

NETWORK PROGRAMMING

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The Internet

- Three basic functions of Internet comm. are addressing, naming, and routing.
- An Internet address uniquely identifies the location of an Internet node.
- Names provide a location-independent reference to Internet node.
- Routing is to deliver packets from source toward their destination address.
- We will study how to deal with these issues in Python.

Internet Addresses

- The current IPv4 addresses (32-bit) is about to running out.
- The new IPv6 addresses are 128-bit values (over $3.4 * 10^{38}$ unique addresses) and are represented as 8 hexadecimal numbers each representing a 16-bit value.

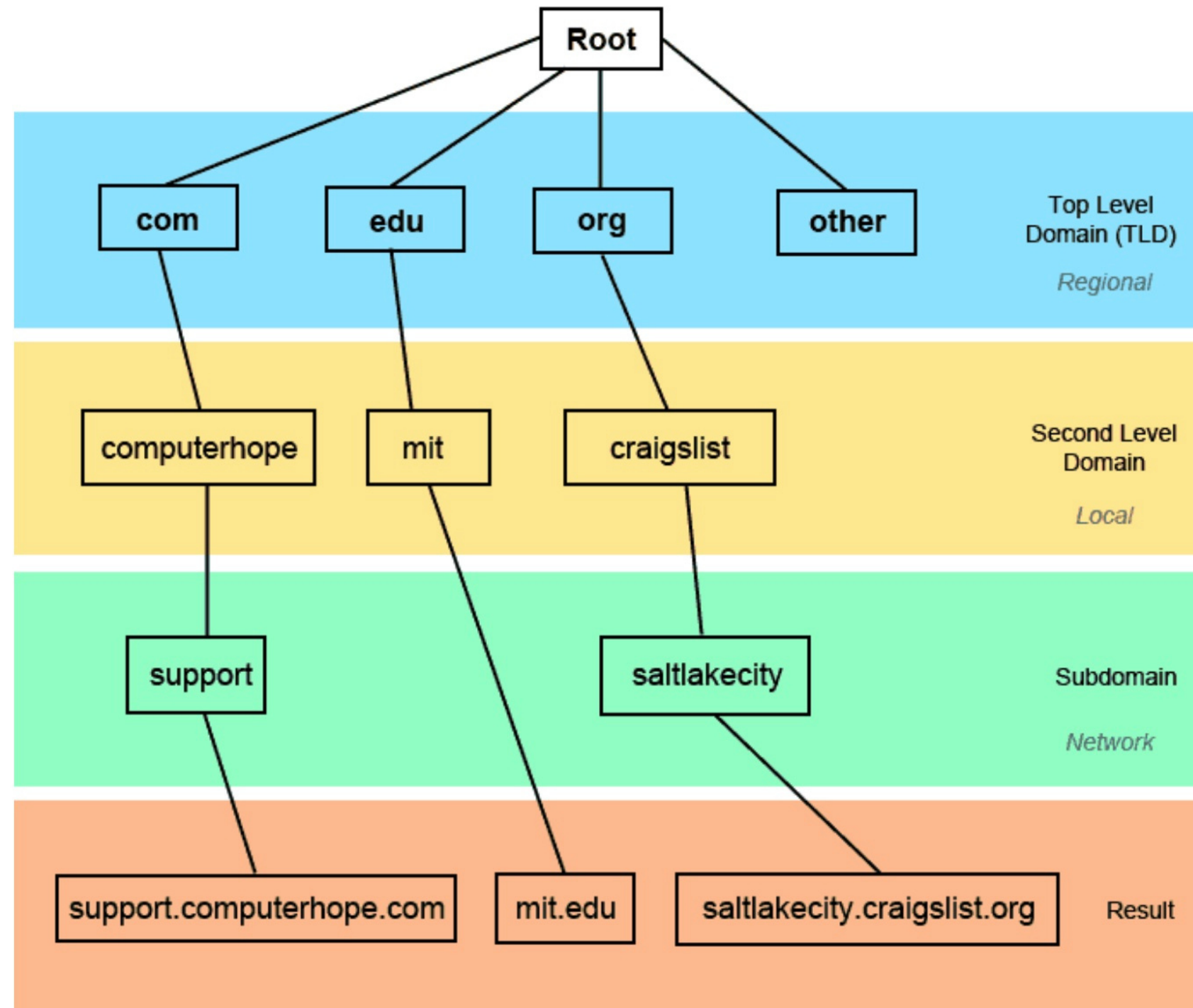
FEDC:BA98:7654:3210:FEDC:BA98:7654:3210

- Read RFC 2373 (<http://www.ietf.org/rfc/rfc2373.txt>) for more information.

Internet Naming

- IP addresses identify locations and are subject to change when hosts are moved.
- Numerical addresses are hard to remember.
- Domain Name System (DNS) provides location-independent and human-friendly identities to Internet nodes.
- DNS defined both a hierarchical naming data model and a protocol for querying the distributed data structure.

