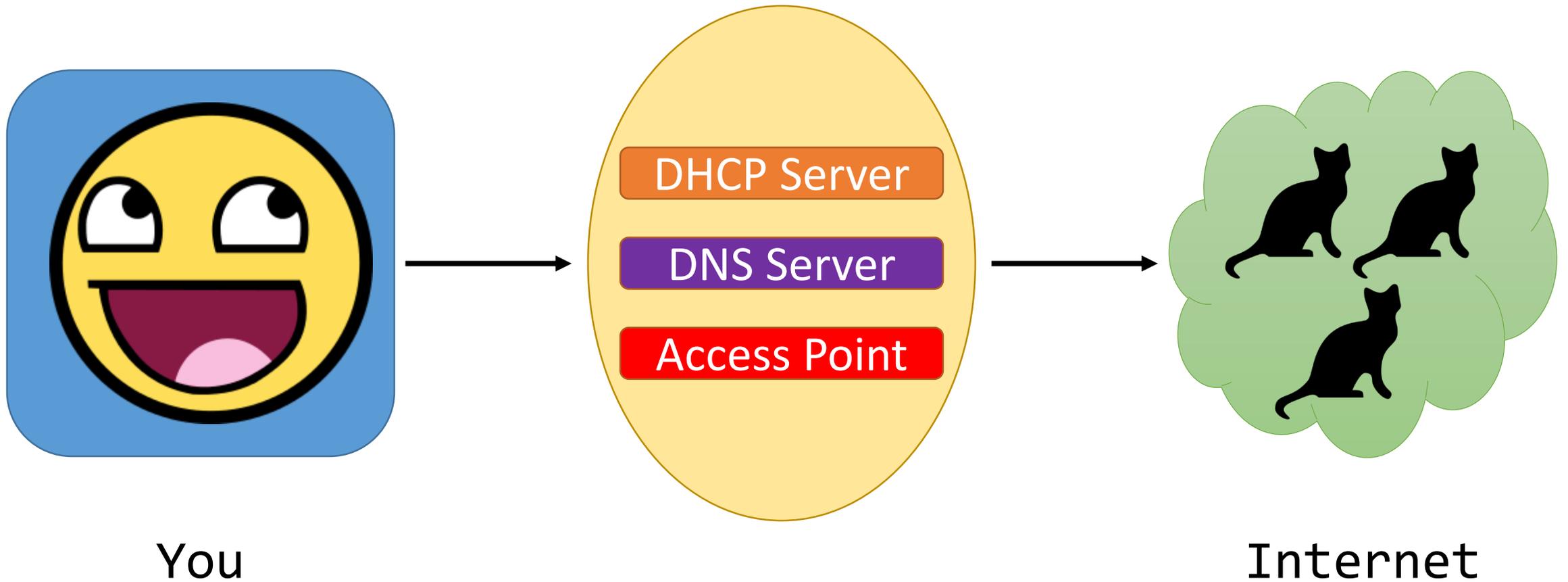
Internet Primer



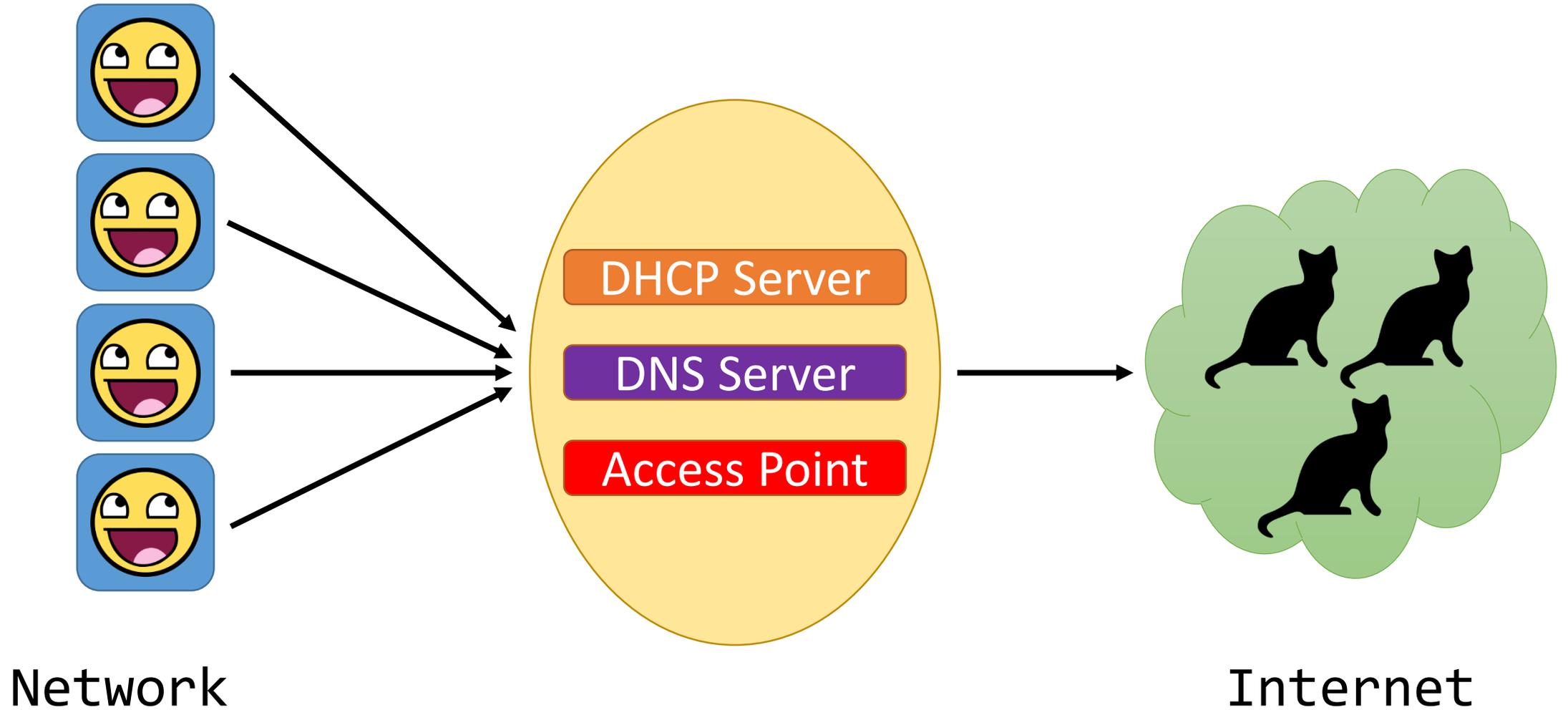
Internet Primer

- This isn't a course on