CSCI 446 Introduction to Computer Networks

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Topic

Computer Network Architecture

Protocol "Layers"

Networks are complex,

with many "pieces":

Hosts

Routers

Links of various media

Applications

Protocols

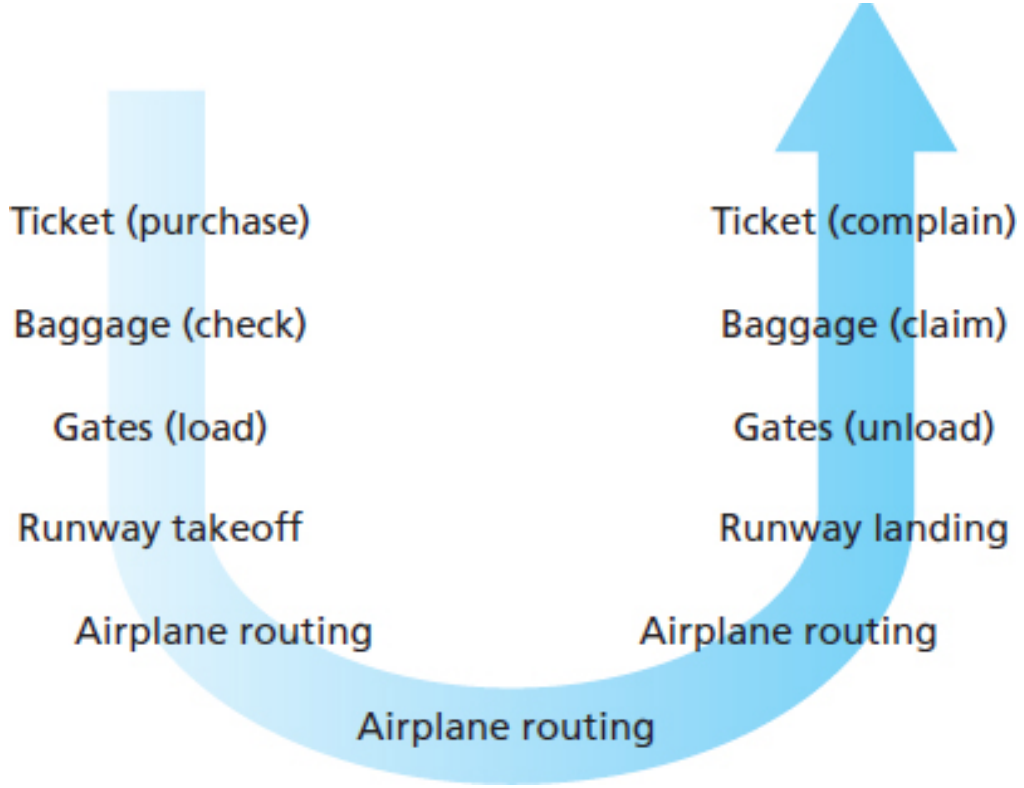
Hardware, software

Question:

is there any hope of **organizing** structure of network?

