

Chapter 1 Introduction

Chapter 1

1.1: Person to person communication, Electronic Commerce, The internet of things

1.1.1 Person to person communication(人和人之间的交流):

- Instant messaging

即时消息

- Allows two people to type messages at each other in real time
允许两个人实时向对方发送信息

- Twitter multi-person messaging service

Twitter多人消息服务

- Allows people to send short messages to their circle of friends or other followers or the whole word.
允许人们向他们的朋友圈或其他追随者或整个世界发送短信

- Social network applicants

社交网络应用

- Information flow driven by the relationships that people declare between each other.
由人们之间声明的关系驱动的信息流

- Wiki content is a collaborative Web site the members of community edit.

Wiki内容是一个由网站的成员进行社区编辑的协作式网站

1.1.2 Electronic Commerce

- Online shopping and financial institution transactions follow client-server model

网上购物和金融机构交易遵循客户-服务器模式

- Online auctions follow peer-to-peer model

在线拍卖遵循点对点模式

- Consumers act as buyers and sellers
消费者既是买家又是卖家
- Central server holds the database of products for sale
中央服务器保存待售产品的数据库

Tag	Full name	Example
B2C	Bussiness-to-consumer	Ordering books online
B2B	Bussiness-to-business	Car manufacturer ordering tires from a supplier
G2C	Government-to-consumer	Government distributing tax forms electronically
C2C	Consumer-to-consumer	Auctioning second-hand products online
P2P	Peer-to-peer	Music or file sharing: Skype

Some forms of e-commerce have acquired little tags based on the fact that "to" and "2" are pronounced the same.

1.1.3 The Internet of things

- Ubiquitous computing

无处不在的计算

- Computing embedded in everyday life
计算嵌入日常生活
- Home security systems wired with door and window sensors
装有门窗传感器的家庭安全系统
- Sensors folded into a smart home monitor
可折叠成智能家居监视器的传感器
- Smart refrigerators
智能冰箱

- IoT (Internet of Things)

IoT(物联网)

- Sensing and communication take place over the Internet
传感和通信通过互联网进行
- Poised to connect every electronic device to the Internet
准备将所有电子设备连接到互联网

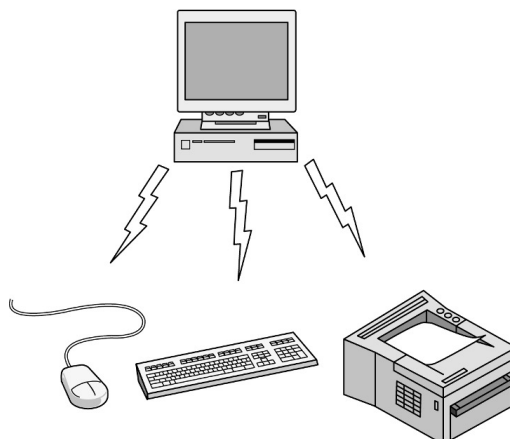
- Power-line networks

电源网络

- Send information throughout the house over the electric wires
通过电线将信息传送到整个房子

1.3: PAN, LAN, MAN, WAN

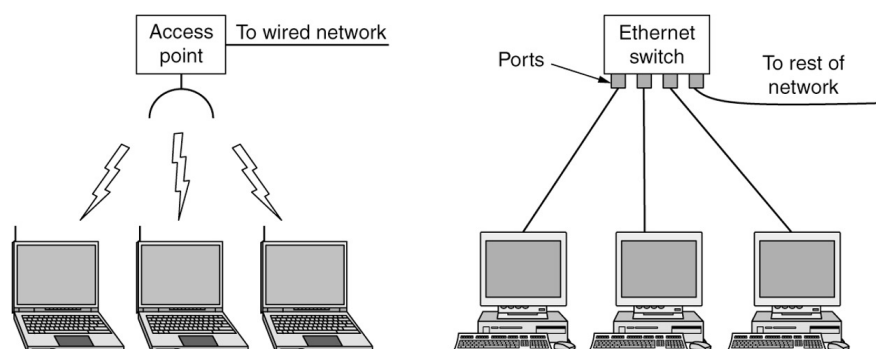
1.3.1 PAN



PANs (Personal Area Networks) let devices communicate over the range of a person. Bluetooth is a short-range wireless network used to connect components without wires.

PANs (个人区域网络) 让设备在一个人的范围内进行通信。蓝牙(Bluetooth)是一种短距离无线网络，用于在没有电线的情況下连接组件。

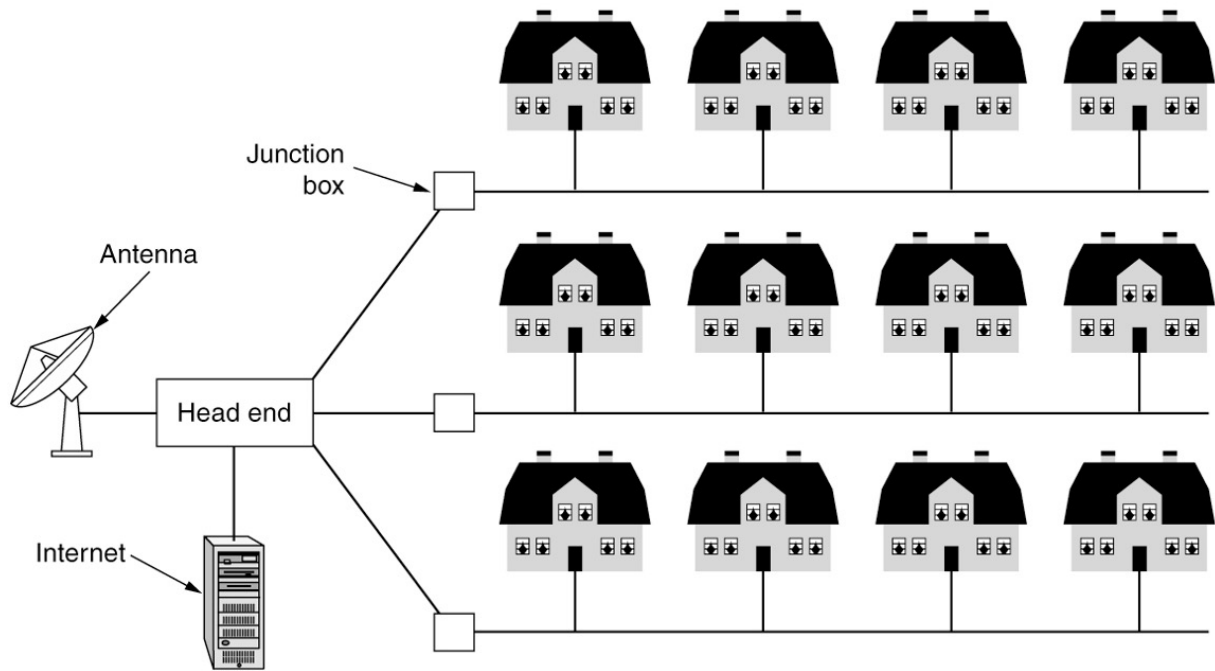
1.3.2 LAN



The configuration on the left represents a wireless 802.11 network. The configuration on the right represents a wired switched Ethernet network.

