计算机网络

15. DOMAIN NAME SYSTEM

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PART IV Network Applications

Ch 29 Naming With The Domain Name System

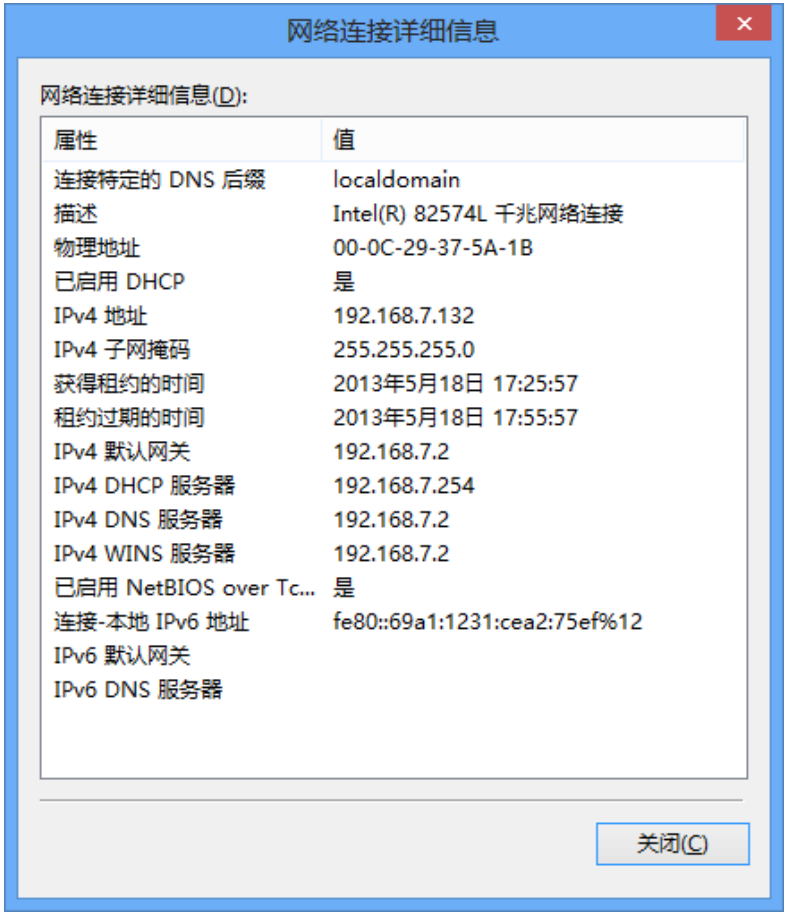
基于域名系统的命名

本章内容

- 身边的DNS
- 命名规则
- 域名解析
- 缓存
- 记录项

DNS客户端

- 这个地址真的起作用吗？



Domain Name System (DNS)

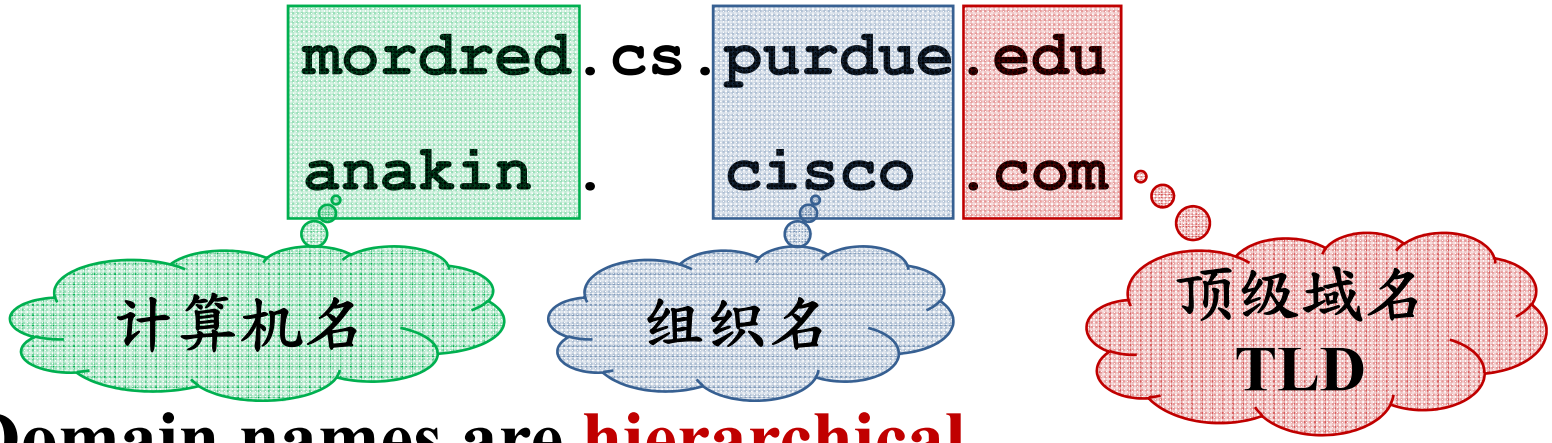
- DNS provides a service that maps human-readable symbolic names to computer addresses
  - 注意：计算机地址不是IP地址
  - Browsers, mail software, and most other Internet applications use the DNS
- Provides an interesting eg. of C/S interaction
  - The mapping is not performed by a single server
  - The naming information is distributed among a large set of servers located at sites across the Internet

Domain Name System (DNS)

