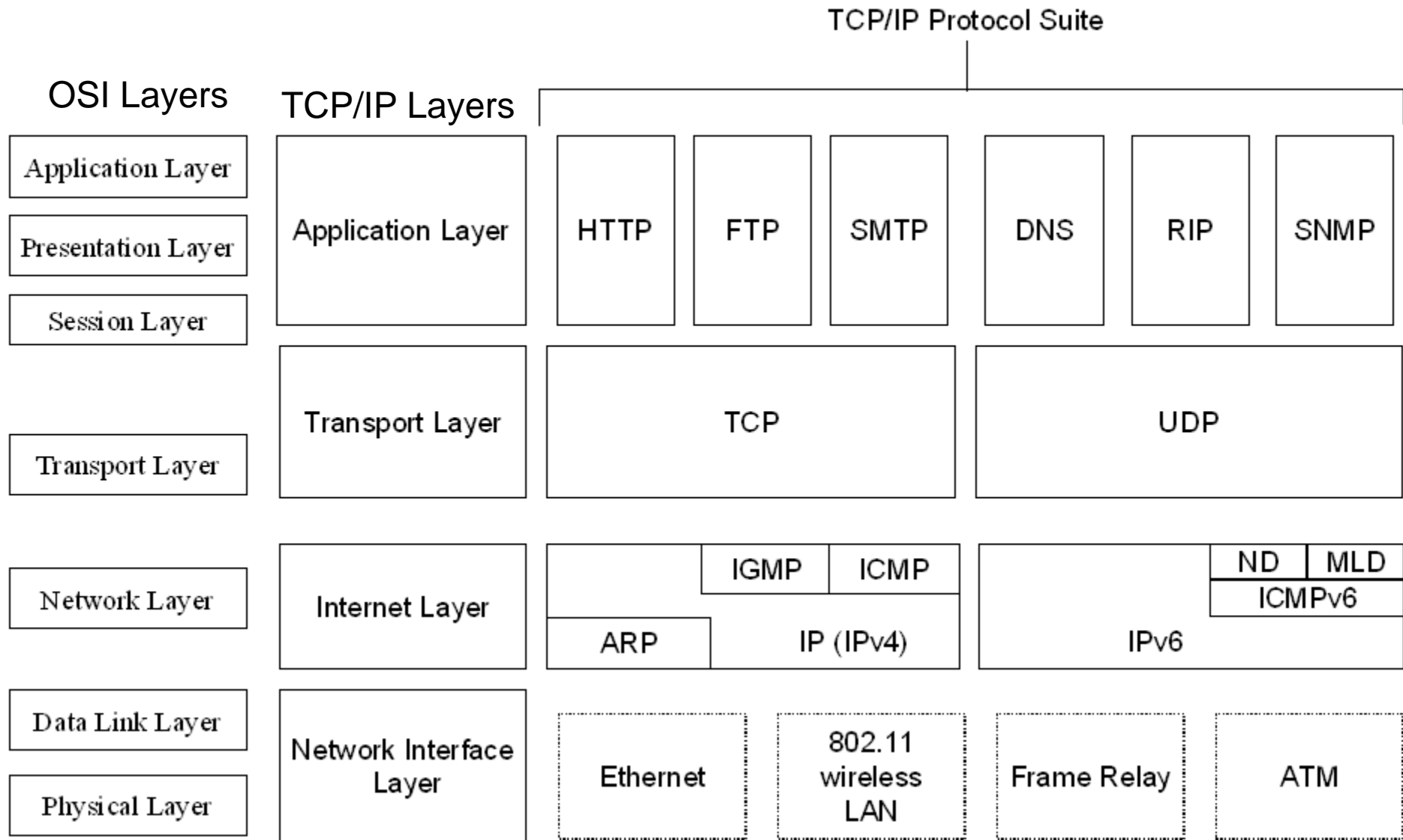


Layered Architectures and Applications

Required reading:
Forouzan Ch. 2
Garcia 2.1, 2.2, 2.3

CSE 3213, Fall 2015
Instructor: N. Vljic



Why Layering?!

Montreal



Alice wants to send a mail to Bob and a parcel to John.

