第六讲
协议算法
Lecture 6
Protocol Algorithm

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声明
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协议算法
Protocol Algorithms

- 计算机网络在现代生活中的作用毋庸置疑；在整个架构设计与功能结构中，多种算法配合相关网络硬件，综合作用以保证相关功能在各个层面的运作。其一大类算法具有典型性，了解这类算法的思想对解决相关问题有积极的启发意义。

  It is undoubted that the networking plays an important role in daily life. In the overall architectural design and functional structuring, various of algorithms coupled with networking hardware, operate together to insure the performance on different levels. A large category of algorithms are stereotypical, and to understand the methodologies of these algorithms can inspire problem-solving of similar kinds.

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- 从大算法的角度，计算机网络方便的技术实施逐渐趋于标准化。一种指导性方式是分层思想，即通过抽象将功能分层，各层仅负责本层功能实现；另一种是将控制与数据分离，即将数据传输与调控数据传输分别处理，分别称为数据层面与控制层面。

  From a broader perspective of algorithm, the practice in computer networking is more and more standardized. The first guidance is the layer-wise modelling by abstraction. Each layer is only responsible for work targeted at itself, and these works are transparency to other layers. The second philosophy is detachment of controlling from data, aka, separate the data transmission from the controlling mechanism of data transmission, called data plane and control plane, respectively.

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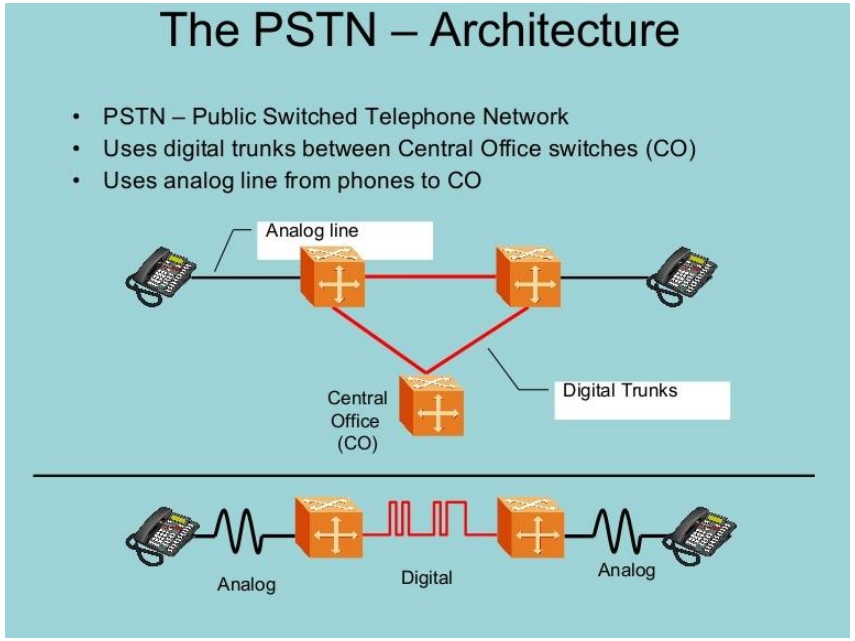
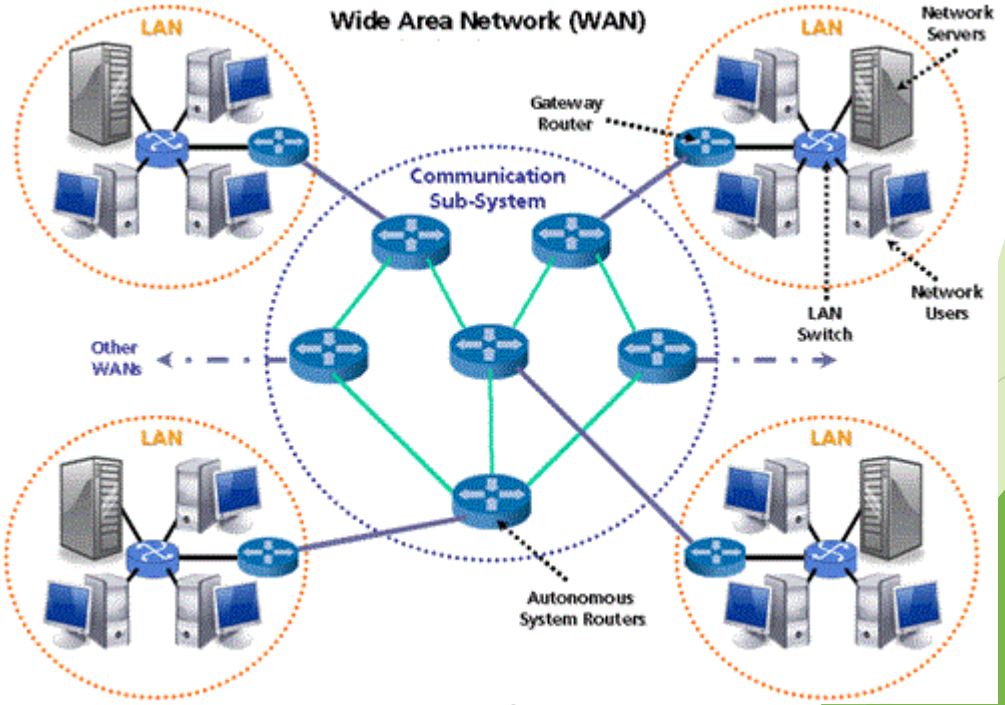
- 在讲相关算法之前，我们先回顾一下公共交换电话网与计算机网络之间差别。