- Whenever an application needs to translate a name
  - the application becomes a client of the naming system
  - the client sends a request message to a name server
  - server finds the corresponding address and sends a reply message
    - if it cannot answer a request, a name server temporarily becomes the client of another name server, until a server is found that can answer the request

Domain Name System (DNS)

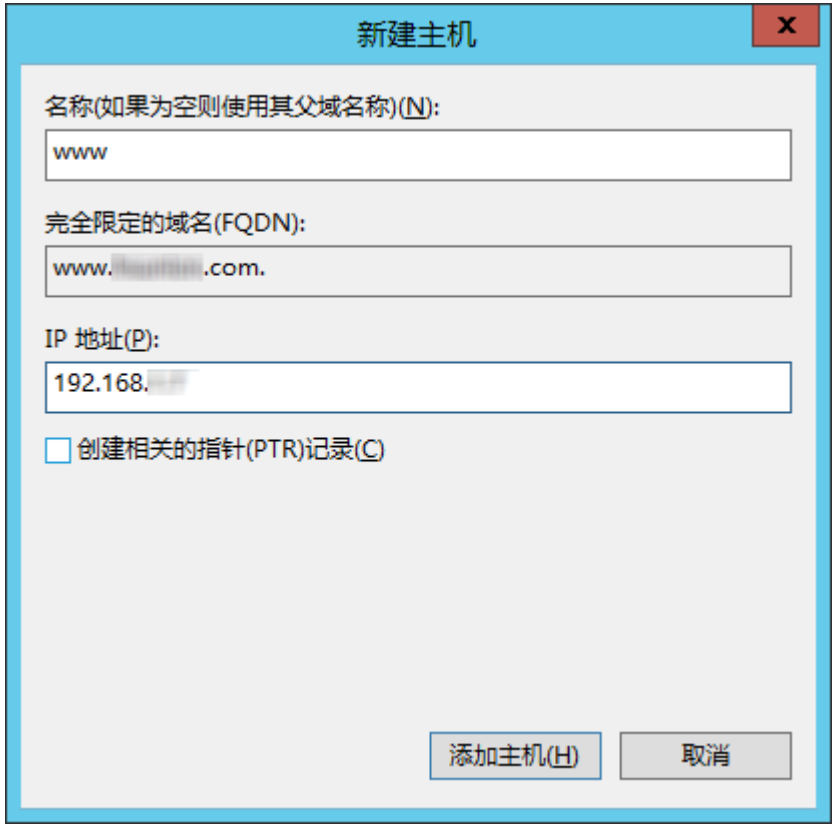
- Each name consists of a sequence of alpha-numeric segments separated by periods



- Domain names are hierarchical
  - ICANN designates one or more domain registrars to administer a given top-level domain and approve specific names

Domain Name System (DNS)

- **DNS does not specify the number of segments in a name**



Domain Name System (DNS)

- 部分开放登记
  - 如gov，不可能开放

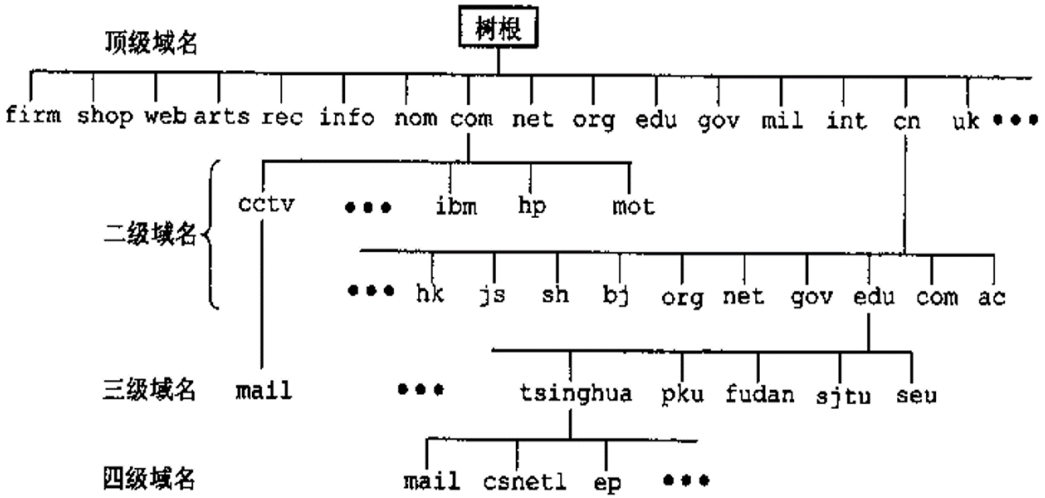


图 12-1 因特网的名字空间

Domain Name	Assigned To
aero	Air transport industry
arpa	Infrastructure domain
asia	For or about Asia
biz	Businesses
com	Commercial organizations
coop	Cooperative associations
edu	Educational institutions
gov	United States Government
info	Information
int	International treaty organizations
jobs	Human resource managers
mil	United States military
mobi	Mobile content providers
museum	Museums
name	Individuals
net	Major network support centers
org	Non-commercial organizations
pro	Credentialed professionals
travel	Travel and tourism
country code	A sovereign nation