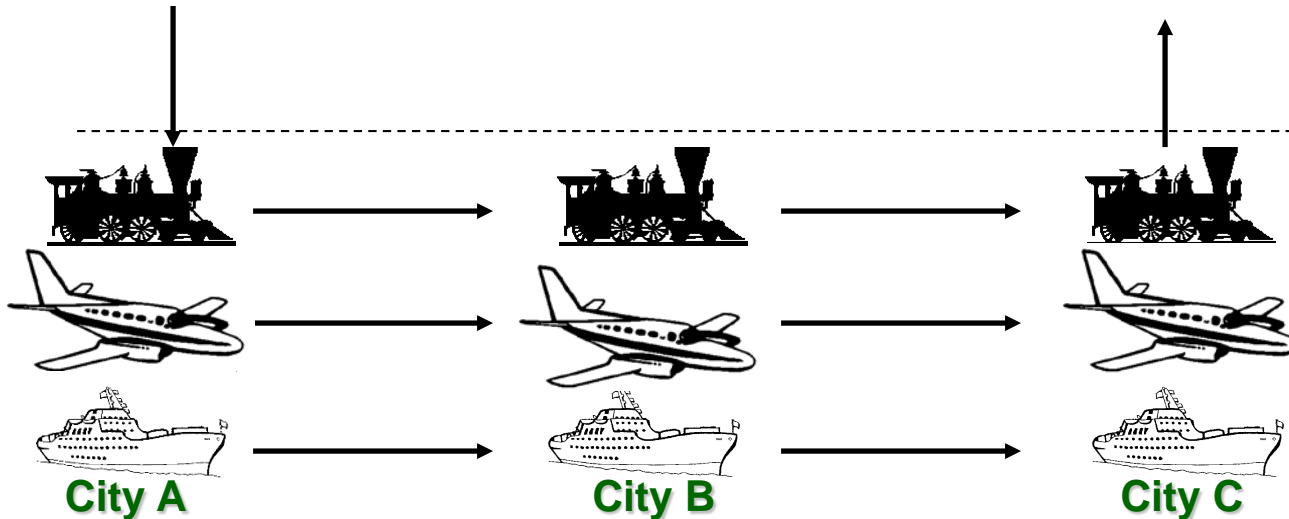


Alice drops off both at the same Post Office.

Post Office



Post Office looks at the addresses (**city names!!!**) and arranges for proper transportation.



London



Paris



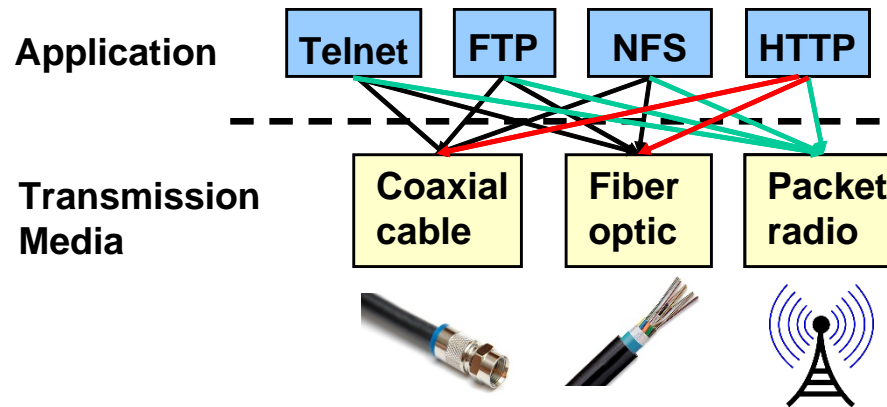
Post Office performs final delivery based on the **street and personal names.**

Post Office



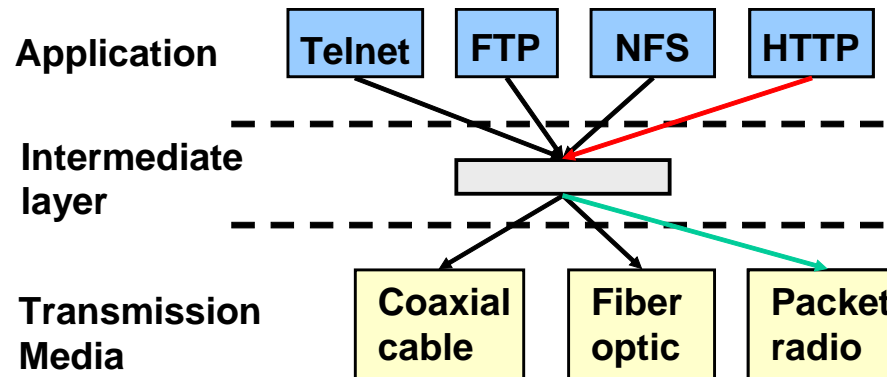
No Layering

- each new application has to be *re-implemented* for every network technology!