左边的配置表示无线802.11网络。右边的配置代表一个有线交换式以太网。

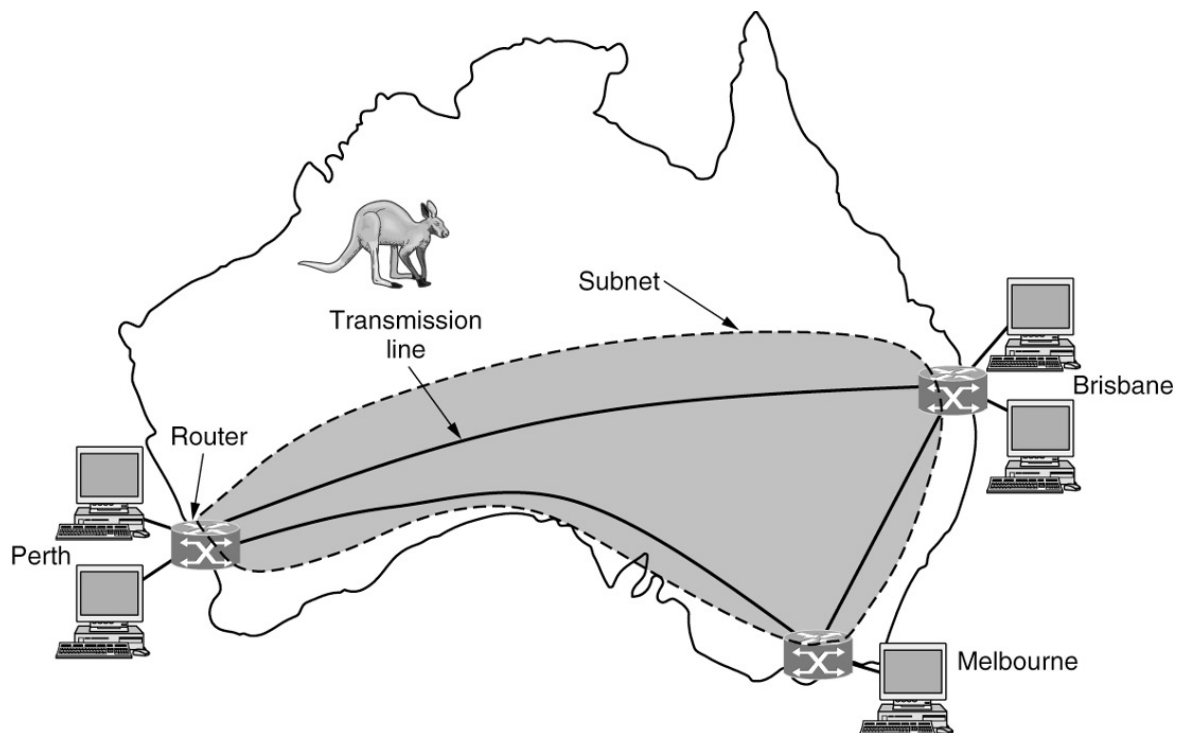
1.3.3 MAN



A MAN (metropolitan area network) where both television signals and the Internet are being fed into the centralized cable head-end (or cable modem termination system) for subsequent distribution to people's homes.

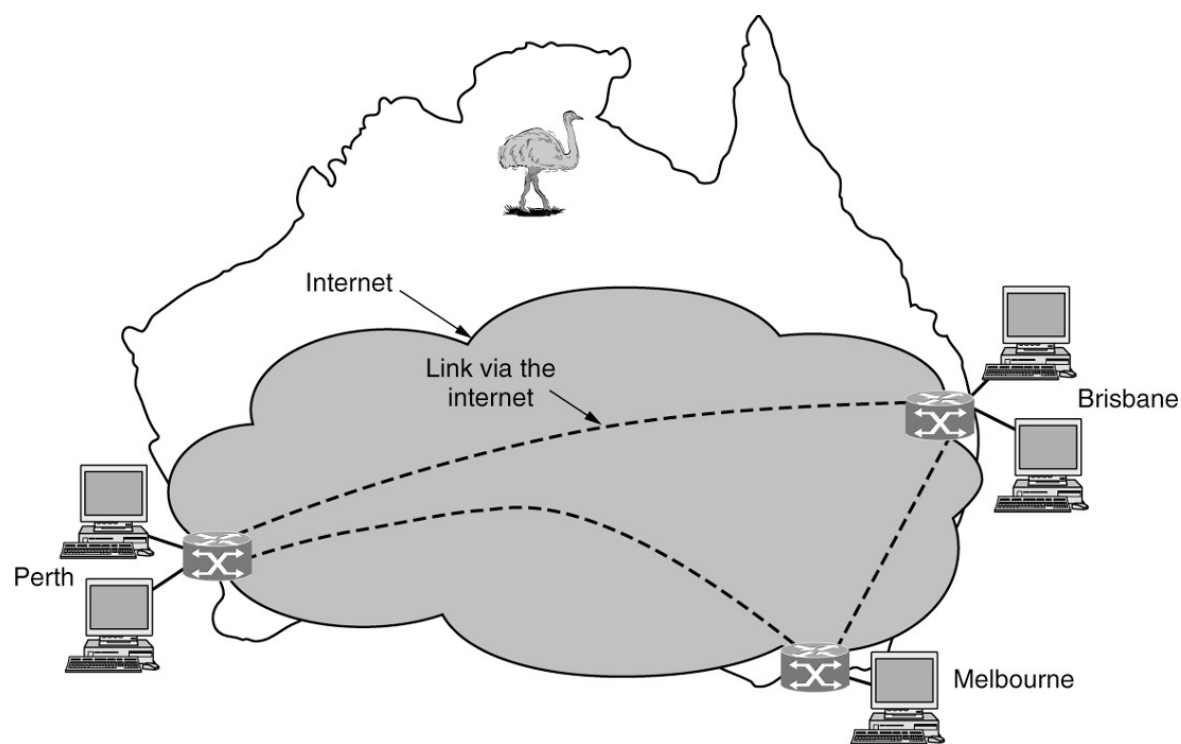
城域网一种城域网，电视信号和因特网都被送入集中的电缆头端(或电缆调制解调器终端系统)，以便随后分配到人们的家中。

1.3.4 WAN



This wide area network illustrates how hosts in Perth, Brisbane, and Melbourne can communicate using leased lines.