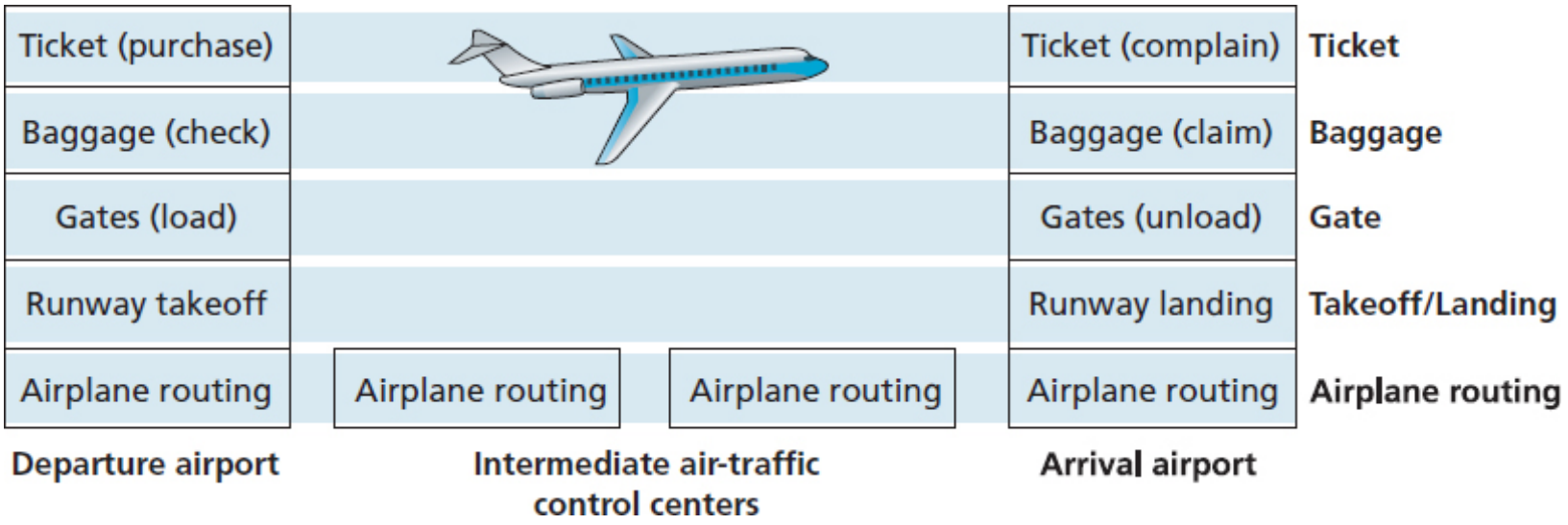
…. or at least our discussion of networks?

Organization of Air Travel



A Series of Steps

Layering of Airline Functionality



layers: each layer implements a service
via its own internal-layer actions
relying on services provided by layer below

Why Layering?

dealing with complex systems:

explicit structure allows identification, relationship of complex system's pieces

- layered **reference model** for discussion

modularization eases maintenance, updating of system

- change of implementation of layer's service transparent to rest of system
- e.g., change in gate procedure doesn't affect rest of system

layering considered harmful?

Internet Protocol Stack

application: supporting network applications

FTP, SMTP, HTTP

transport: process-process data transfer

TCP, UDP

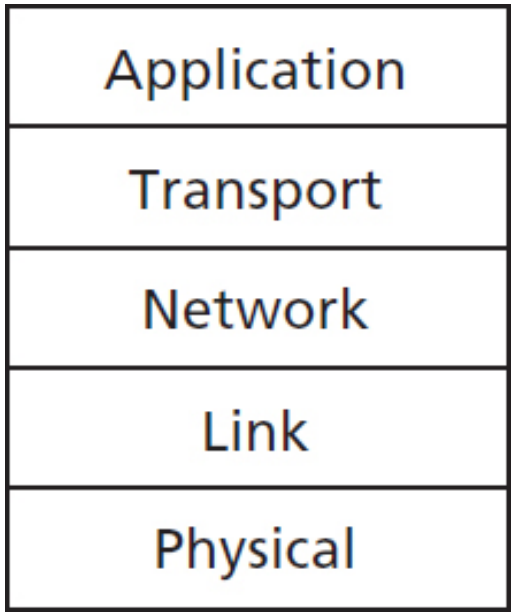
network: routing of datagrams from source to destination

IP, routing protocols

link: data transfer between neighboring network elements

Ethernet, 802.111 (WiFi), PPP

physical: bits “on the wire”



