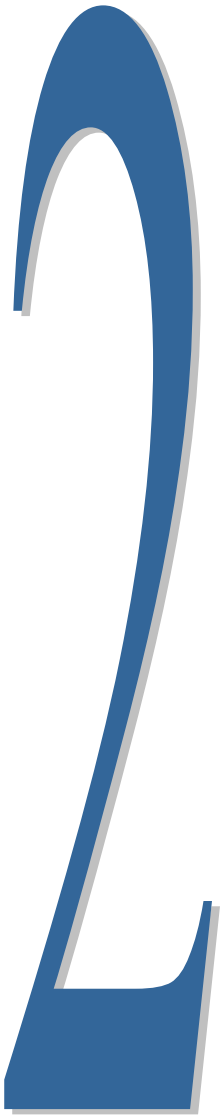


Network communications



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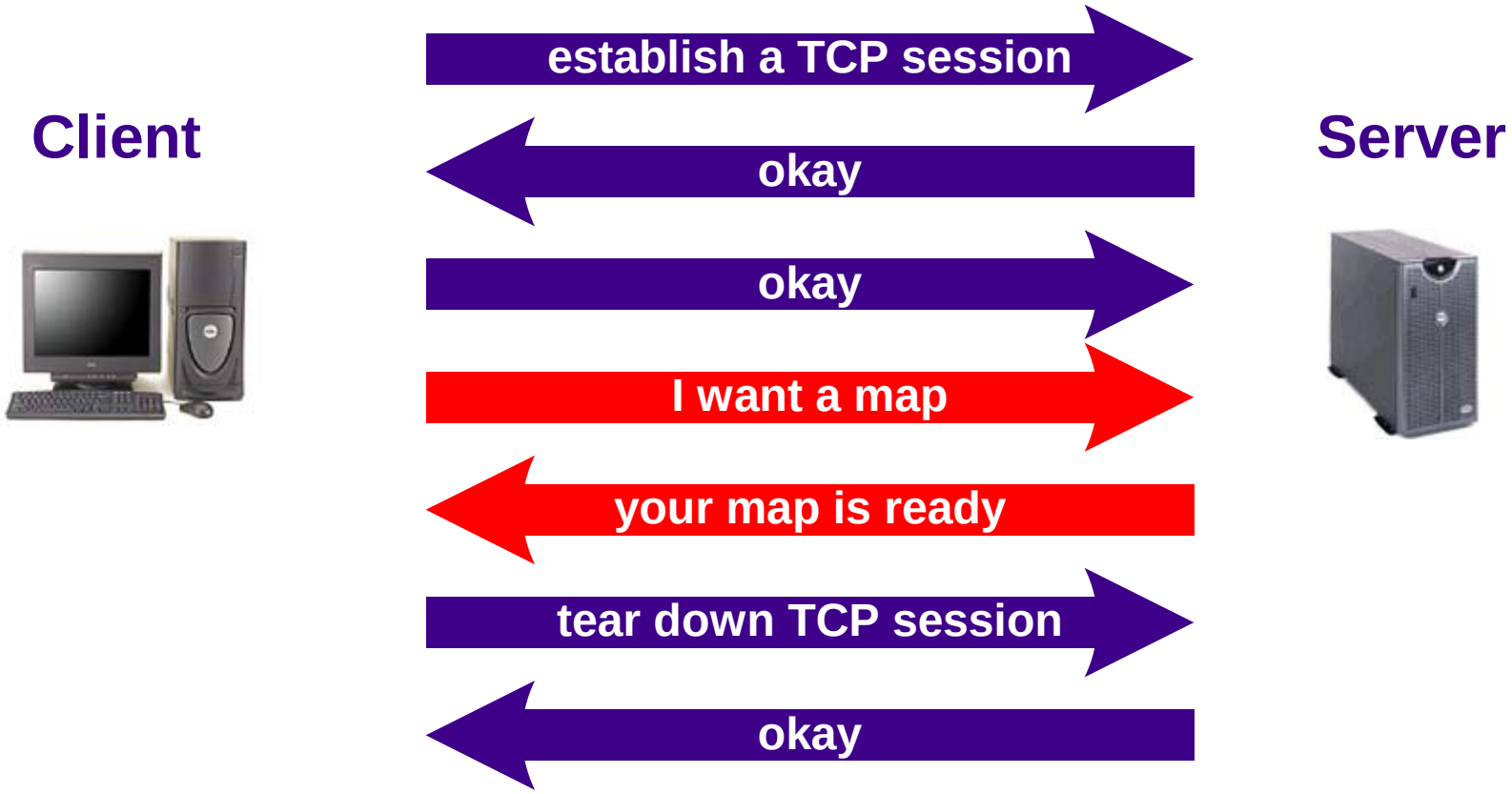
Lesson 2 goals