Domain Names That Begin with `www`

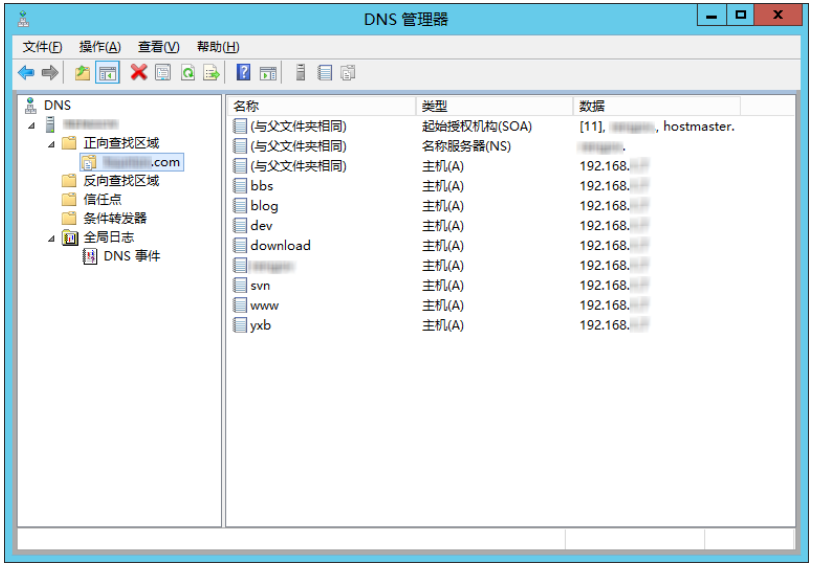
- Many organizations assign domain names that reflect the service a computer provides

```
ftp.foobar.com
www.foobar.com
```

  - mnemonic, but are not required
- The use of `www` to name computers that run a web server is merely a convention
  - an arbitrary computer can run a web server, even if the domain name does not contain `www`
  - a computer that has a domain name beginning with `www` is not required to run a web server

DNS Hierarchy and Server Model

- Each organization is free to choose the details of its servers
  - place all names for the organization in a single physical server, or among multiple servers



本地名字服务器和根名字服务器

- 每台主机应该知道本地名字服务器（ **local name server** ）
- 每台本地名字服务器应该知道根名字服务器（ **Root name servers** ）
- 一般是通过NIC获得信息并手工配置

DNS Root Servers

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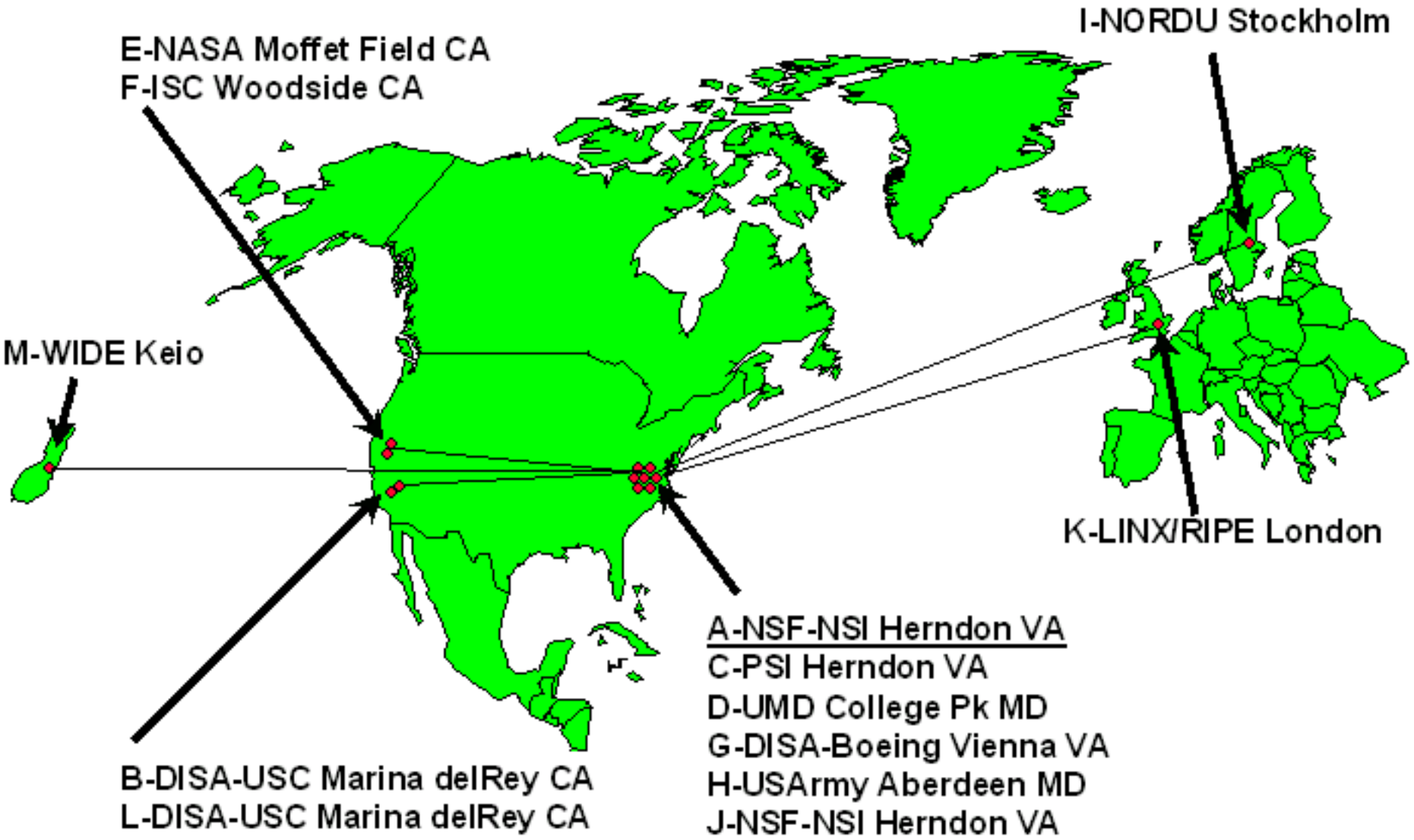
Designation, Responsibility, and Locations