ISO/OSI Reference Model

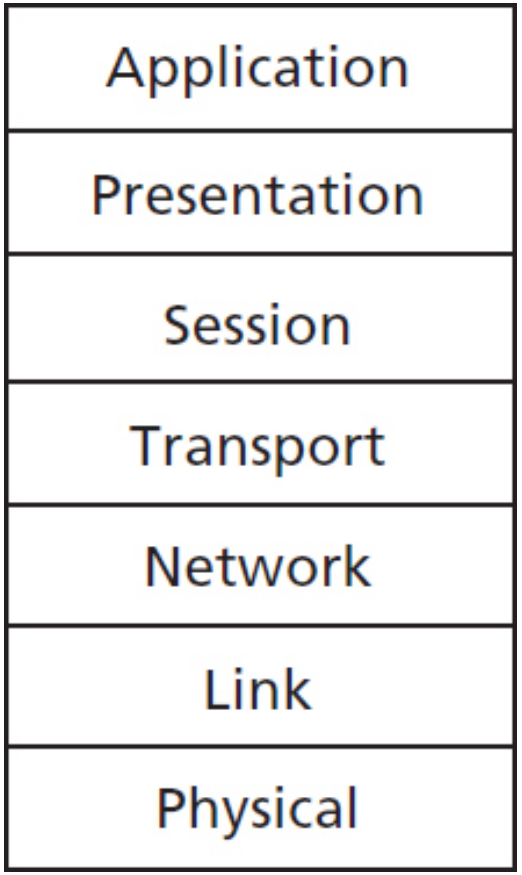
presentation: allow applications to interpret meaning of data, e.g., encryption, compression, machine-specific conventions

session: synchronization, checkpointing, recovery of data exchange

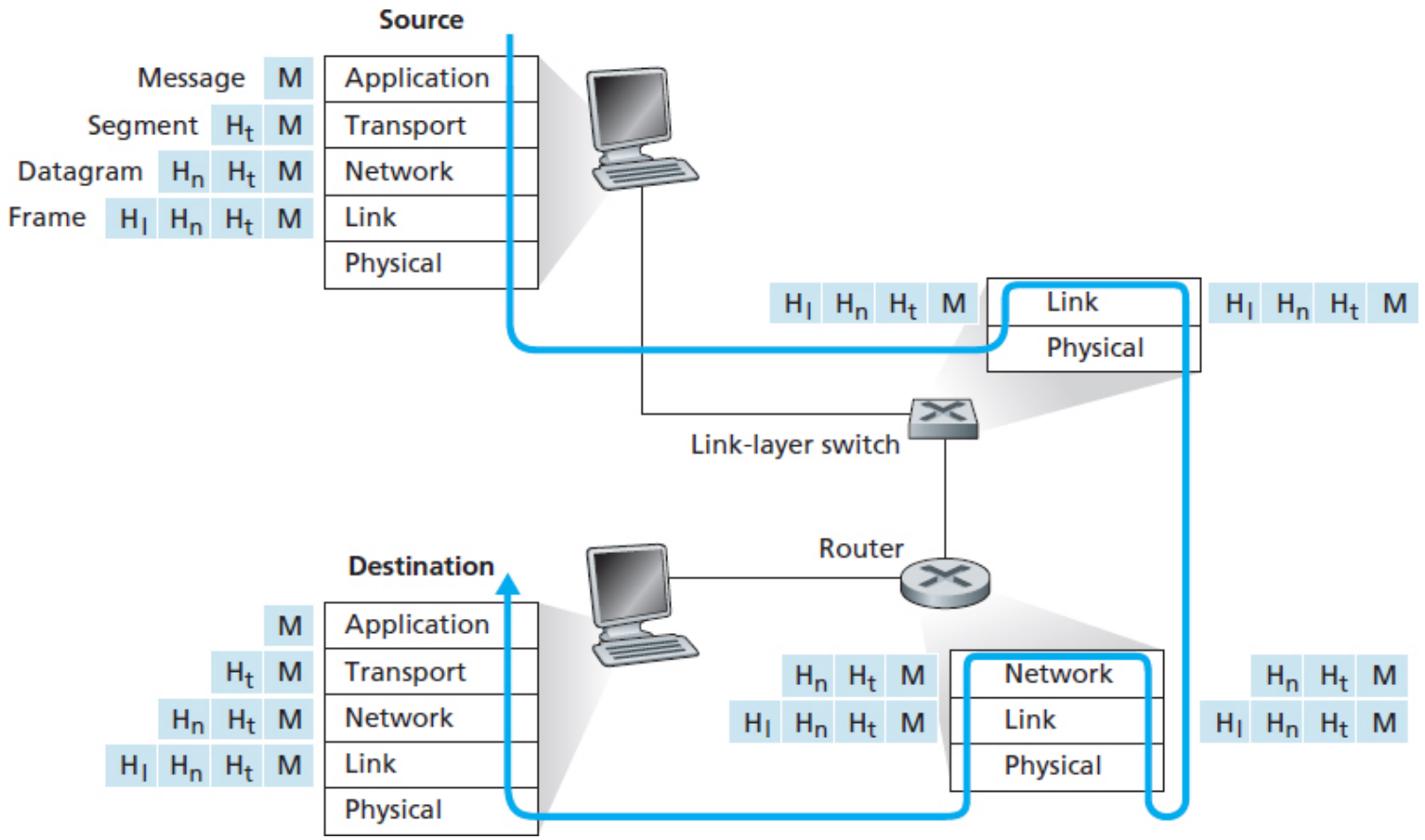
Internet stack "missing" these layers!