- Identify and describe Internet protocols
  - Basis for security and firewalls
- Troubleshoot communication problems
  - Use operating system TCP/IP utilities
- Understand ArcIMS interprocess communication

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TCP/IP networking

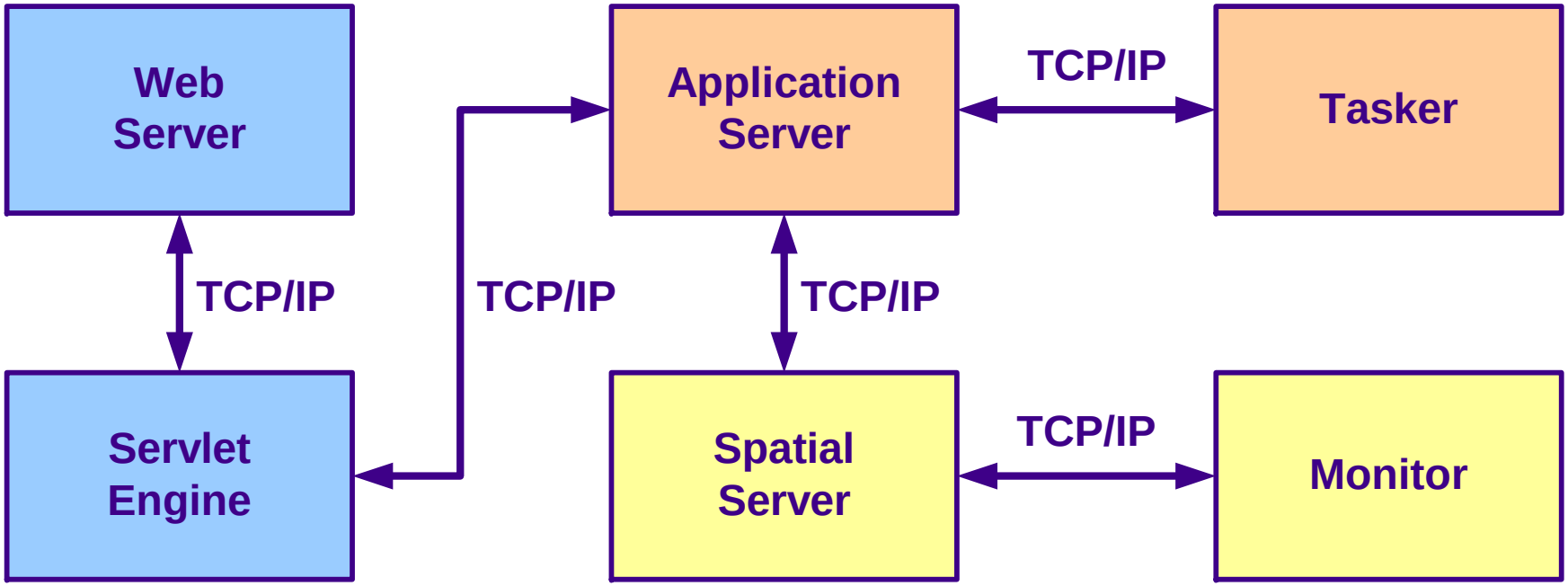
- All communication in ArcIMS uses TCP/IP networking



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ArcIMS server process communication

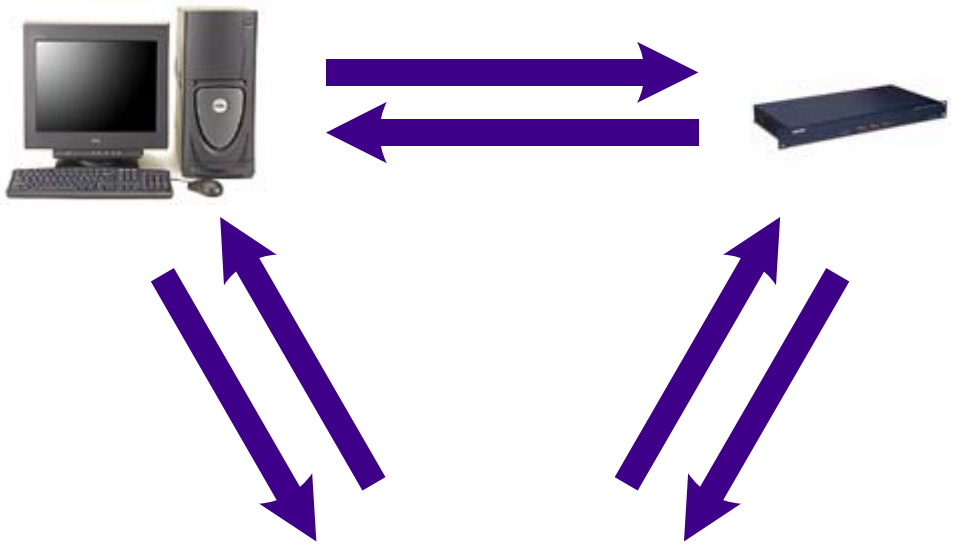
- All server processes use TCP/IP networking
  - even when they reside on a single host