域名服务器管辖区划分

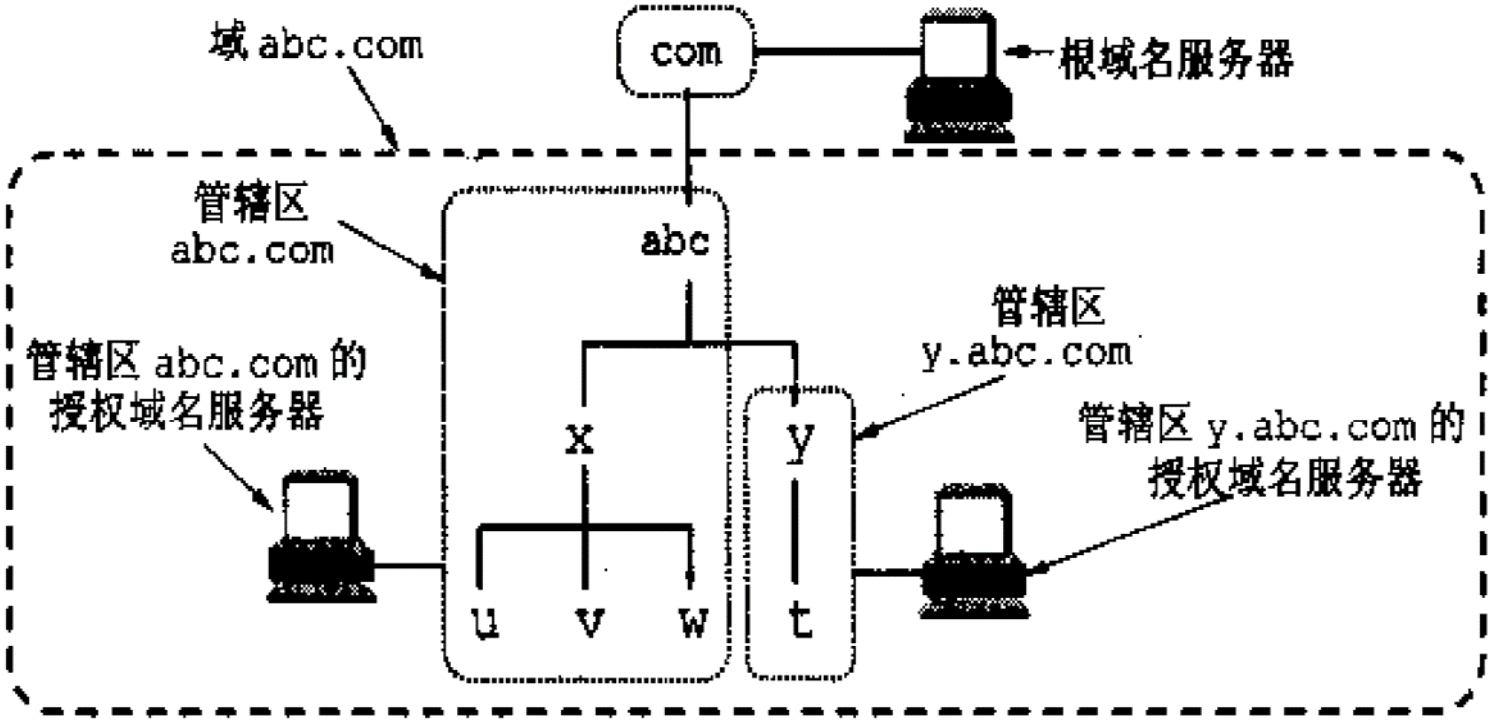
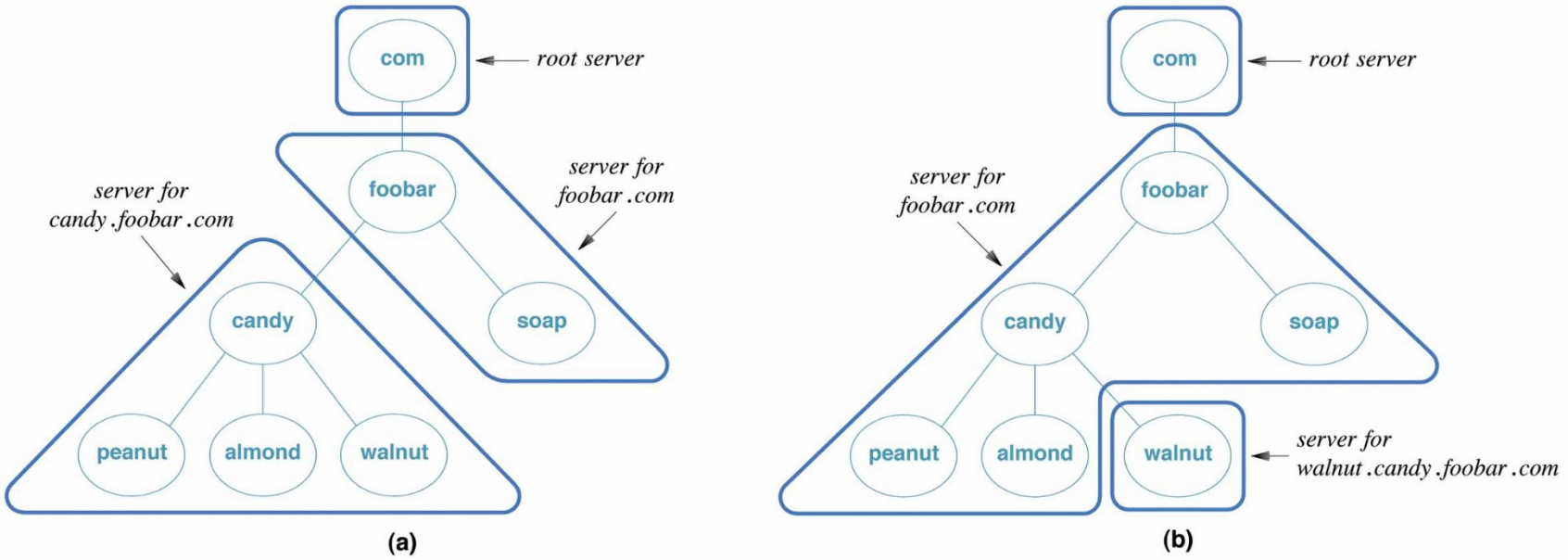