这个广域网展示了珀斯、布里斯班和墨尔本的主机如何使用租用线路进行通信。

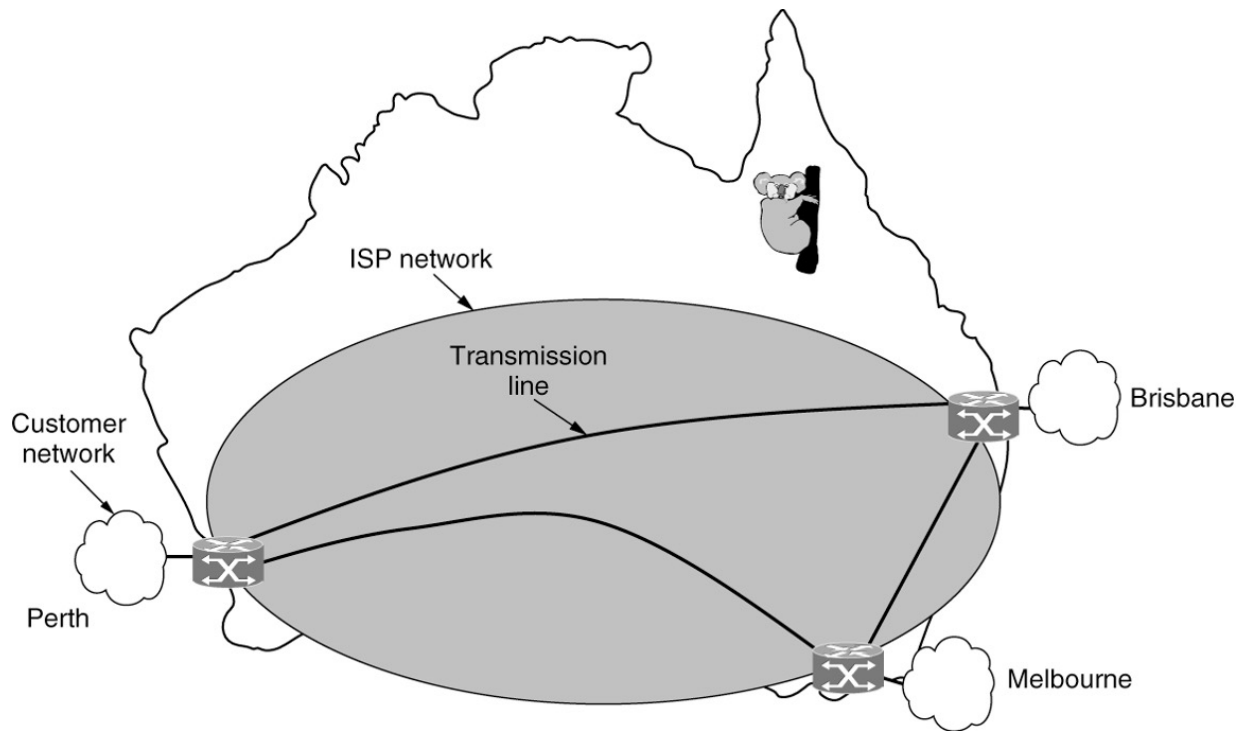


This wide area network illustrates how hosts in Perth, Brisbane, and Melbourne can communicate via the Internet.

这个广域网展示了珀斯、布里斯班和墨尔本的主机如何通过互联网进行通信。

By using Internet connectivity instead of leasing dedicated transmission lines to connect offices, the wide area network (WAN) connections can be made between the offices as virtual links using the underlying capacity of the Internet.

通过使用因特网连接而不是租用专用传输线路来连接办公室，广域网(WAN)连接可以在办公室之间作为虚拟链路使用因特网的基础能力。



This wide area network illustrates how hosts in Perth, Brisbane, and Melbourne can communicate via an ISP.

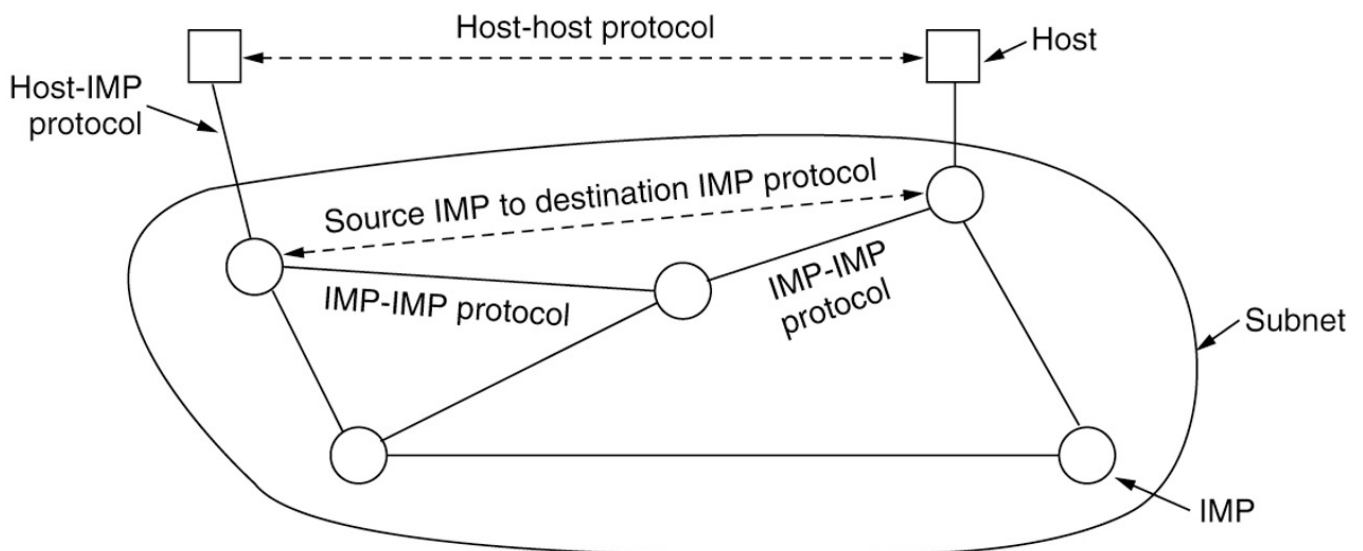
这个广域网展示了珀斯、布里斯班和墨尔本的主机如何通过ISP进行通信。

By using a network that is operated by a commercial Internet service provider (ISP), the wide area network (WAN) connections can be made between the offices. This type of set-up may help reduce performance degradation issues that may be seen when connecting over the Internet.

通过使用由商业互联网服务提供商(ISP)运营的网络，可以在办公室之间建立广域网(WAN)连接。这种类型的设置可能有助于减少连接互联网时可能出现的性能下降问题。

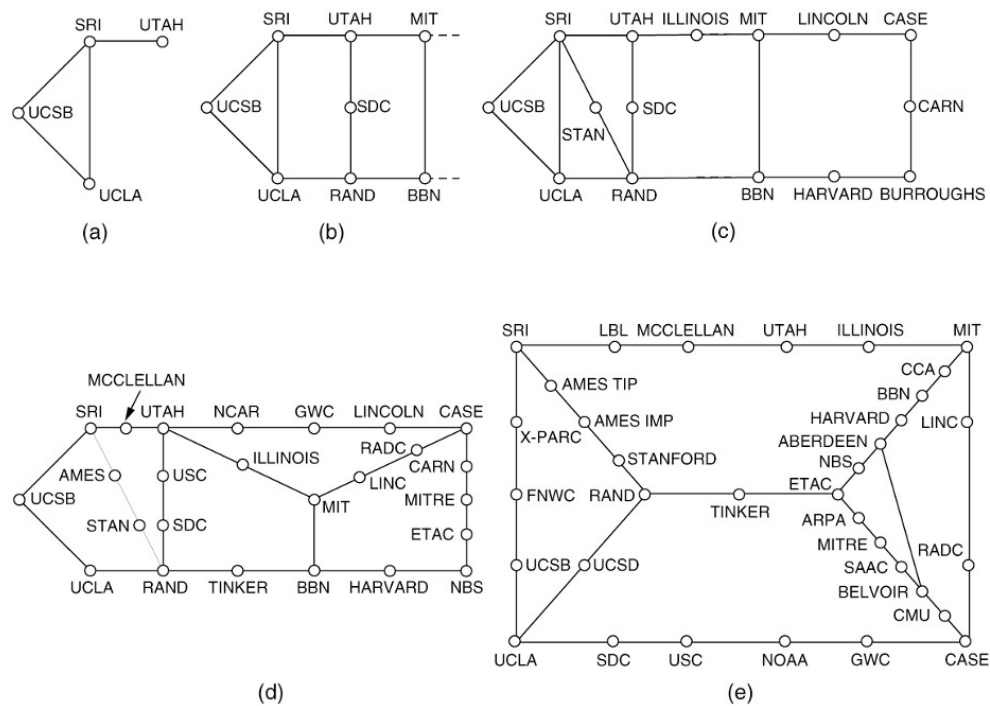
1.4: ARPANET, NSFNET, Mobile Network Architecture