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TCP/IP network hosts

- Every device connected to network is a host
  - Any host can talk to any other host
  - Every host has an IP address



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Gathering network information: using ipconfig

- Local area network 192.168.1.0
  - Host numbers from 192.168.1.1 to 192.168.1.254

```
C:\>ipconfig

Windows 2000 IP Configuration

Ethernet adapter Local Area Connection:

        Connection-specific DNS Suffix  . : esri.com
        IP Address. . . . . . . . . . . . : 192.168.1.100
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 192.168.1.1

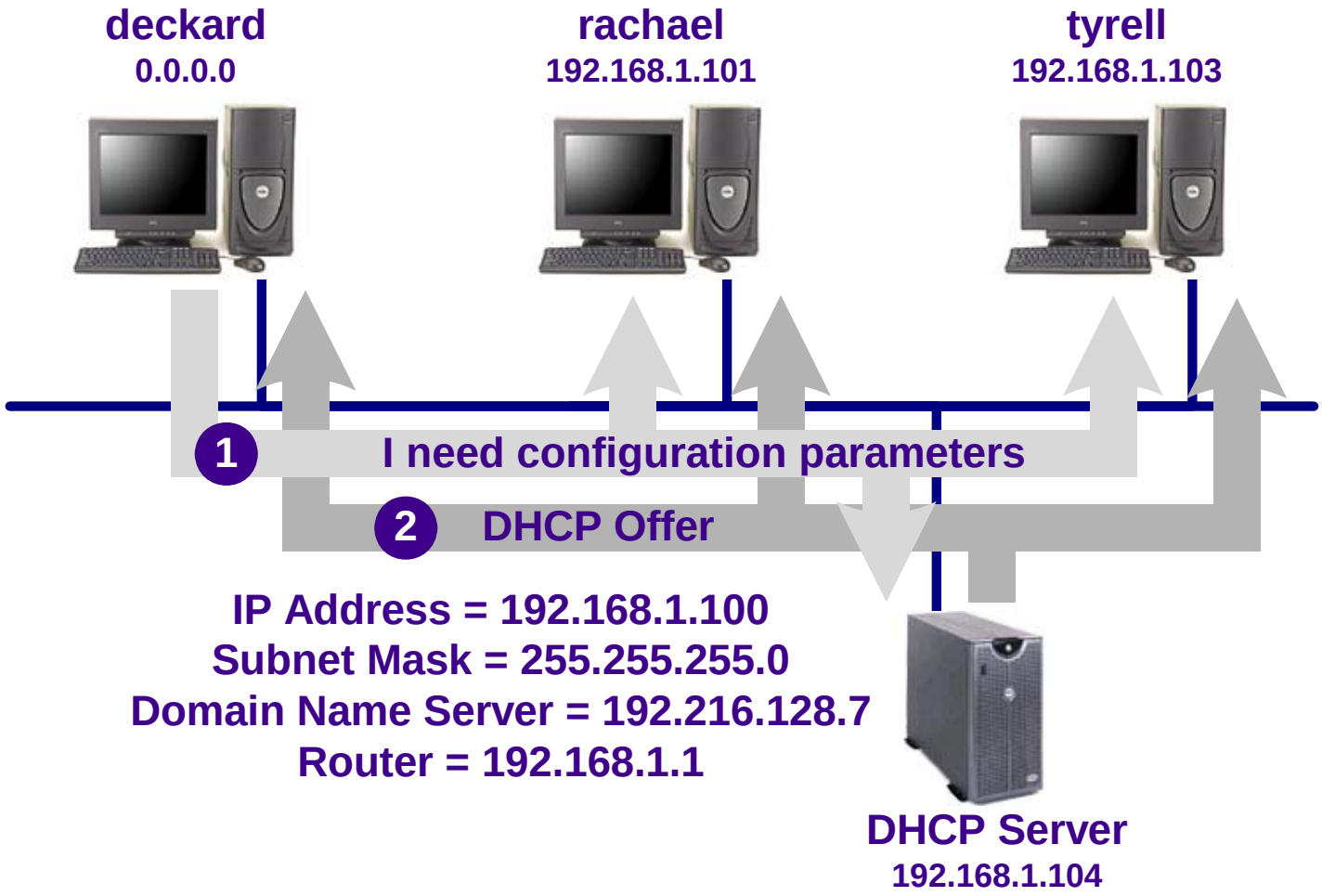
C:\>
```