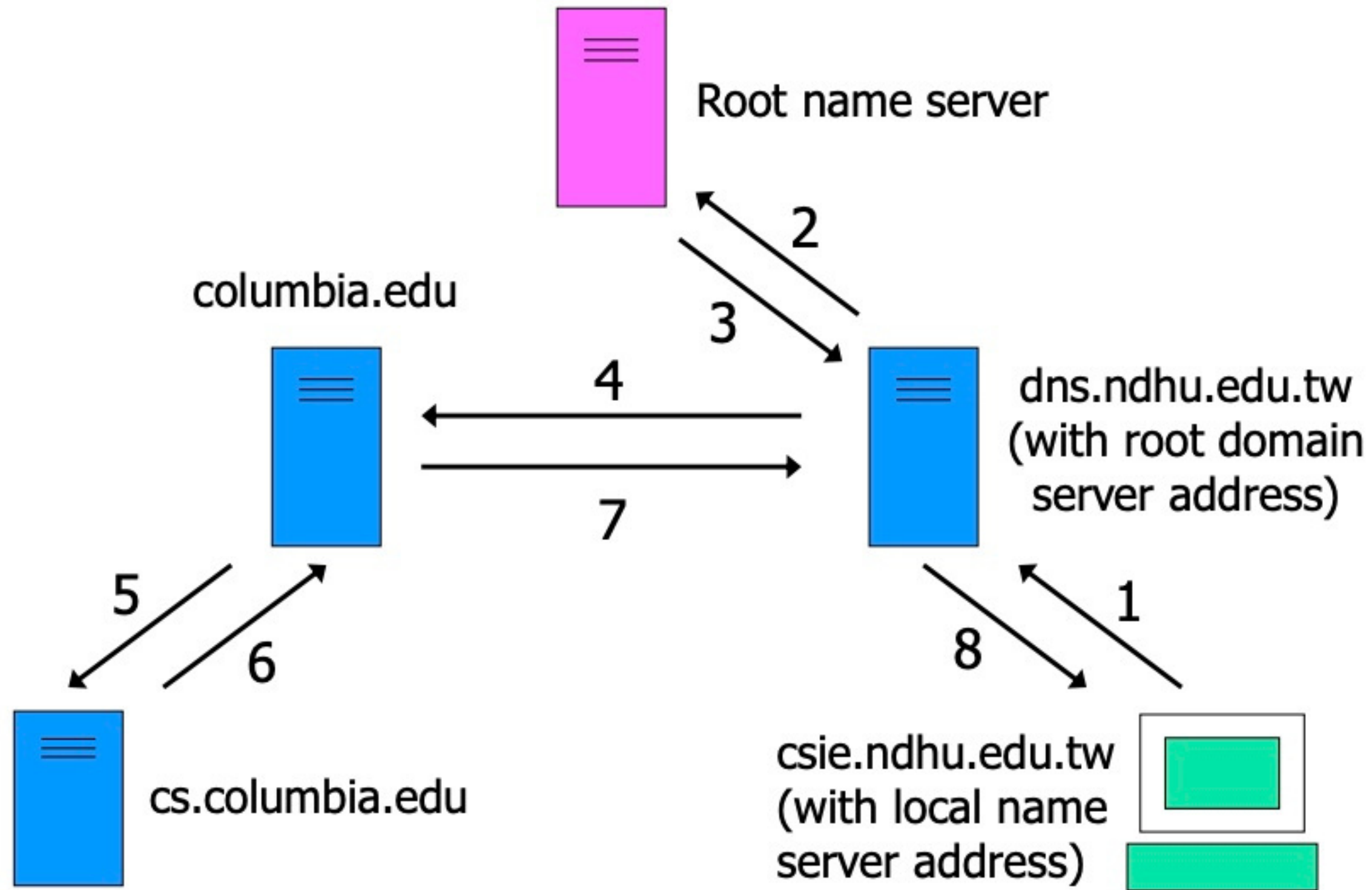
DNS Namespace



DNS Name Lookup Algorithm

- The resolver queries the local name server first. If found, returns immediately
- Local name server queries one of the root domain servers.
- The root domain server provides iterative query service and returns the address of the servers for a parent domain of the queried address.
- The local name server query one of the server which recursively queries its subdomain name servers if necessary.

DNS Name Lookup Example



ipaddress Module

- The The ipaddress library module provides capabilities to manipulate IPv4/IPv6 addresses directly.

```
import ipaddress
```

```
adr4 = ipaddress.ip_address('192.0.2.1')
```

```
adr6 = ipaddress.ip_address('2001:DB8::1')
```

```
adr6, adr4
```


socket Module

- The socket module provides BSD socket interface to all modern systems
- Get address from domain name (DNS lookup):

```
import socket
```

```
socket.gethostbyname('www.ndhu.edu.tw')
```

- Get name from address (reverse DNS lookup):

```
socket.gethostbyaddr('134.208.11.217')
```

```
socket.getfqdn('134.208.11.217')
```

```
socket.gethostname()
```

gethostname & sethostname

- `Socket.gethostname()` returns a string of the hostname of the current machine
- `Socket.sethostname(name)` allow you to set the current machine's hostname to name.
- Note that `gethostbyname()` only returns IPv4 address.
- Use `getaddinfo()` for IPv4/v6 dual support

Other Methods