networking, so this is far from the whole story, but it's enough to get us started.
- At home or at work we have local, small networks, and these networks are woven together to create a large, interconnected network—an Internet.
 - If you think about each of these small networks being isolated communities with only a single road in or out, the picture becomes a bit clearer.

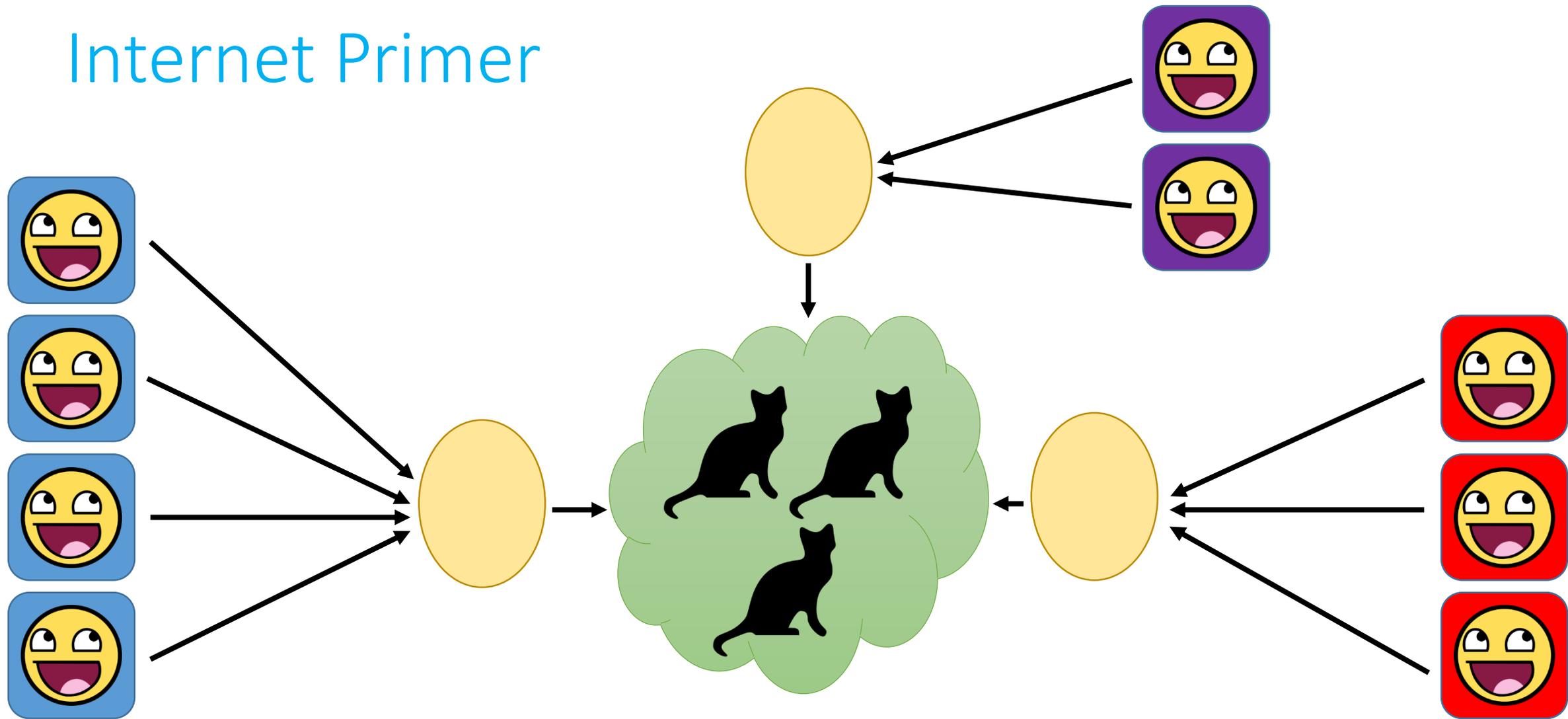
Internet Primer