	Binary	Dotted decimal
IP Address	11000000.10101000.00000001.01100100	192.168.1.100
Subnet mask	11111111.11111111.11111111.00000000	255.255.255.0
Network id	11000000.10101000.00000001.00000000	192.168.1.0
Host id	00000000.00000000.00000000.01100100	0.0.0.100

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Dynamic Host Configuration Protocol (DHCP)

- Host broadcasts request for configuration parameters
  - DHCP Server broadcasts available address



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Ports

- Allow many simultaneous network connections
- IP address + port number = socket

```
C:\>netstat

Active Connections

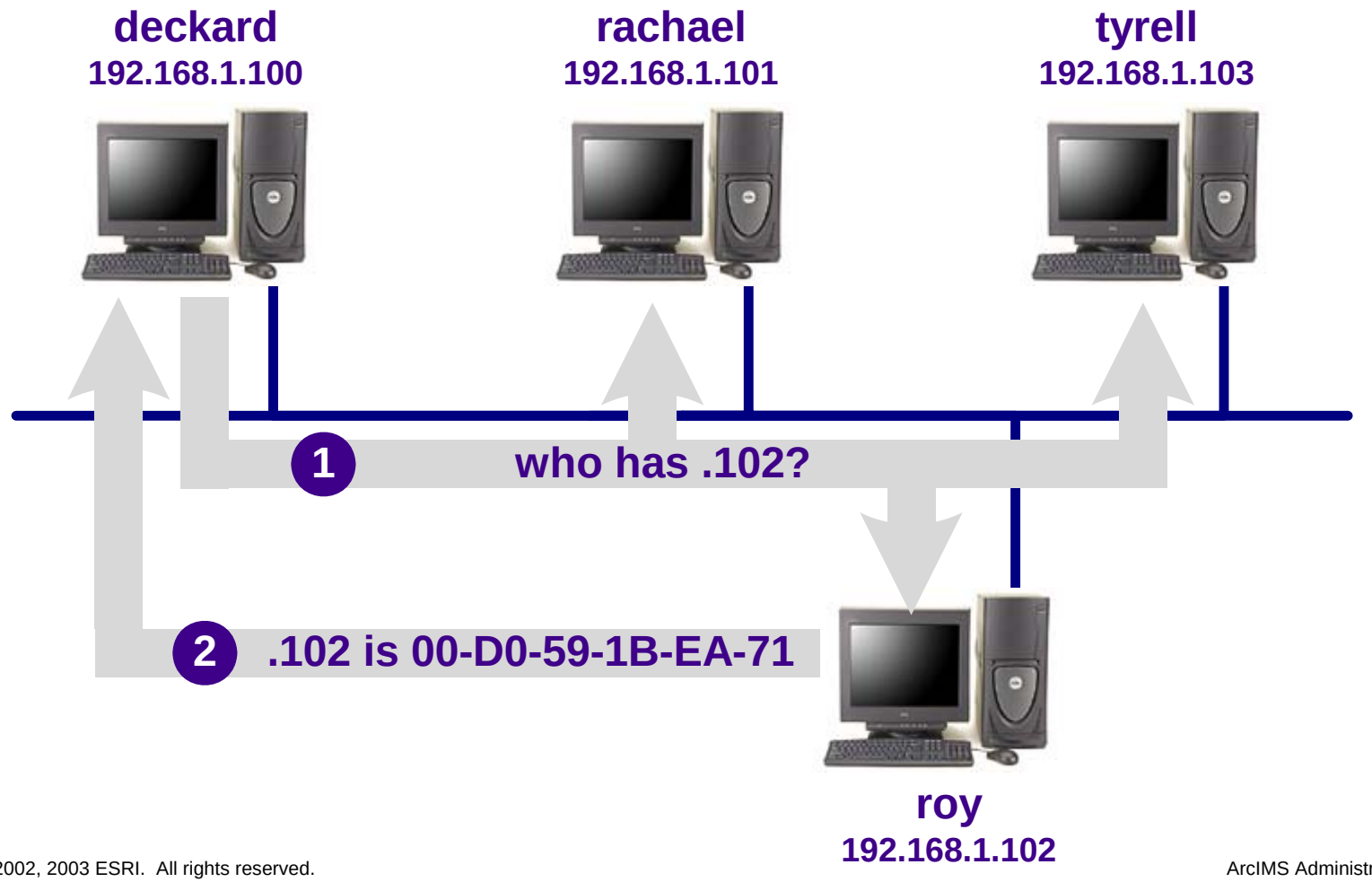
  Proto  Local Address          Foreign Address        State
  TCP    deckard:1030           TYRELL:netbios-ssn     ESTABLISHED
  TCP    deckard:1664           RACHAEL:netbios-ssn    ESTABLISHED
  TCP    deckard:2393           RACHAEL:4040           ESTABLISHED
  TCP    deckard:2685           RACHAEL:9090           ESTABLISHED
  TCP    deckard:2688           bjork.linkline.com:pop3  TIME_WAIT
  TCP    deckard:2691           bjork.linkline.com:pop3  TIME_WAIT
  TCP    deckard:2692           www9.cnn.com:http      ESTABLISHED
  TCP    deckard:2693           i4.cnn.net:http        ESTABLISHED
  TCP    deckard:2694           i4.cnn.net:http        ESTABLISHED
  TCP    deckard:2695           www9.cnn.com:http      SYN_SENT
  TCP    deckard:2696           i4.cnn.net:http        SYN_SENT

C:\>
```