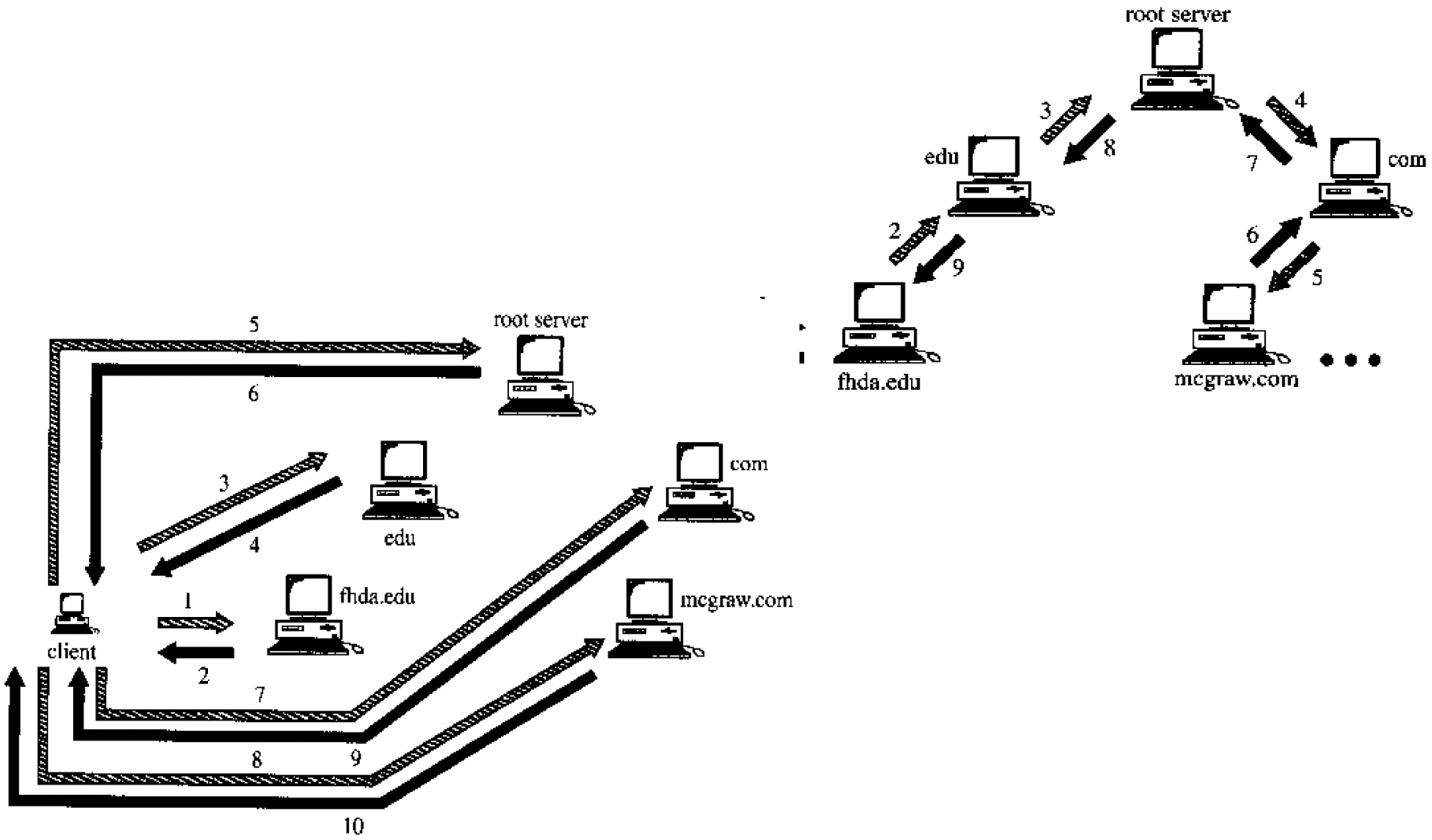
图 12-2　域名服务器管辖区的的划分举例

DNS Hierarchy and Server Model

- Allow each organization to assign names to computers or to change those names without informing a central authority