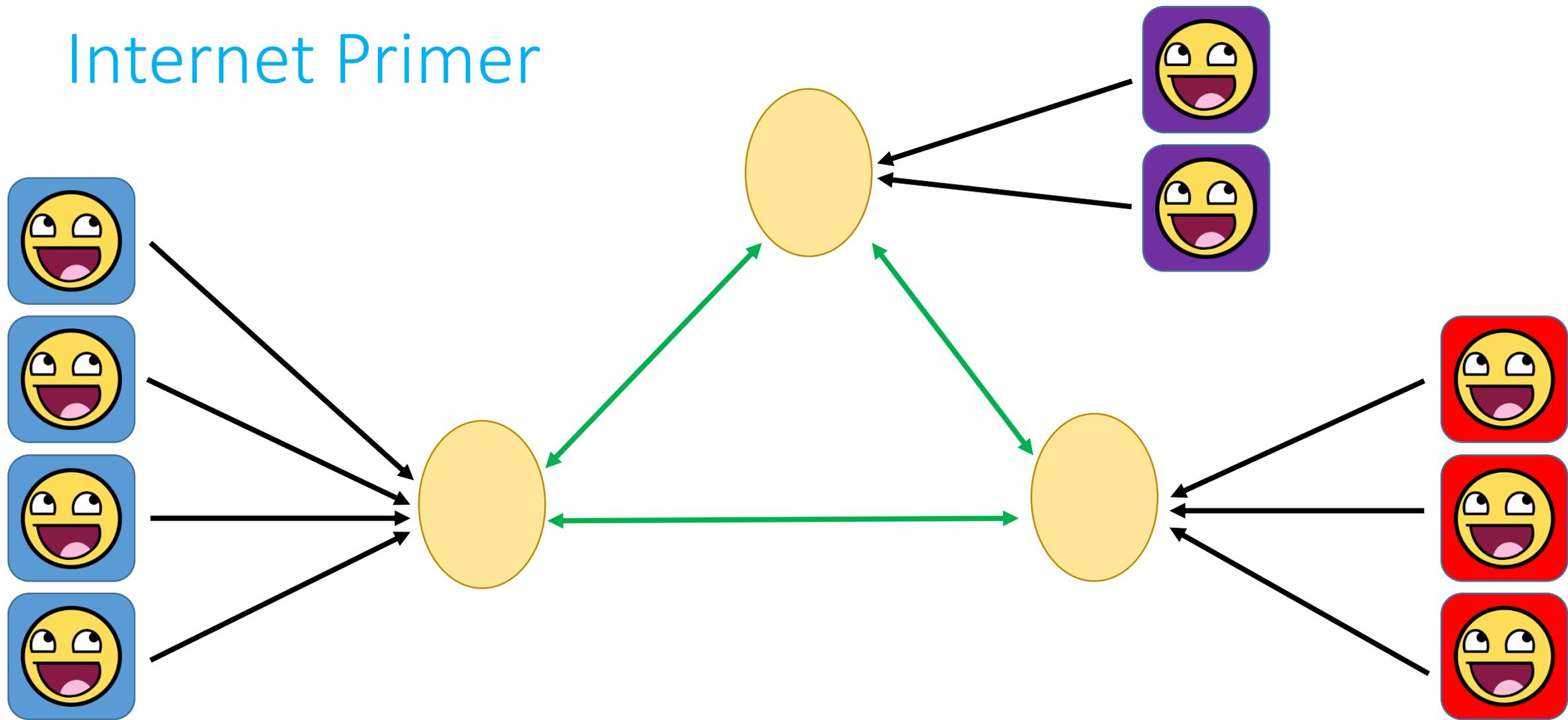
Internet Primer



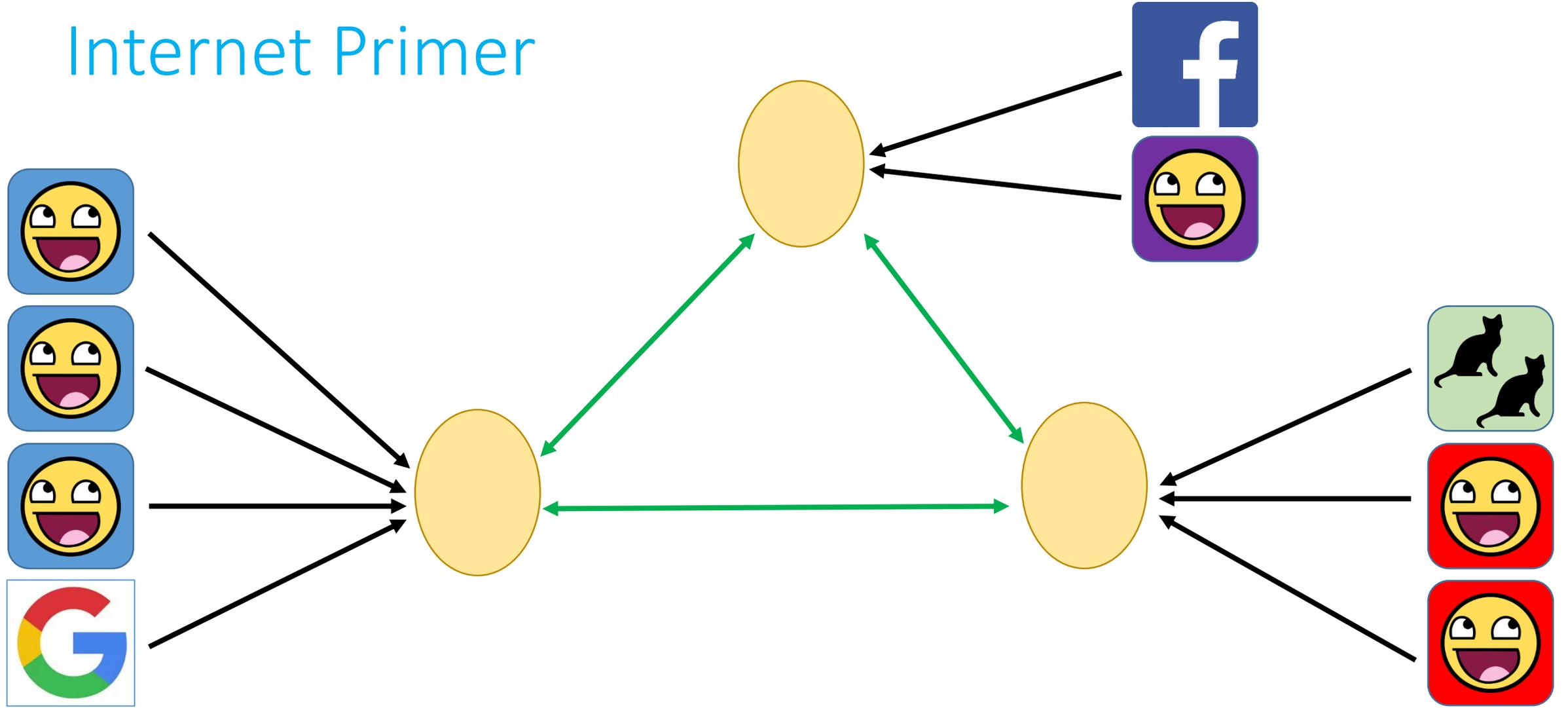
Internet Primer



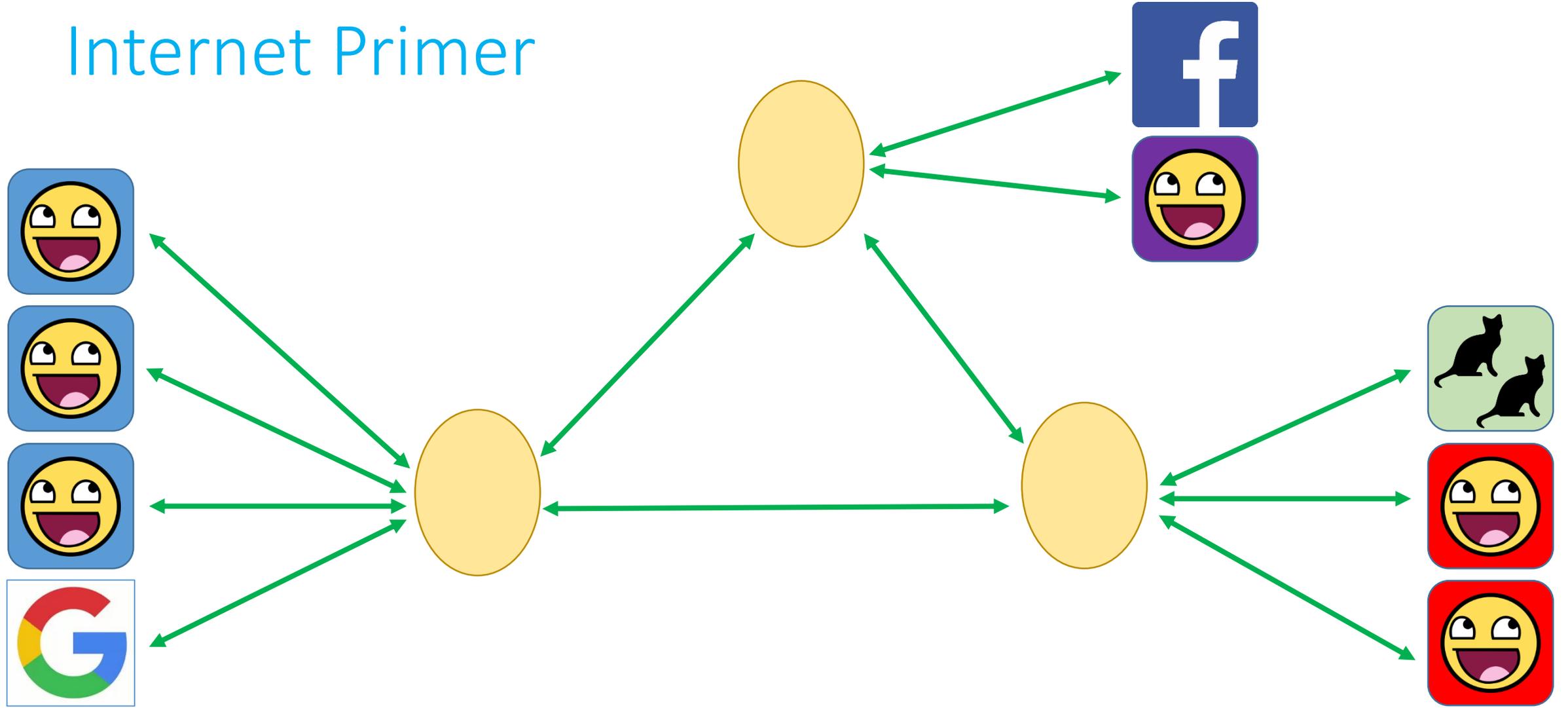