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Address Resolution Protocol (ARP)

- Using ARP to locate hardware (MAC) address
  - believes the first response it receives



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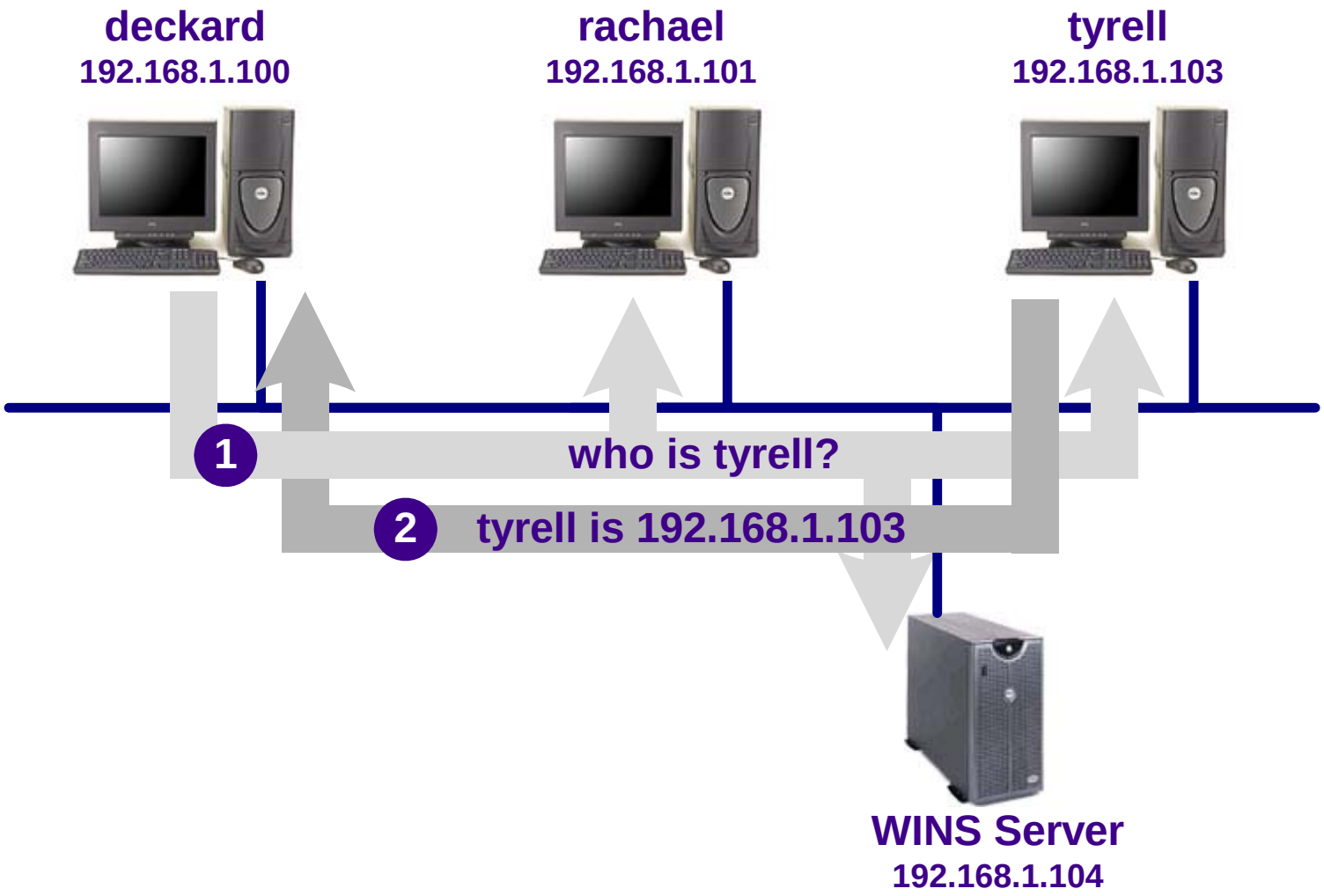
Hostname resolution