Recursive resolution (递归解析)



递归查询

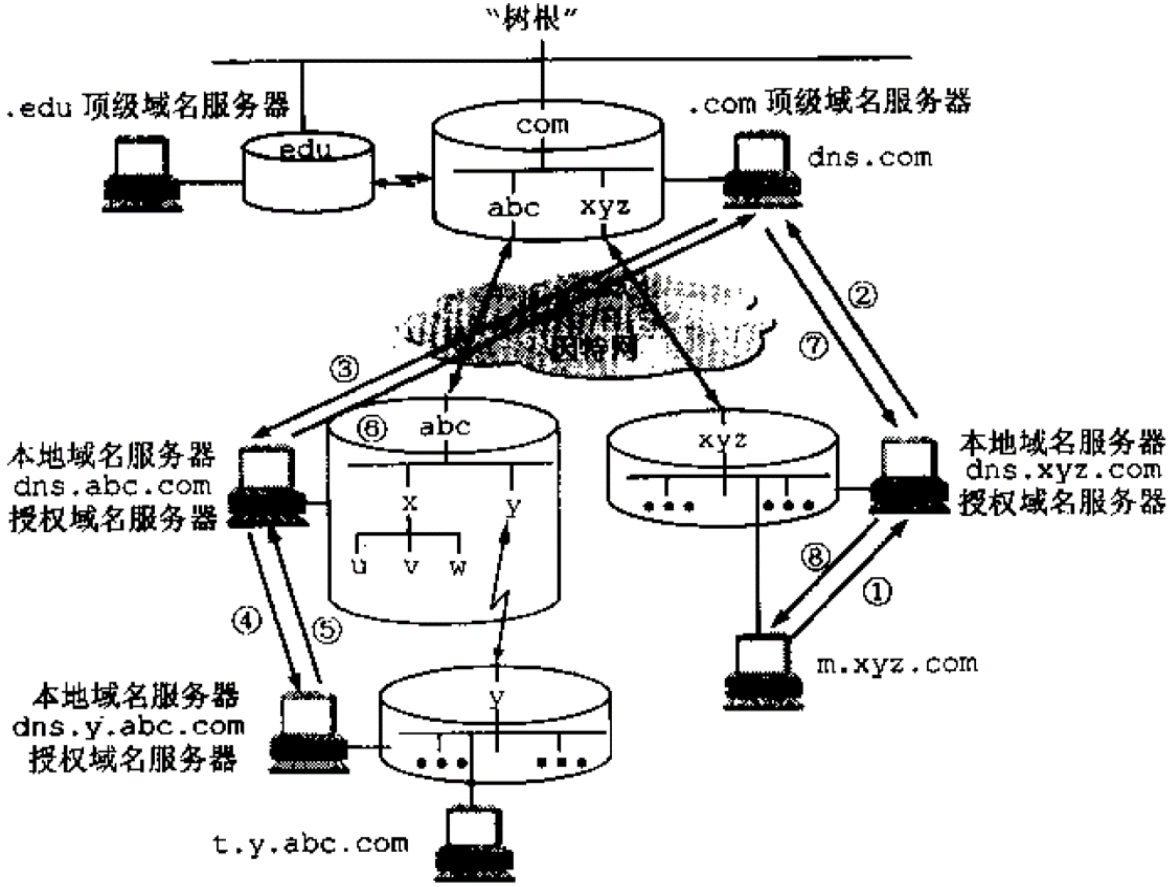


图 12-3　域名转换的递归查询过程举例

递归与迭代相结合的查询

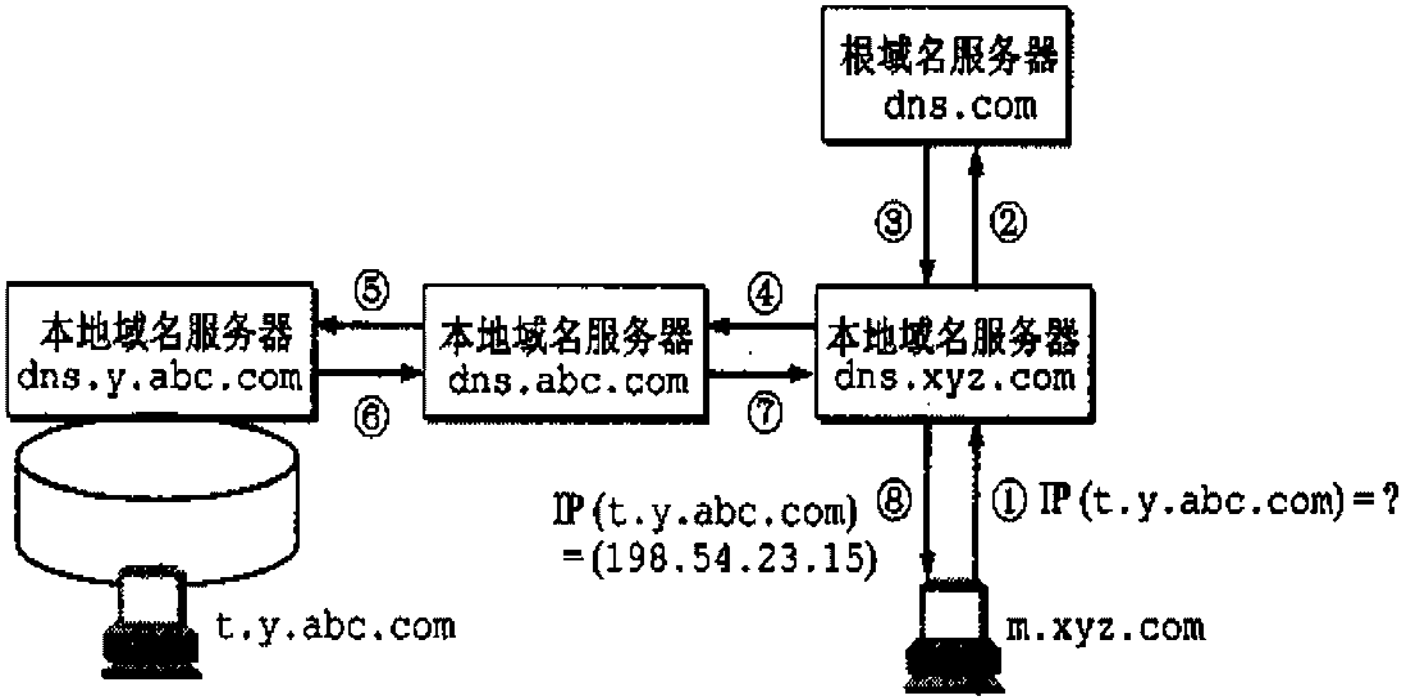


图 12-4　递归与迭代相结合的查询

Name Resolution

- The translation of a domain name into an address is called name resolution
  - and the name is said to be resolved to an address
  - Software to perform the translation is known as a name resolver (or simply resolver)
- In the socket API, Resolver is invoked by calling function `gethostbyname`
- The resolver becomes a client by contacting a DNS server
  - DNS server returns an answer to the caller

Name Resolution

- Each resolver is configured with the address of one or more local domain name servers
- The resolver forms a DNS request message
  - sends the message to the local server
  - waits for the server to send a DNS reply message for the answer
- A resolver can choose to use either the stream or message paradigm
  - most resolvers are configured to use a message paradigm because it imposes less overhead for a small request

Caching in DNS Servers

- The locality of reference principle that forms the basis for caching applies to the Domain Name System in two ways:
  - Spatial
  - Temporal
- DNS exploits spatial locality
  - a name resolver contacts a local server first
- To exploit temporal locality
  - a DNS server caches all lookups

Caching in DNS Servers

- According to the algorithm, when a request arrives for a name outside the set for which the server is an authority
  - further client-server interaction results
- The server temporarily becomes a client of another name server
- When the other server returns an answer
  - the original server caches the answer and sends a copy of the answer back to the resolver from which request arrived

Caching in DNS Servers

- In addition to knowing the address of all servers down the hierarchy
  - each DNS server must know the address of a root server
- How long should items be cached?
  - if an item is cached too long, the item will become stale
  - DNS specify a cache timeout for each item

Types of DNS Entries

- Each entry in a DNS database consists of three items
  - a domain name
  - a record type
    - The record type specifies how the value is to be interpreted
  - a value
- A query sent to a DNS server specifies both a domain name and a type
  - server only returns a binding that matches the type of query

Types of DNS Entries

- The principal type maps a domain name to an IP address
  - DNS classifies such bindings as type A
    - type A lookup is used by applications such as FTP, ping, or a browser
  - DNS supports several other types, including type MX
    - that specifies a Mail eXchanger
    - when it looks up the name in an email address, SMTP uses type MX

Types of DNS Entries

- Each entry in a DNS server has a type
- When a resolver looks up a name
  - the resolver specifies the type that is desired
  - DNS server returns only entries that match it
- The address returned depends on the type
  - eg, a corporation may decide to use the name corporation.com for both web and email services
  - It is possible for the corporation to divide the workload between separate computers
  - by mapping type A lookups to one computer and type MX lookups to another