1.4.1 ARPANET



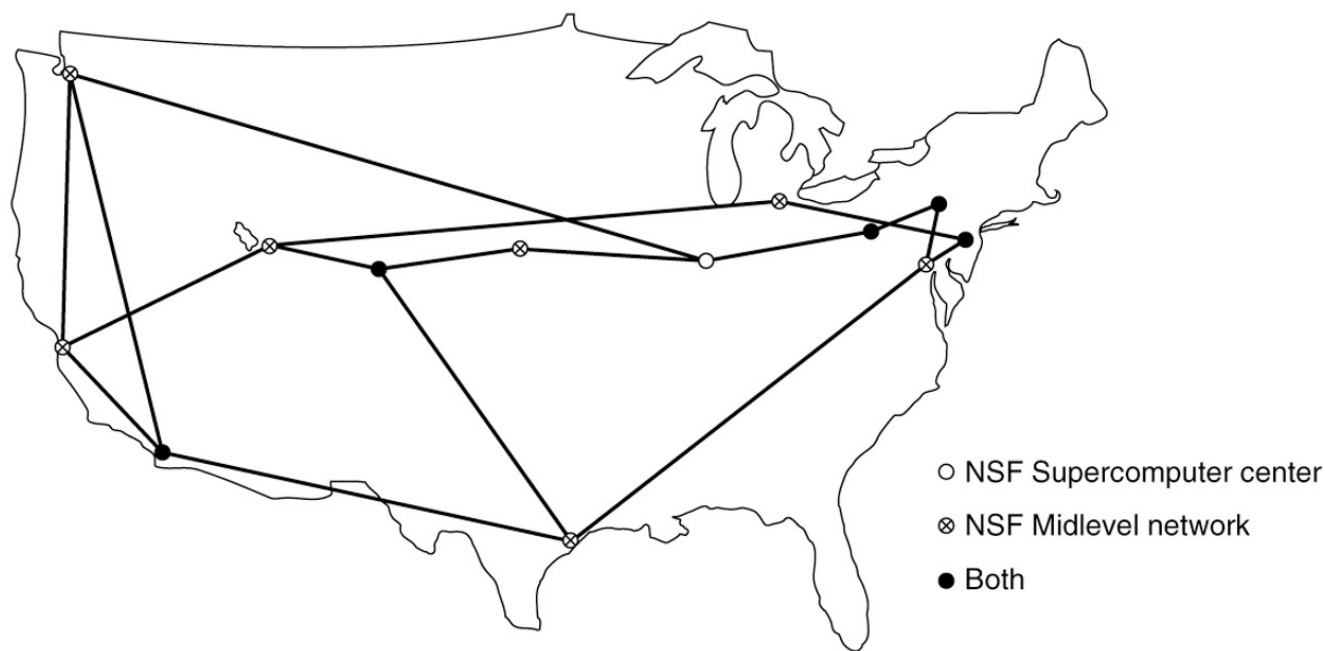
The original ARPANET software was split into two parts: subnet and host. The subnet software consisted of the IMP end of the host-IMP connection, the IMP-IMP protocol, and a source IMP to destination IMP protocol designed to improve reliability.

最初的ARPANET软件被分成两个部分:子网和主机。子网软件由主机-IMP连接的IMP端、IMP-IMP协议和旨在提高可靠性的源IMP到目的IMP协议组成。



Growth of the number of nodes on ARPANET. (a) December 1969. (b) July 1970. (c) March 1971. (d) April 1972. (e) September 1972.

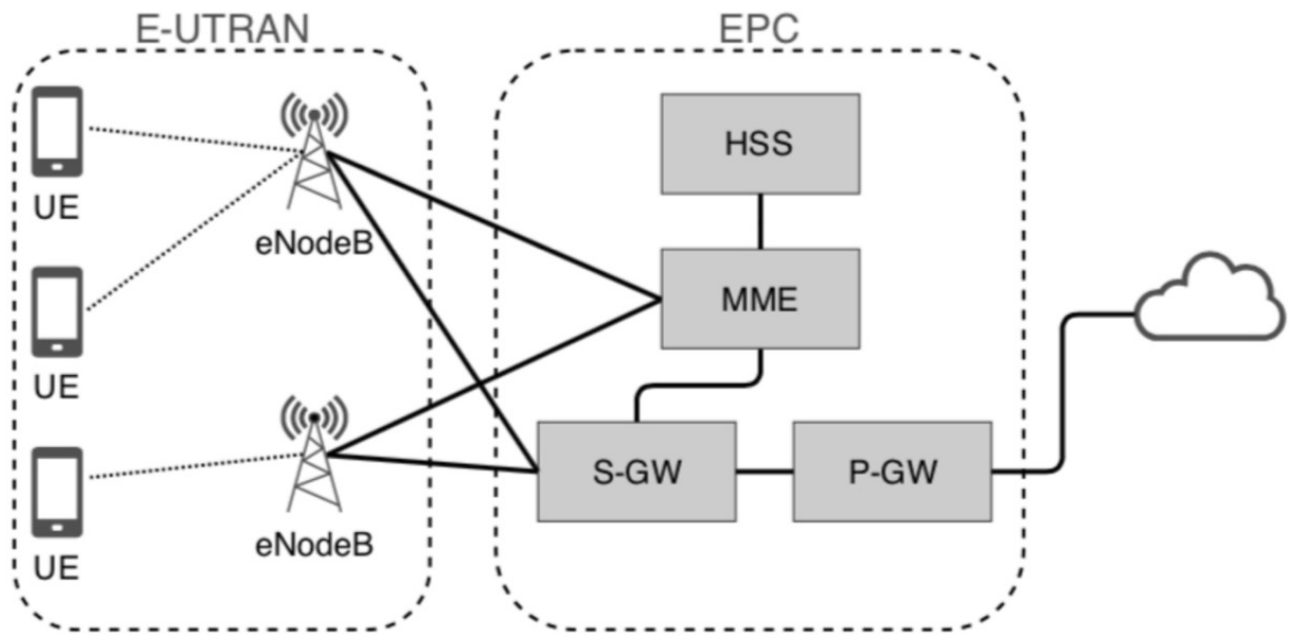
1.4.2 NSFNET



NSFNET was a backbone network designed to be a successor to the ARPANET that would be open to all university research groups, allowing them to communicate without having to contract with the Department of Defense.

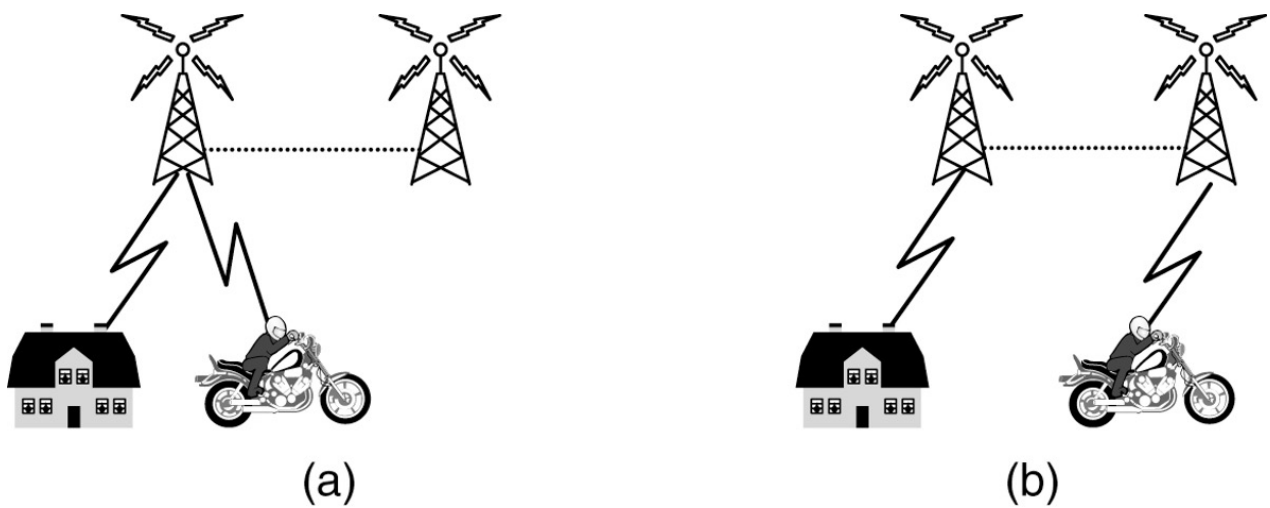
NSFNET是一个骨干网络，旨在成为阿帕网的继承者，该网络将向所有大学研究小组开放，允许他们不必与国防部签订合同就可以进行交流。