Internet Primer



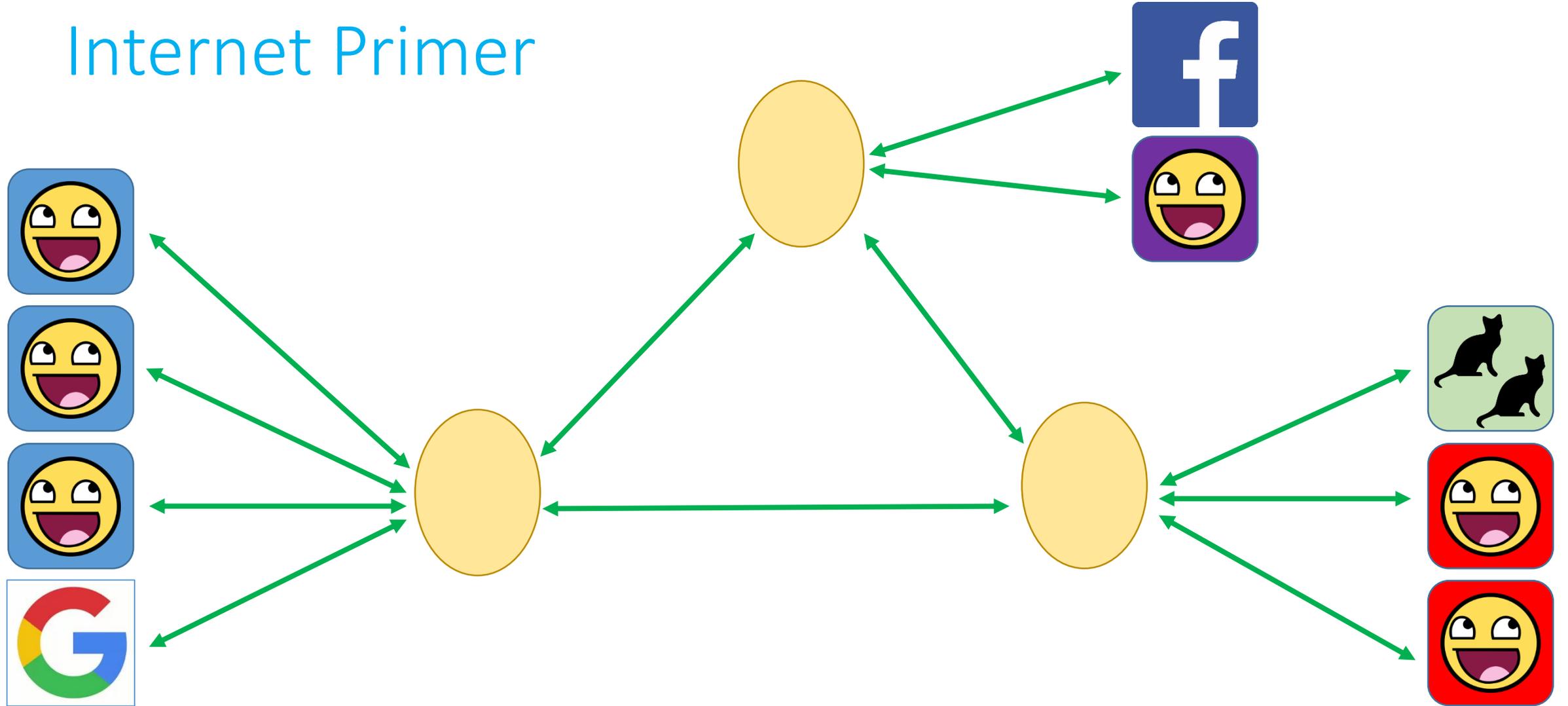
Internet Primer



Internet Primer



Internet Primer



protocols