  Before we proceed to some algorithms, let's have a quick review of the public switched telephone network and computer network.





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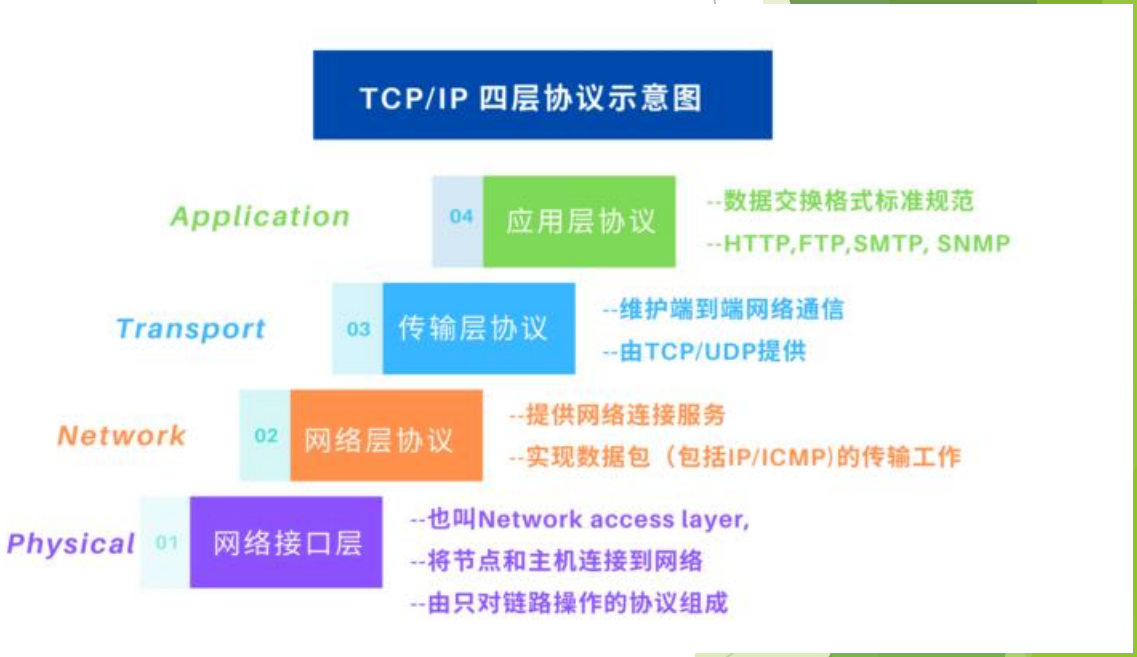
- 计算机网络中最大特点是分布式的，其节点在相互通讯之前并不需要预先建立连接，数据包在节点传送时，也是尽力而为；最重要的协议簇，即TCP/IP协议集。

  The most eminent characteristic of computer network is the distributed property, and there is no necessary to establish the connection prior to communication. The nodes offer a best-effort service of delivering datagrams between hosts. And the most significant protocol suite in the computer networking field is the TCP/IP protocols.