1.4.3 Mobile Network Architecture



The architecture of the mobile phone network has several parts.

移动电话网络的体系结构由几个部分组成。



When a user moves out of the range of one cellular base station and into the range of another one, the flow of data must be re-routed from the old to the new cell base station.

当用户移动出一个蜂窝基站的范围，进入另一个蜂窝基站的范围时，数据流必须从旧的蜂窝基站重新路由到新的蜂窝基站。

- Packet switching comes from the Internet community
- 分组交换起源于Internet社区

- Connectionless networks

无连接网络

- Every packet is routed independently

每个分组都是独立路由的

- If some routers go down during a session, no harm will be done as long as the system can dynamically reconfigure itself

如果某些路由器在会话期间发生故障，只要系统能够动态地重新配置自己，就不会造成任何损害

- Circuit switching comes from telephone companies

电路交换来自电话公司

- Connection-oriented networks

面向连接的网络

- Caller must dial the called party's number and wait for a connection before talking or sending data

在通话或发送数据之前，主叫方必须拨打被叫号码并等待连接

- Route maintained until call is terminated

路由保持，直到呼叫终止

- Can support quality of service more easily

能否更容易地支持服务质量

- First-generation mobile phone systems

第一代移动电话系统

- Transmitted voice calls as continuously varying (analog) signals

传输的语音呼叫为连续变化的(模拟)信号

- AMPS (Advanced Mobile Phone System)

AMPS(高级移动电话系统)

- Second-generation (2G) mobile phone systems

第二代(2G)移动电话系统

- Transmitted voice calls in digital form to increase capacity, improve security, and offer text messaging

以数字形式传输语音通话，以增加容量，提高安全性，并提供文本信息

- GSM (Global System for Mobile communications)

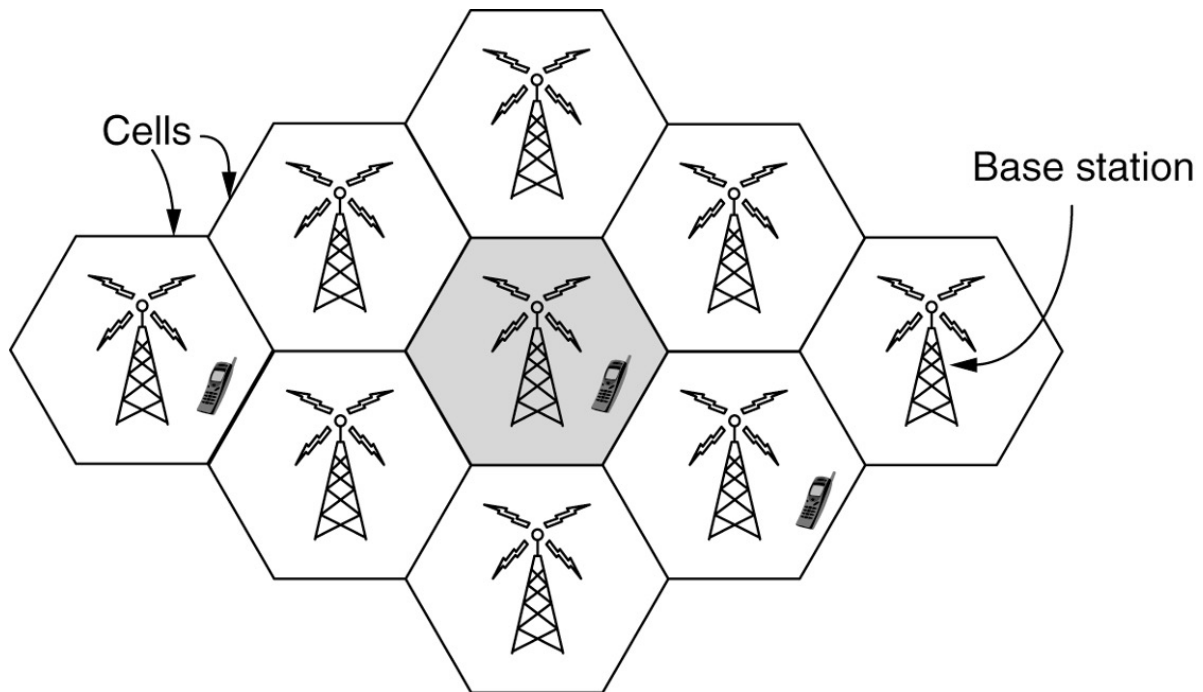
全球移动通信系统

- Third generation (3G) offer digital voice and broadband digital data services

第三代(3G)提供数字语音和宽带数字数据服务

- Spectrum scarcity led to today's cellular network design

频谱稀缺导致了今天的蜂窝网络设计



To manage the radio interference between users, the coverage area is divided into cells.

为管理用户间的无线电干扰，将覆盖区域划分为小区。

- 4G
 - Later 4G known as LTE (Long Term Evolution) technology
后来的4G被称为LTE(长期演进)技术
 - Offers faster speeds
提供更快的速度
 - Emerged in the late 2000s
出现于2000年代末
 - Quickly became the predominant mode of mobile Internet access in the late 2000s
在2000年代末迅速成为移动互联网访问的主要模式
 - Outpacing competitors like 802.16 (WiMiMax)
超越802.16 (WiMiMax)等竞争对手
- 5G technologies are promising faster speeds
5G技术有望实现更快的速度
 - Up to 10 Gbps
高达10 Gbps
 - Set for large-scale deployment in the early 2020s
将在本世纪20年代初大规模部署
- Main distinction: frequency spectrum they rely on
主要区别:它们所依赖的频谱

1.5: Design goals, Connections and reliability

1.5.1 Design goals

- Reliability 可靠性
 - Make a network operate correctly even though it is comprised of a collection of components that are themselves unreliable
使网络正确地运行，即使它是由一组本身不可靠的组件组成的
 - Error detection finds errors in received information
错误检测发现接收到的信息存在错误
 - Error correction corrects a message by recovering the possibly incorrect bits
错误纠正通过恢复可能不正确的位来纠正消息
- Find a working path through a network using routing
使用路由找到通过网络的工作路径
 - Routing allows network to automatically make the decision
路由允许网络自动做出决策
- Resource allocation 资源分配
 - Scalable designs continue to work well when network gets large
当网络变得越来越大时，可扩展的设计仍然可以很好地工作
 - Statistical multiplexing: sharing based on the statistics of demand
统计复用:根据需求的统计进行共享
- An allocation problem that occurs at every level
每个层次上都存在的分配问题
 - Keeping a fast sender from swamping a slow receiver with data
避免快速的发送端用数据淹没慢速的接收端
 - Use flow control
使用流程控制
- Congestion problem
拥塞问题
 - Occurs when too many computers want to send too much traffic, and the network cannot deliver it all
当太多计算机想要发送太多流量，而网络无法全部传输时发生
- Quality of service reconciles competing demands
服务质量协调相互竞争的需求