- `gethostbyname_ex(hostname)`: extended interface to get more info from `hostname`.
- `getprotobyname(protocolname)`: returns the constant ID of the protocol
- `getservbyname(servicename[, protoname])`: returns the port number for the service
- `getservbyport(port[, protoname])`: returns the service name for the port

DNS Lookup Example (1)

```
import socket
```

```
addr1 = socket.gethostbyname('google.com')
```

```
addr2 = socket.gethostbyname('yahoo.com') print(addr1, addr2)
```

```
# 74.125.202.100 98.137.246.8
```

IP Network

```
import socket

# Function to display hostname and IP address
def get_Host_name_IP():
    try:
        host_name = socket.gethostname()
        host_ip = socket.gethostbyname(host_name)
        print("Hostname : ", host_name)
        print("IP : ", host_ip)
    except: print("Unable to get Hostname and IP")
# Driver code get_Host_name_IP() #Function call
```

DNS Lookup Example (2)

■ `gethostbyname_ex(hostname)`: extended interface to get more info from

`hostname`.

```
import socket
```

```
import ipaddress
```

```
host = socket.gethostname()
```

```
print(host)
```

```
ip = socket.gethostbyname('localhost')
```

```
print(ip)
```

```
net = ipaddress.ip_network(ip)
```

```
print(net)
```

IPv6 vs IPv4

- Python supports both IPv4 and IPv6.
- In most cases, you don't need to worry about the difference.
- In case you need to tell the difference, you can extract the IP version and test it for 4 or 6.