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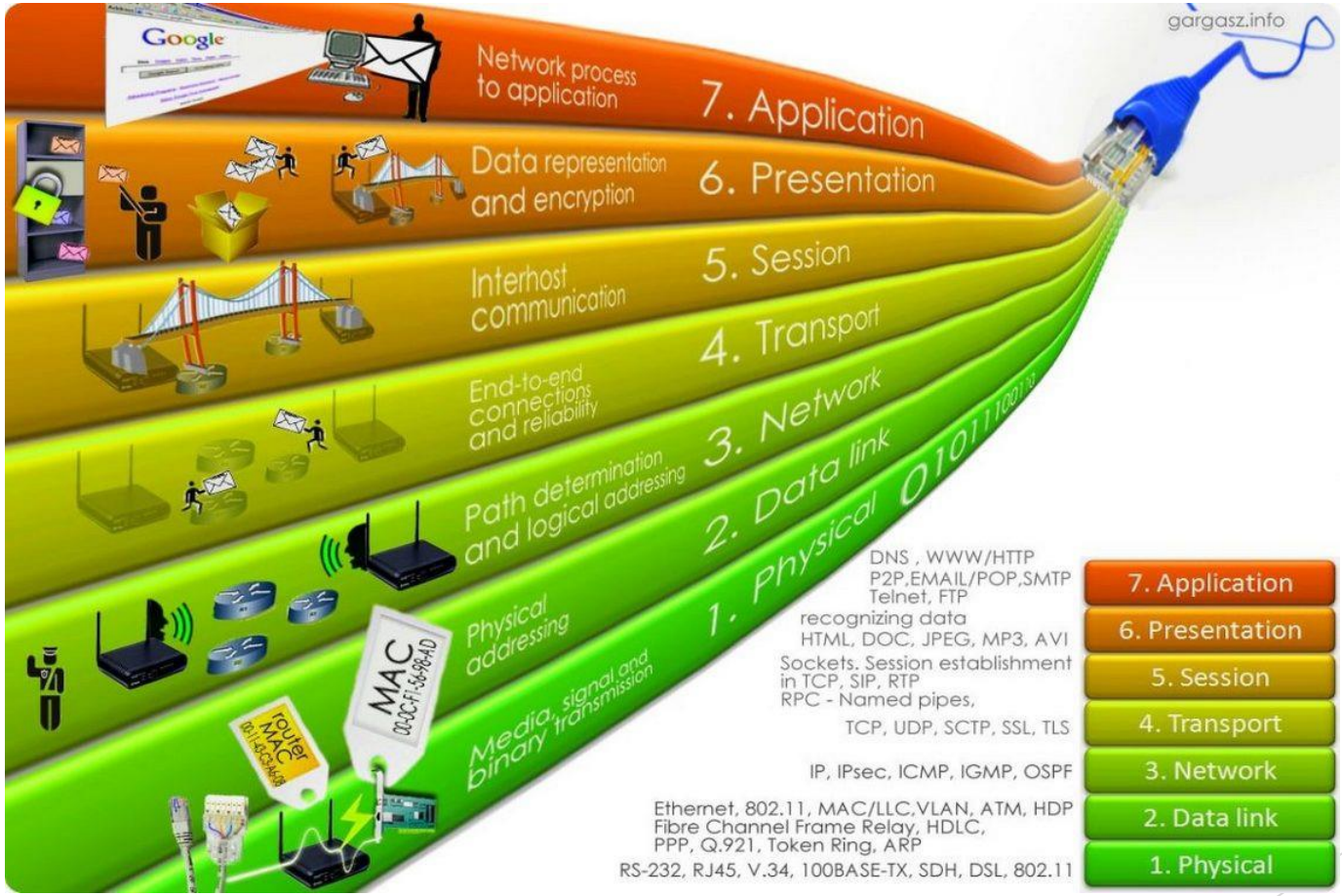

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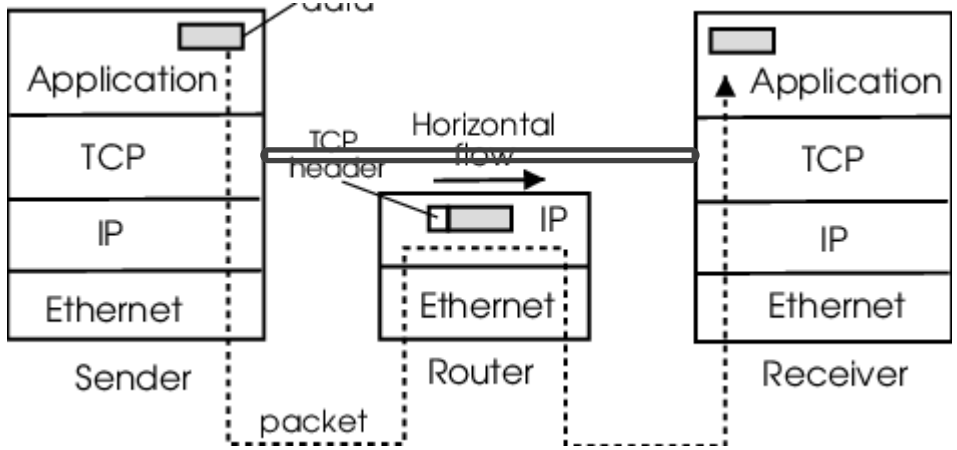
- 在TCP/IP协议集中，仿传统PSTN的面向流的TCP连接，是偏向逻辑意义上的，这点从路由器的视角看，更为清晰。

  In the TCP/IP protocol suite, the stream-oriented TCP connections analogous to the concepts in traditional PSTN are from the logical perspective, this is clearer from the router's perspective.