- Evolvability 可发展性
 - Design issue concerns the evolution of the network
设计问题涉及网络的演化
 - Over time, networks grow larger and new designs emerge that need to be connected to the existing network
随着时间的推移，网络变得越来越大，新的设计需要连接到现有的网络
 - Use protocol layering structuring mechanism to support change by dividing the overall problem and hiding implementation details
通过划分整体问题并隐藏实现细节，使用协议分层结构机制来支持更改
 - Use addressing or naming mechanism to identify the senders and receivers involved in a particular message
使用寻址或命名机制来识别特定消息中涉及的发送者和接收者
 - Different network technologies often have different limitations
不同的网络技术通常有不同的局限性
 - Overall topic is called internetworking
总体主题是“网络互联”
- Security
 - Confidentiality mechanisms defend against eavesdropping on communications
保密机制可以防止通信被窃听
 - Authentication mechanisms prevent someone from impersonating someone else
身份验证机制可以防止冒充他人
 - Integrity mechanisms prevent surreptitious changes to messages
完整性机制可以防止对消息的秘密更改

1.5.2 Connections and Reliability

- Connection-oriented service
面向连接的服务
 - Modeled after the telephone system
模仿电话系统
 - Service user first establishes a connection, uses the connection, and then releases the connection
服务用户首先建立连接，使用连接，然后释放连接
 - Can conduct a negotiation about the parameters to be used
可以协商要使用的参数
- Connectionless service
无连接服务

- Modeled after the postal system

模仿邮政系统

- Packet is a message at the network layer

包是网络层的消息

- Store-and-forward switching: intermediate nodes receive a message in full before sending it on to the next node

存储转发交换:中间节点在将消息发送给下一个节点之前完整地接收消息

- Cut-through switching: transmission of a message at a node starts before it is completely received by the node

直通切换(Cut-through switching):在消息被节点完全接收之前, 该节点就开始传输消息

- Datagram service: Unreliable (not acknowledged) connectionless service

数据报服务:不可靠(未得到确认)的无连接服务

- Reliability characterizes connection-oriented and connectionless services

可靠性是面向连接和无连接服务的特征

- Connectionless service

无连接服务

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可靠性是面向连接和无连接服务的特征

		Service	Example
Connection-oriented	{	Reliable message stream	Sequence of pages
		Reliable byte stream	Movie download
		Unreliable connection	Voice over IP
Connection-less	{	Unreliable datagram	Electronic junk mail
		Acknowledged datagram	Text messaging
		Request-reply	Database query

Six common connection-oriented and connectionless services.

六种常见的面向连接和无连接服务。

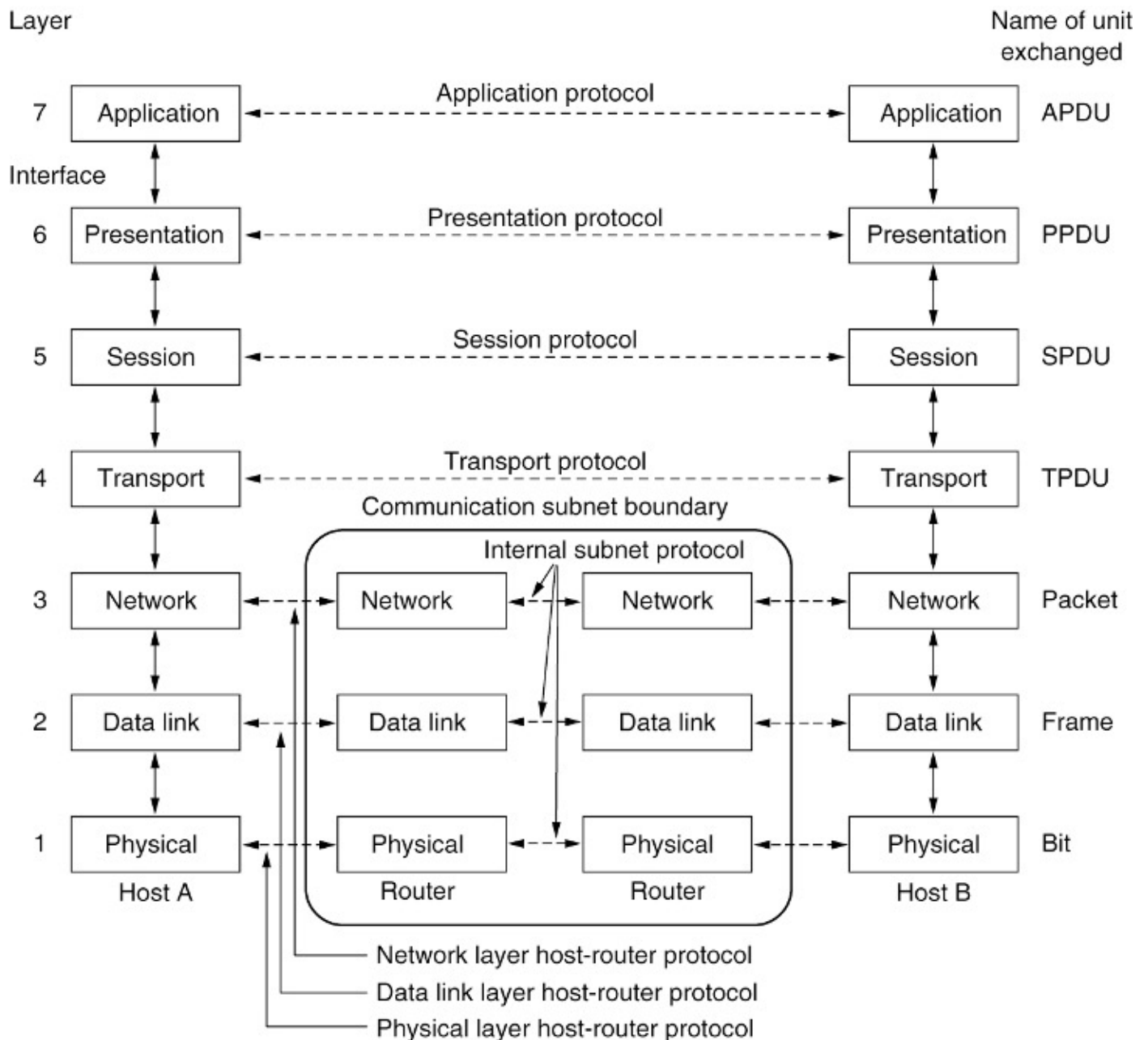
1.6: OSI reference model, TCP/IP reference model, critique of the both models

- The OSI Reference Model
OSI参考模型
- The TCP/IP Reference Model
TCP/IP参考模型
 - The Link Layer
链接层
 - The Internet Layer
互联网层
 - The Transport Layer
传输层
 - The Application Layer
应用层
- A critique of the OSI model and protocols
OSI模型和协议的评论
- Critique of the TCP/IP reference model and protocols
TCP/IP参考模型和协议的评论

- The model used in this book
本书中使用的模型

1.6.1 OSI reference model

- Principles for the seven layers
这7层的原则
 - Layers created for different abstractions
为不同的抽象创建层
 - Each layer performs well-defined function
每一层都执行定义良好的功能
 - Function of layer chosen with definition of international standard protocols in mind
选择层的功能时考虑到国际标准协议的定义
 - Minimize information flow across interfaces between boundaries
最小化边界之间的信息流动
 - Number of layers should be optimum
层数应该是最优的
- Three concepts central to the OSI model:
OSI模型三个核心概念
 - Services 服务
 - Interfaces 接口
 - Protocols 协议



The OSI model has seven layers.