these services, **if needed**, must be implemented in application

needed?



Encapsulation



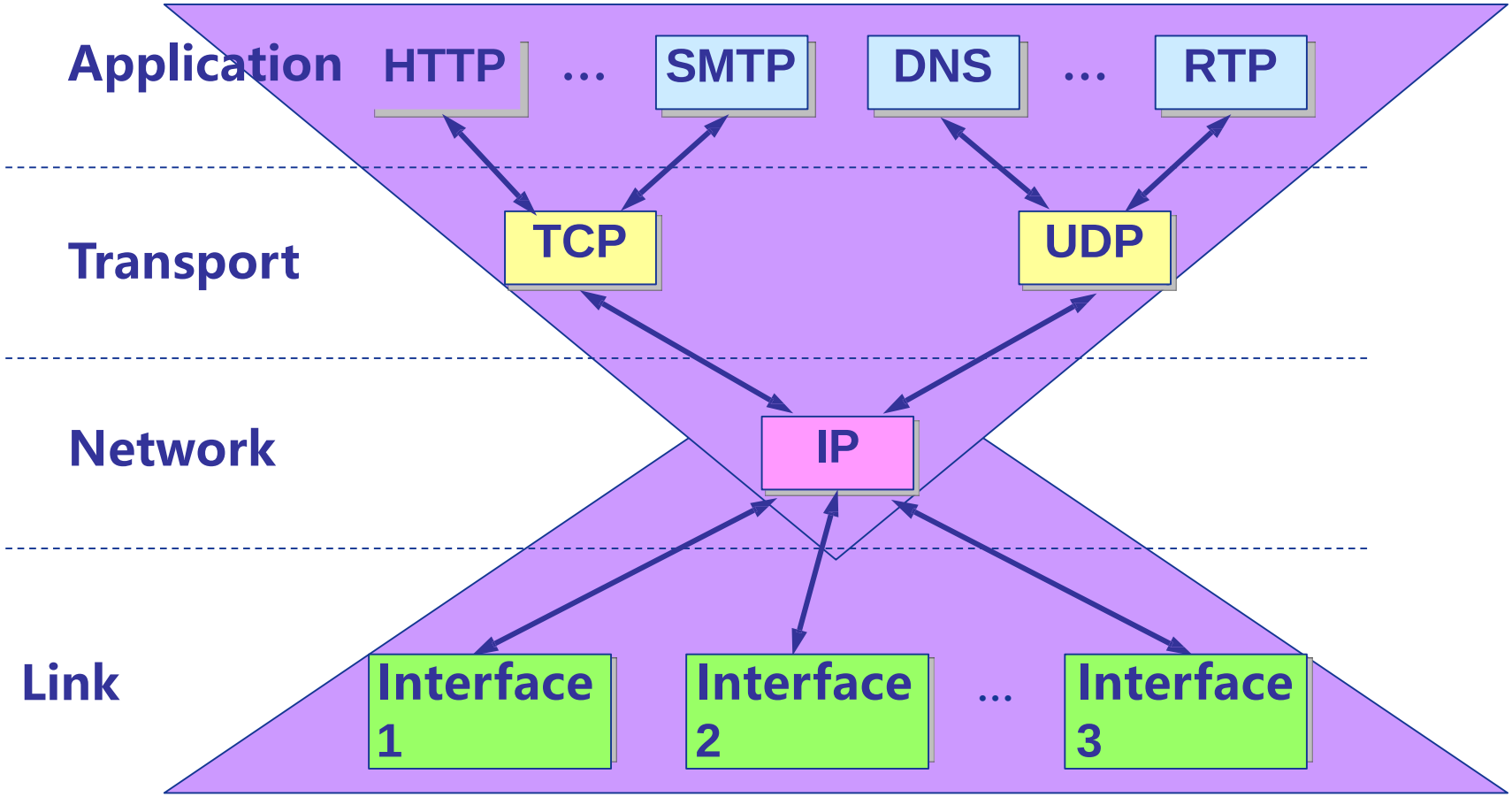
Why do we need a data encapsulation?