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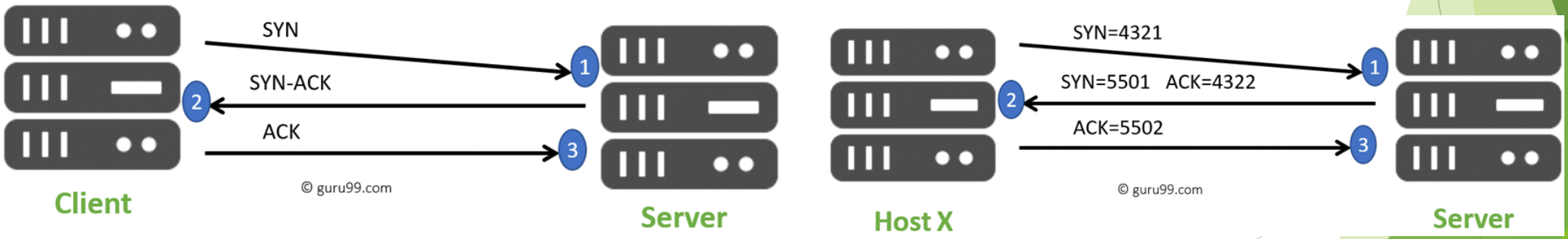
- 面向流的TCP连接强调在不可靠的传输机制上，建立一个可靠的连接或流式传输。TCP的三次握手协议，或三次握手算法，用以保证一个连接的建立。

  TCP requires a way to build the stream-oriented communication between hosts upon an un-reliable transmission mechanism. The three-way handshake algorithm of TCP is to make sure the successful establishment of a TCP connection.



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- 我们以回环接口上的客户端与服务器模型来查看TCP建立连接的三次握手过程，注意发起连接的一方的SYN位与确认连接的另一方的ACK位的变化。

  We demonstrate the three-way handshake of TCP connection initiation by implementing a client/server model over the loop interface. Note the values of SYN and ACK on each peer during the process.

	Time	Source	Destination	Protoc	Lengt	Info
87	24.634582	127.0.0.1	127.0.0.1	TCP	56	60060 → 27015 [SYN] Seq=3373982931 Win=65535 Len=0 MSS=65495 WS=256 SACK_PERM=1
88	24.634653	127.0.0.1	127.0.0.1	TCP	56	27015 → 60060 [SYN, ACK] Seq=1679585359 Ack=3373982932 Win=65535 Len=0 MSS=65495 WS=256 SACK_PERM=1
89	24.634719	127.0.0.1	127.0.0.1	TCP	44	60060 → 27015 [ACK] Seq=3373982932 Ack=1679585360 Win=2619648 Len=0
90	24.634776	127.0.0.1	127.0.0.1	TCP	58	60060 → 27015 [PSH, ACK] Seq=3373982932 Ack=1679585360 Win=2619648 Len=14
91	24.634805	127.0.0.1	127.0.0.1	TCP	44	27015 → 60060 [ACK] Seq=1679585360 Ack=3373982946 Win=2619648 Len=0
92	24.699800	127.0.0.1	127.0.0.1	TCP	44	60060 → 27015 [FIN, ACK] Seq=3373982946 Ack=1679585360 Win=2619648 Len=0
93	24.699879	127.0.0.1	127.0.0.1	TCP	44	27015 → 60060 [ACK] Seq=1679585360 Ack=3373982947 Win=2619648 Len=0
94	24.700011	127.0.0.1	127.0.0.1	TCP	58	27015 → 60060 [PSH, ACK] Seq=1679585360 Ack=3373982947 Win=2619648 Len=14
95	24.700061	127.0.0.1	127.0.0.1	TCP	44	60060 → 27015 [ACK] Seq=3373982947 Ack=1679585374 Win=2619648 Len=0
96	24.700873	127.0.0.1	127.0.0.1	TCP	44	27015 → 60060 [FIN, ACK] Seq=1679585374 Ack=3373982947 Win=2619648 Len=0
97	24.700965	127.0.0.1	127.0.0.1	TCP	44	60060 → 27015 [ACK] Seq=3373982947 Ack=1679585375 Win=2619648 Len=0

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- 当连接建立起来之后，TCP数据包仍然由非可靠的IP包承载传播，依然需要依靠适当的算法，保证逻辑上的面向连接的传播特性。

  After the establishment of the connection, the TCP packets are encapsulated into the unreliable IP packets for transmitting. It relies on certain algorithms to ensure the connection-oriented properties.

- TCP采用一种确认重传机制，来保证面向连接的服务的可靠性。

  TCP implement an acknowledge and retransmit algorithm to ensure the reliability of some connection-oriented services built upon TCP.

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