OSI模型有7层.

1.6.2 TCP/IP reference model

- The Link Layer

链接层

- Lowest layer in the model

模型的最底层

- Describes what links must do to meet the needs of this connectionless internet layer

描述了链路必须做什么才能满足无连接的internet层的需求

- The Internet Layer

互联网层

- Permits hosts to inject packets into any network and have them travel independently to the destination
允许主机向任何网络注入数据包，并让它们独立地到达目的地
- Defines an official packet format and protocol called IP (Internet Protocol)
定义了一种称为IP (Internet protocol)的官方数据包格式和协议
- Defines a companion protocol called ICMP (Internet Control Message Protocol) that helps IP function
定义了一个名为ICMP (Internet Control Message protocol)的伴生协议，帮助实现IP功能

• The Transport Layer

传输层

- The layer above the internet layer in the TCP/IP model
TCP/IP模型中高于internet层的一层
- Uses two end-to-end transport protocols
使用两个端到端传输协议

• TCP (Transmission Control Protocol)

TCP(传输控制协议)

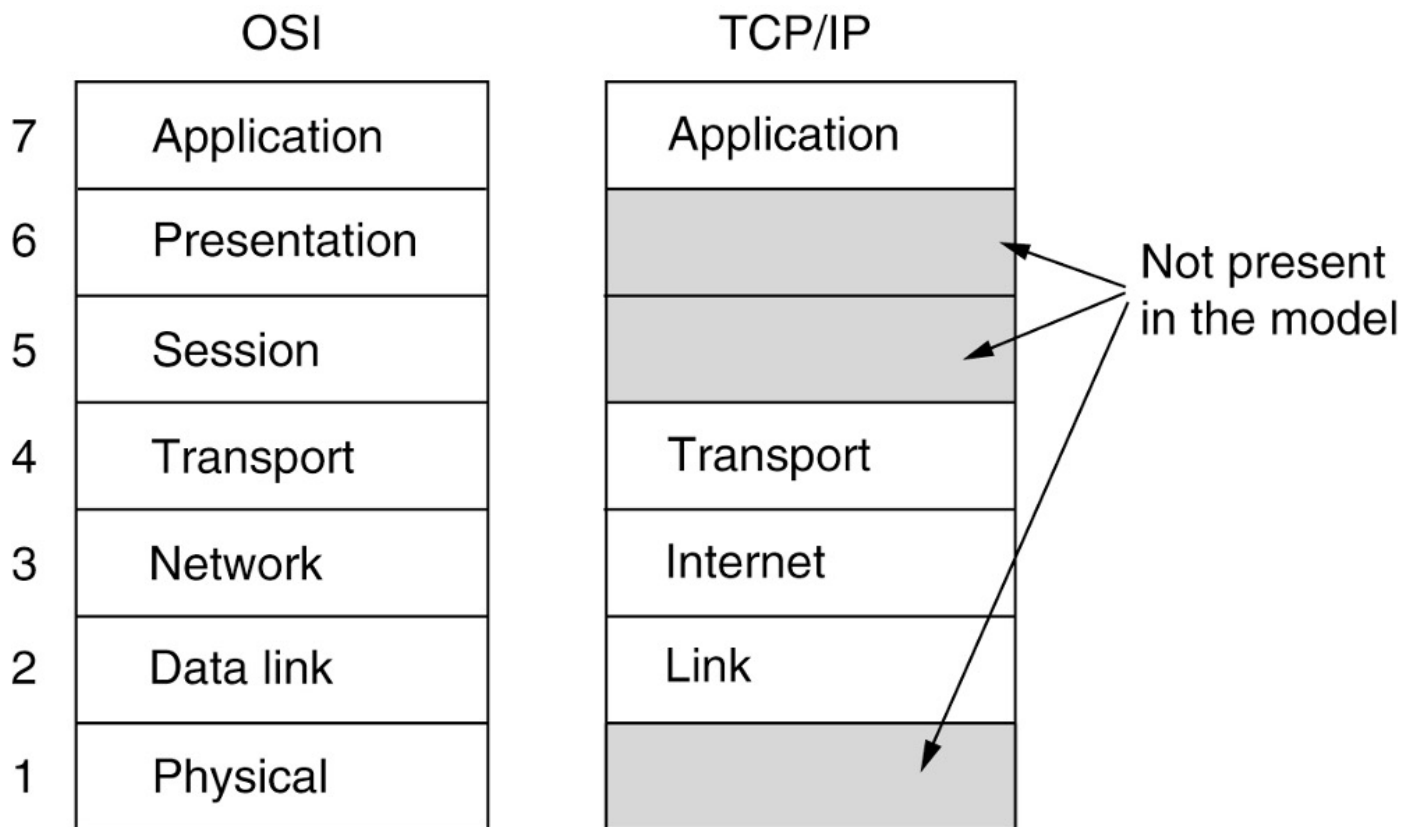
• UDP (User Datagram Protocol)

UDP(用户数据报协议)

• The Application Layer

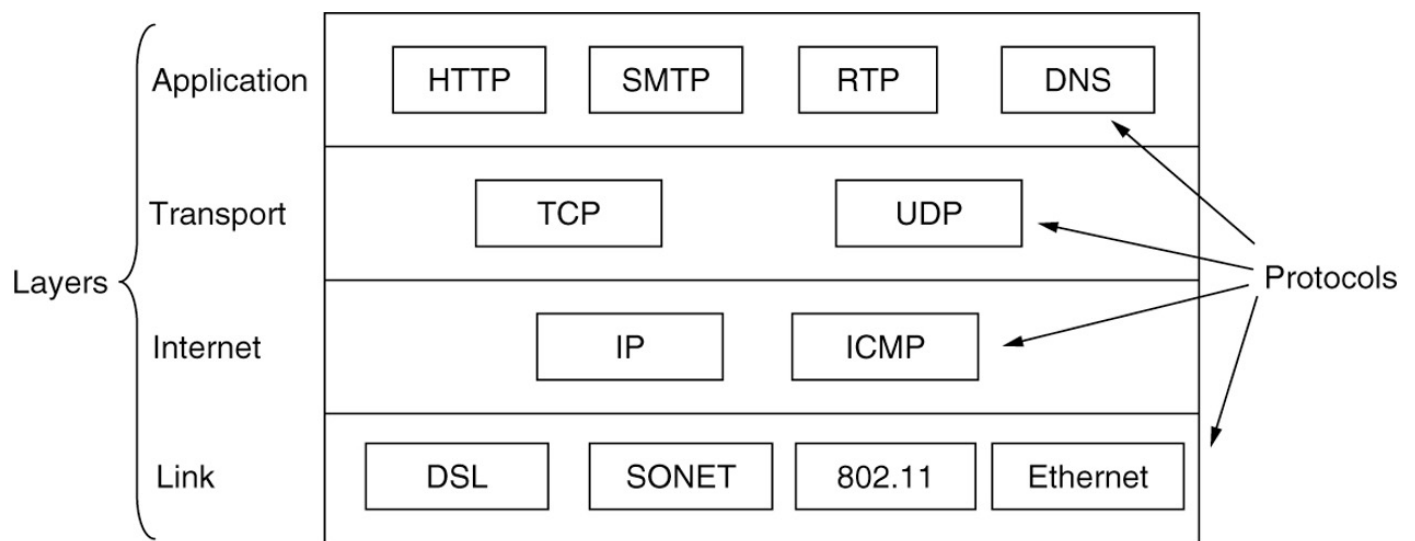
应用层

- Contains all the higher-level protocols
包含所有高级协议



The TCP/IP layers loosely align with the OSI model.