- Increase control information.
- Construct protocol data units (PDU)
- The control information mainly includes:
  - Address: Identifies the sender/receiver.
  - Error detection code (Error-detecting code): For error detection or correction.
  - Protocol Control: Additional messages that implement protocol functions such as priority, quality of service (QoS), and security control.

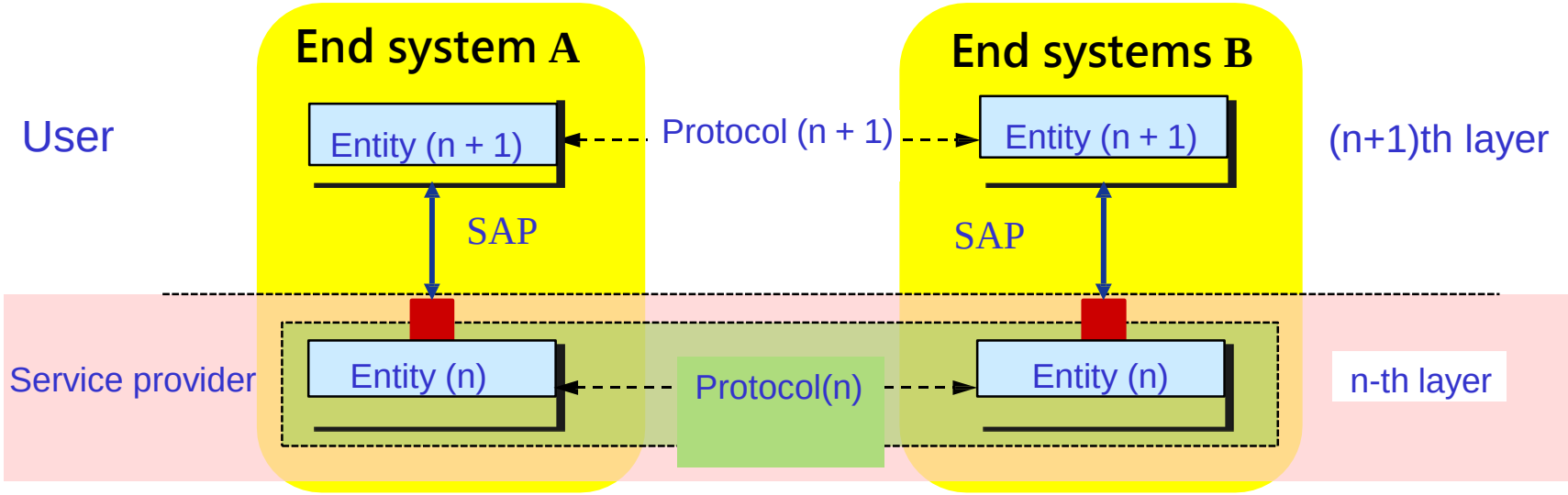
TCP / IP Model

IP over Everything

IP can be applied to a wide variety of networks.

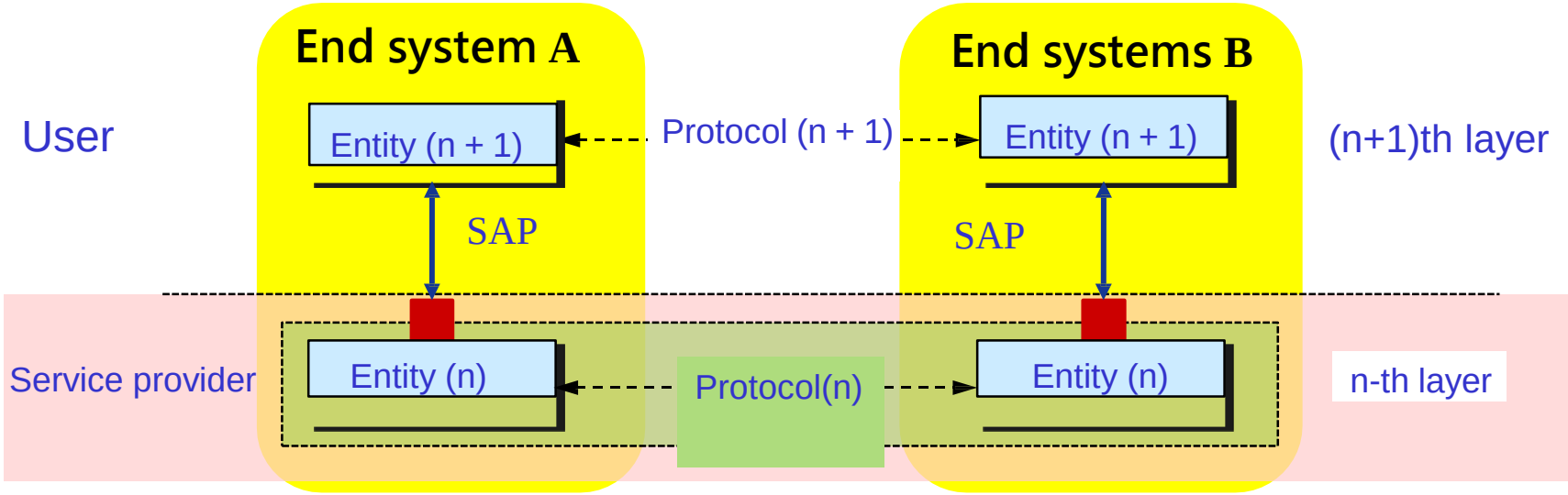


Basic concepts of layered network architecture



- An entity refers to any hardware or software process that can send or receive information.
- A protocol is a collection of rules that control the communication between two peer entities. The protocol is "horizontal."
- Entities at any layer need to use lower-layer services, follow the protocol of this layer, and realize the functions of this layer.

Basic concepts of layered network architecture



- The layer provides services, and the service is "vertical".
- The realization of the lower-layer protocol is transparent to the upper-layer service users.
- The adjacent layer entities of the same system interact through interfaces. Through the service access point SAP (Service Access Point), primitives are exchanged to specify the specific service requested.

Thank you!