- Benefits of using names
  - Names are easier to remember than IP addresses
  - Names change less frequently than IP addresses
- Resolution is an extra step before contacting a destination host
- Windows 2000 uses the following name resolution order
  1. Cache
  2. WINS
  3. Broadcast
  4. Hosts
  5. DNS

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Hostname resolution: NetBIOS name query

- Example: deckard needs to contact tyrell



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Hostname resolution: NetBIOS name query




```
C:\>ping tyrell

Pinging tyrell [192.168.1.103] with 32 bytes of data:

Reply from 192.168.1.103: bytes=32 time<10ms TTL=255
Reply from 192.168.1.103: bytes=32 time<10ms TTL=255
Reply from 192.168.1.103: bytes=32 time<10ms TTL=255
Reply from 192.168.1.103: bytes=32 time<10ms TTL=255

Ping statistics for 192.168.1.103:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum =  0ms, Average =  0ms

C:\>nbtstat -c

Local Area Connection:
Node IpAddress: [192.168.1.100] Scope Id: []

                  NetBIOS Remote Cache Name Table

       Name              Type       Host Address    Life [sec]
    --------------------------------------------------------
    TYRELL         <00>  UNIQUE          192.168.1.103       592

C:\>arp -a

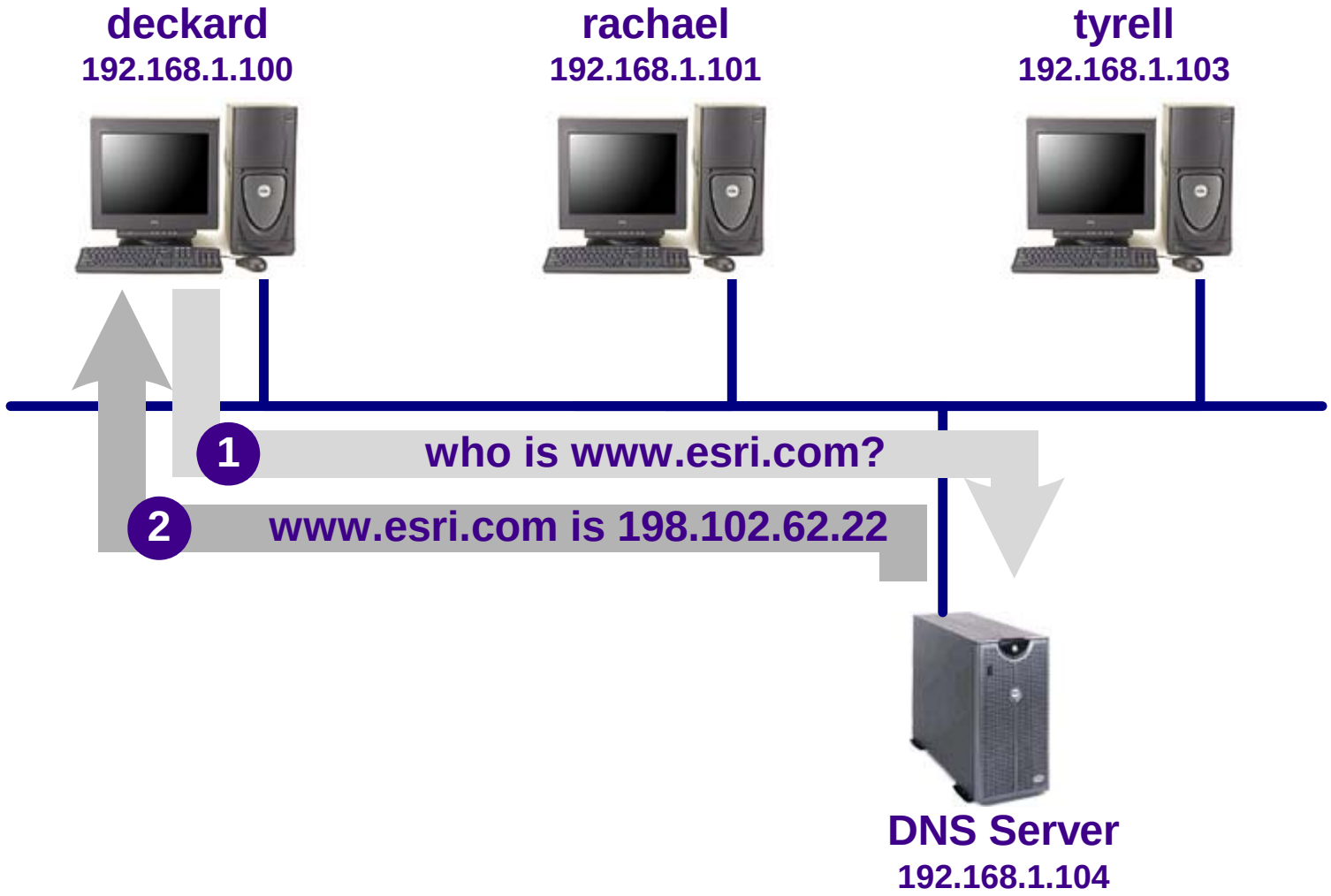
Interface: 192.168.1.100 on Interface 0x1000003
  Internet Address      Physical Address      Type
  192.168.1.103         00-50-da-70-1e-24     dynamic

C:\>
```