资源记录

- 每个服务器用资源记录（Resource Record ）的集合去实现区域信息。本质上，一个资源记录是一个名字到值的绑定：

  <名字Name, 值Value, 类型Type, 分类Class, 生存期TTL>

- 名字name/值value：主机名字到IP地址

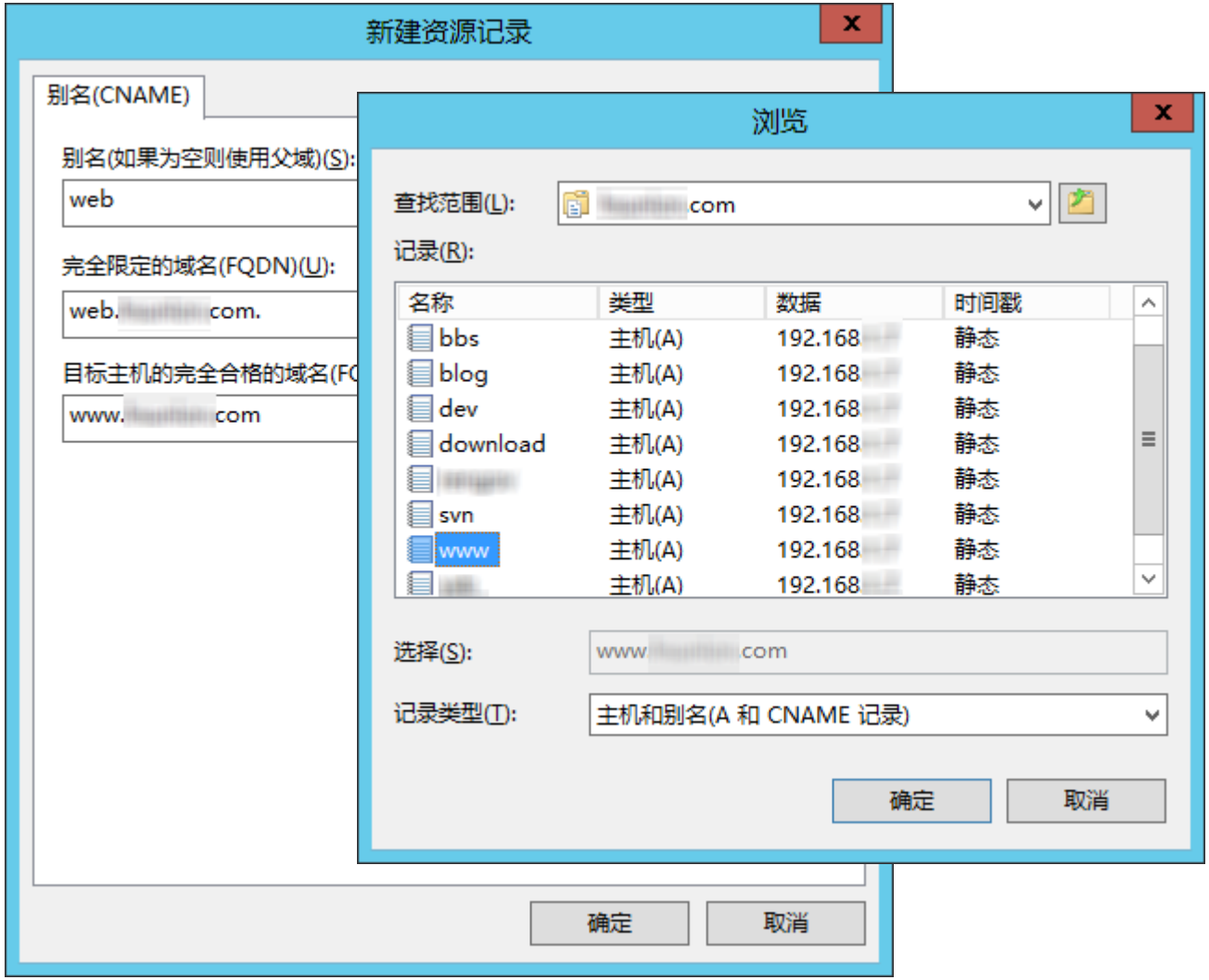
资源记录中各个字段的含义

- 类型type
  - NS：值字段给出了运行名字服务器的主机域名，而该名字服务器知道如何解析特定的域名
  - CNAME：值字段给出了特定主机的规范名字，主要用于定义主机别名
  - MX：值字段出了运行邮件服务器的主机域名，而该邮件服务器知道如何接收解析指定域的值
  - 分类Class：允许其他实体（除InterNIC外）定义有用的记录类型，目前广泛使用的分类是因特网使用的分类，记IN。
  - 生存期TTL：指明资源记录的有效期限

Aliases and CNAME Res. Records

- The DNS offers a CNAME
  - provides an alias for another DNS entry
  - aliases can be useful
- 假设foobar.com下有名为abc的计算机，运行一段时间后，希望将其部署为Web服务器。
  - Web服务器最好以`www.foobar.com`为域名
  - 不想重复部署
  - 不想改名
  - CNAME

新建一个CNAME


新建资源记录
别名(CNAME)
别名(如果为空则使用父域)(S):
web
完全限定的域名(FQDN)(U):
web.com.
目标主机的完全合格的域名(FQ
www.com
确定
取消
浏览
查找范围(L):
com
记录(R):
名称
类型
数据
时间戳
bbs 主机(A) 192.168 静态
blog 主机(A) 192.168 静态
dev 主机(A) 192.168 静态
download 主机(A) 192.168 静态
主机(A) 192.168 静态
svn 主机(A) 192.168 静态
www 主机(A) 192.168 静态
主机(A) 192.168 静态
选择(S):
www com
记录类型(T):
主机和别名(A 和 CNAME 记录)
确定
取消

Abbreviations and the DNS

- **DNS does not incorporate abbreviations - a server only responds to a full name**
- 可以配置如何处理缩写
- 但是最好不要使用缩写

Internationalized Domain Names

- DNS uses the ASCII character set
  - 中文域名
- 国际化域名应用（IDNA）是因特网工程工作组 (http://www.ietf.org) 在 RFC 3490 下定义的一个协议

选作作业

- 用Omnipeek监听收发DNS的数据流
  - 访问厦门大学软件学院主页
  - 浏览器对DNS的访问是基于TCP的还是UDP的
- 请你的同学配合，在不同地方ping一些门户网站的主机，查看DNS是否指向同一个IP地址，这样做有何好处？（是不是意味着访问不同的内容？）

15. THANK YOU.

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