TCP/IP层松散地与OSI模型保持一致。



The relation of IP, TCP, and UDP protocols are illustrated. We will study these.

述了IP、TCP和UDP协议之间的关系。我们会研究这些。

1.6.3 critique of the both models

- Bad timing

糟糕的时机

- Competing TCP/IP protocols were already in widespread use

相互竞争的TCP/IP协议已经被广泛使用

- Bad design

糟糕的设计

- Both the model and the protocols are flawed

模型和协议都有缺陷

- Bad implementations

糟糕的实现

- Initial implementations were huge, unwieldy, and slow

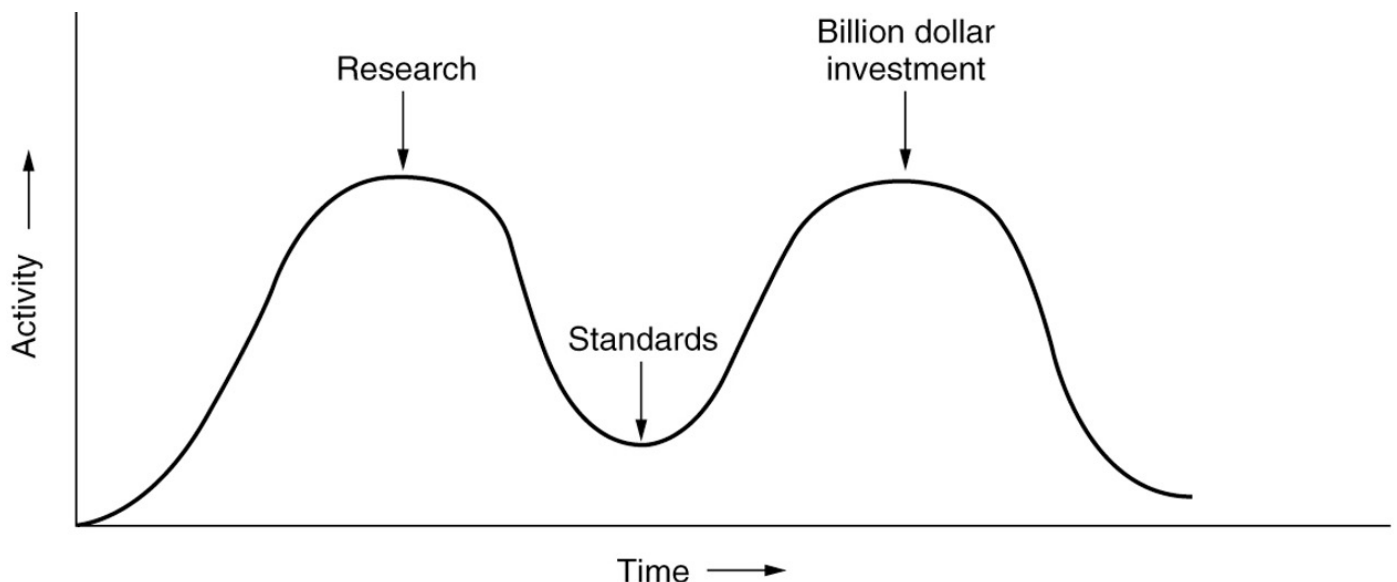
最初的实现是巨大的，笨重的，缓慢的

- Bad politics

糟糕的政治

- Widely thought to be the creature of the European telecommunication ministries, the European Community, and later the U.S. Government

被广泛认为是欧洲电信部门、欧洲共同体以及后来的美国政府的产物



It is essential that the standards be written in the trough in between the two “elephants.” If they are written too early (before the research results are well established), the subject may still be poorly understood; the result is a bad standard. If they are written too late, so many companies may have already made major investments in different ways of doing things that the standards are effectively ignored. If the interval between the two elephants is very short (because everyone is in a hurry to get started), the people developing the standards may get crushed.

重要的是，这些标准应该写在两个“大象”之间的槽中。“如果他们写得太早(在研究结果得到充分确立之前)，这个主题可能仍然不被理解;结果是一个糟糕的标准。如果制定得太晚，那么许多公司可能已经在不同的做事方式上进行了大量投资，而这些标准实际上被忽略了。如果两头大象之间的时间间隔很短(因为每个人都急于开始)，开发标准的人可能会感到崩溃。

- Model does not clearly distinguish the concepts of services, interfaces, and protocols

Model没有明确区分服务、接口和协议的概念

- Model is not at all general

Model一点也不通用

- Poorly suited to describing any other protocol stack

不适合描述任何其他协议栈

- The link layer is not really a layer at all in the normal sense of the term

链接层根本不是通常意义上的层

- Model does not distinguish between the physical and data link layers

Model不区分物理层和数据链路层

- Other protocol implementations were distributed free

其他协议实现是免费发布的

1.8: Policy, legal and social issues

政策、法律和社会问题

- Online speech

在线演讲

- Communications Decency Act protects some platforms from federal criminal prosecution

《通信体面法》保护一些平台免受联邦刑事起诉

- DMCA takedown notices (after the Digital Millennium Copyright Act) threaten legal action

DMCA下架通知(在Digital Millennium Copyright Act之后)威胁要采取法律行动

- Net neutrality

网络中立性

- ISPs should provide equal quality of service to a given type of application traffic, regardless of who is sending that content

无论谁发送内容，isp都应该为给定类型的应用流量提供同等质量的服务

- No blocking, no throttling, no paid prioritization, transparency

无阻塞，无节流，无付费优先级，透明

- Does not prevent an ISP from prioritizing any traffic

不阻止ISP对任何流量进行优先级设置

- Zero rating: ISP might charge its subscribers according to data usage but grant an exemption for a particular service

零费率:ISP可能会根据用户的数据使用情况收取费用，但对特定服务给予豁免

- Online speech

在线演讲

- Communications Decency Act protects some platforms from federal criminal prosecution
《通信体面法》保护一些平台免受联邦刑事起诉
- DMCA takedown notices (after the Digital Millennium Copyright Act) threaten legal action
DMCA下架通知(在Digital Millennium Copyright Act之后)威胁要采取法律行动

- Security

安全

- DDoS (Distributed Denial of Service) attack
DDoS(分布式拒绝服务)攻击
- Botnets
僵尸网络
- Spam email
垃圾邮件
- Phishing
钓鱼

- Privacy

隐私

- Profiling and tracking users by collecting data about their network behavior over time
通过收集用户一段时间内的网络行为数据来分析和跟踪用户
- Storing cookies in Web browser
在浏览器中存储cookie
- Browser fingerprinting
浏览器指纹
- Mobile services location privacy
移动服务位置隐私

- Disinformation

造谣

- Ill-considered, misleading, or downright wrong information
欠考虑的、误导性的或完全错误的信息
- Fake news
假新闻
- Challenges
挑战
 - How does one define disinformation in the first place?
首先如何定义虚假信息?
 - Can disinformation be reliably detected?

可以可靠地检测虚假信息吗？

- What should a network or platform operator do about it once it is detected
一旦检测到它，网络或平台运营商应该做什么