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Hostname resolution: DNS query

- Example: deckard needs to contact www.esri.com



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Hostname resolution: DNS query




```
C:\>nslookup tyrell
Server:  ns1.linkline.com
Address:  192.216.128.7

*** ns1.linkline.com can't find tyrell: Non-existent domain

C:\>nslookup www.esri.com
Server:  ns1.linkline.com
Address:  192.216.128.7

Name:    www.esri.com
Address:  198.102.62.22

C:\>ping www.esri.com

Pinging www.esri.com [198.102.62.22] with 32 bytes of data:

Reply from 198.102.62.22: bytes=32 time=61ms TTL=114
Reply from 198.102.62.22: bytes=32 time=120ms TTL=114
Reply from 198.102.62.22: bytes=32 time=121ms TTL=114
Reply from 198.102.62.22: bytes=32 time=160ms TTL=114

Ping statistics for 198.102.62.22:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 61ms, Maximum =  160ms, Average =  115ms

C:\>nbtstat -c

Local Area Connection:
Node IpAddress: [192.168.1.100] Scope Id: []

                  NetBIOS Remote Cache Name Table

       Name              Type       Host Address    Life [sec]
    ------------------------------------------------------------
    TYRELL         <00>  UNIQUE          192.168.1.103       487

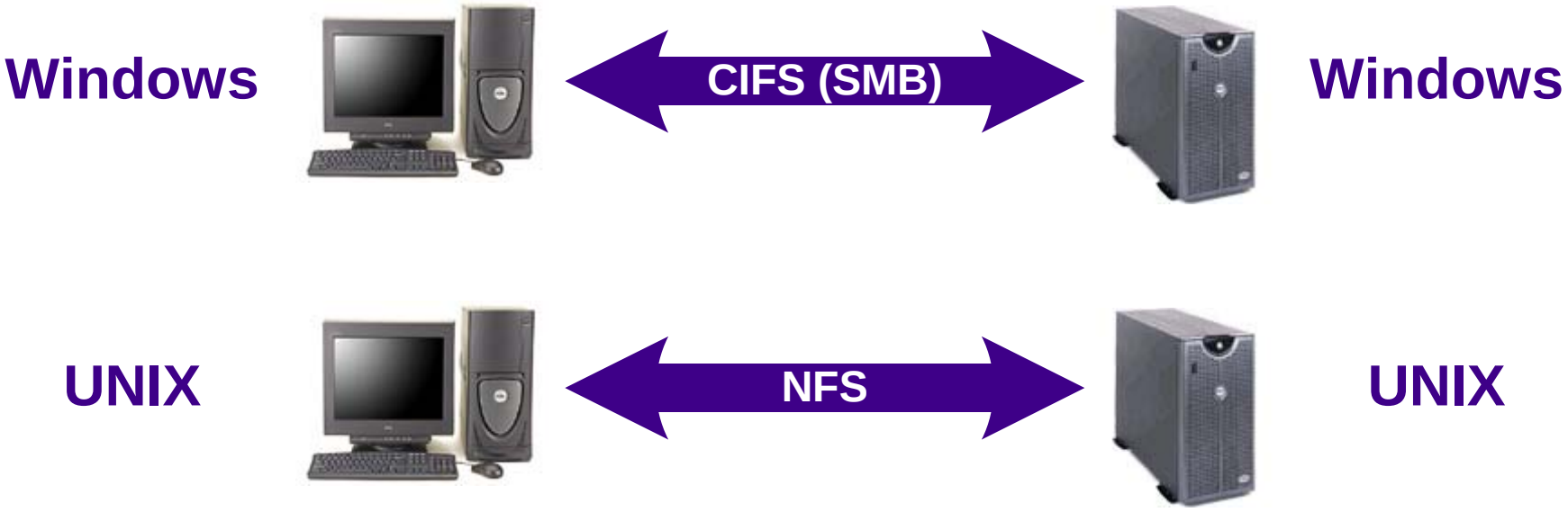
C:\>arp -a

Interface: 192.168.1.100 on Interface 0x1000003
  Internet Address      Physical Address      Type
  192.168.1.1           00-20-78-c5-4f-00     dynamic
  192.168.1.101         00-a0-cc-e7-16-c4     dynamic
  192.168.1.103         00-50-da-70-1e-24     dynamic
```

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File Sharing Systems

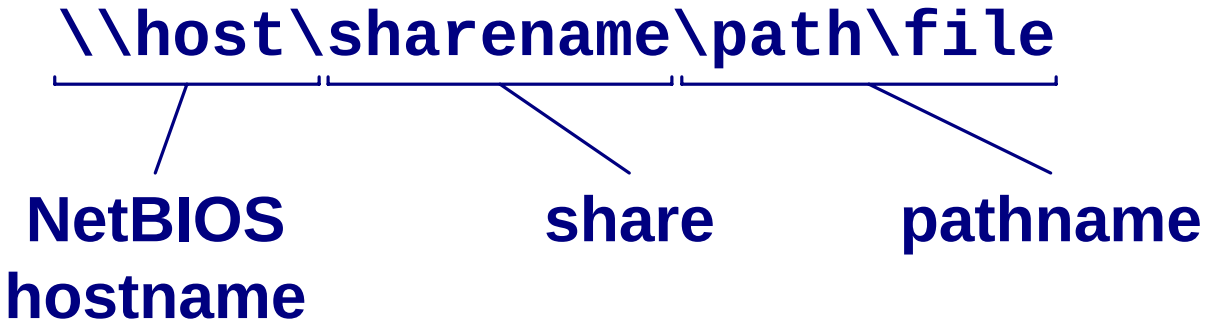
- Allows a computer to use files on another machine
- Two primary methods to share files
  - Common Internet File System (CIFS)
  - Network File System (NFS)



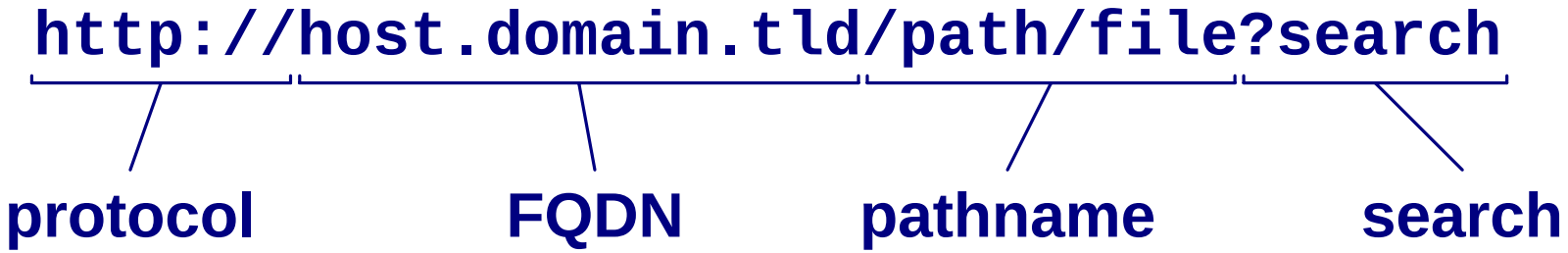
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File Sharing Systems: UNC versus URL

UNC Syntax - for file sharing



URL Syntax - not for file sharing



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Exercise 2 overview

- Find your IP address and hostname
- Examine TCP connections
- Use Fport
- Use DHCP
- Examine shared directories

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