Layering

- intermediate layer(s) provide a unique abstraction for various network technologies



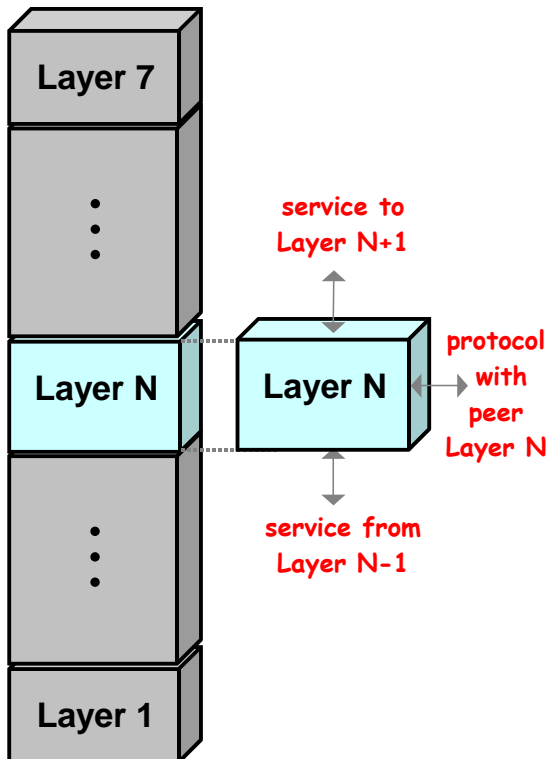
Why Protocol Layering?

- 1) **modularity** – one problem is decomposed into a number of smaller more manageable sub-problems
⇒ easier / more flexible design and maintenance of computer networks
- 2) **functionality reuse** – a common functionality of a lower layer can be shared by many upper layers
⇒ more rapid development of novel computer network services and applications

A monolithic network design that uses a single large body of hardware and software to meet all network requirements can quickly become obsolete and also is extremely difficult and expensive to modify.

Layered approach accommodates incremental changes much more rapidly.

Protocol Layering – grouping of related communication functions into hierarchical set of **layers**



- each layer:
 - (1) performs a subset of functions required for communication with another system
 - (2) **relies on next lower layer** to perform more primitive functions
 - (3) **provides service to next higher layer**
 - (4) implements **protocol** for communication with **peer layer** in other systems
- **vertical communication** – commun. between adjacent layers – requires mutual understanding of what services and/or information lower layer must provide to layer above
- **horizontal communication** – commun. between software or hardware elements running at the same layer on different machines

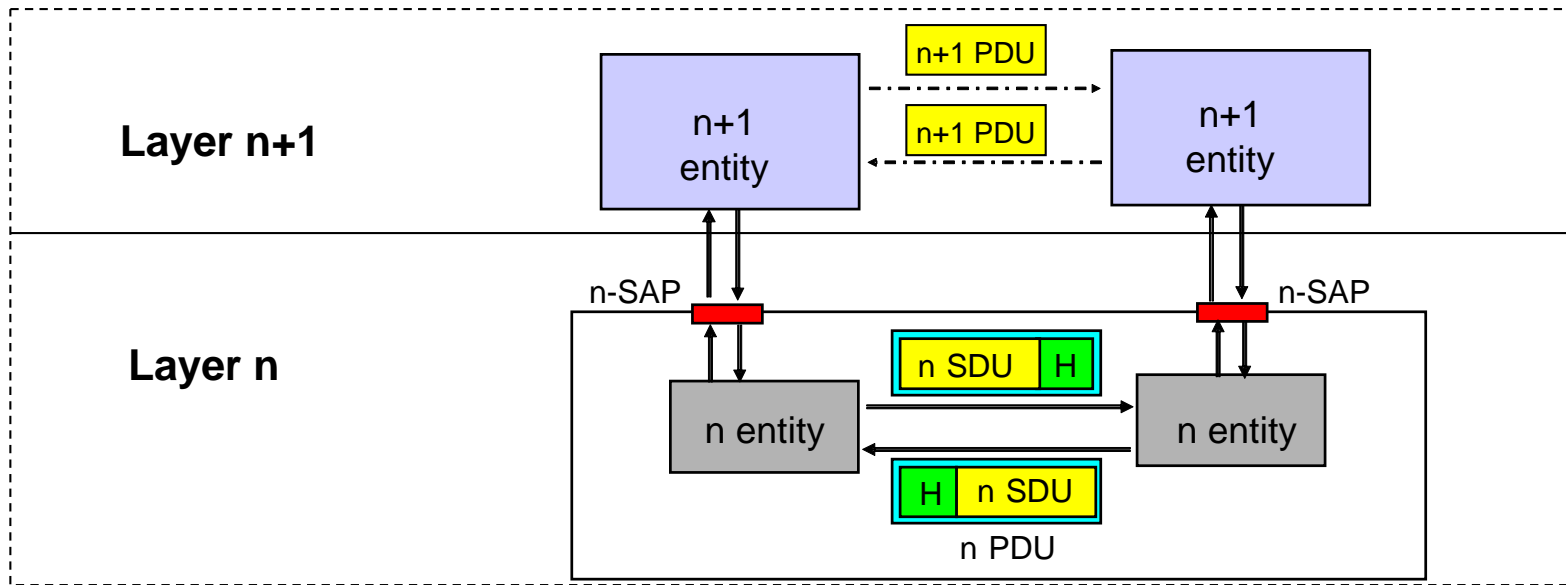
Horizontal communication between peer processes is virtual, i.e. indirect.

Protocol – set of rules that govern data comm. between **peer entities**

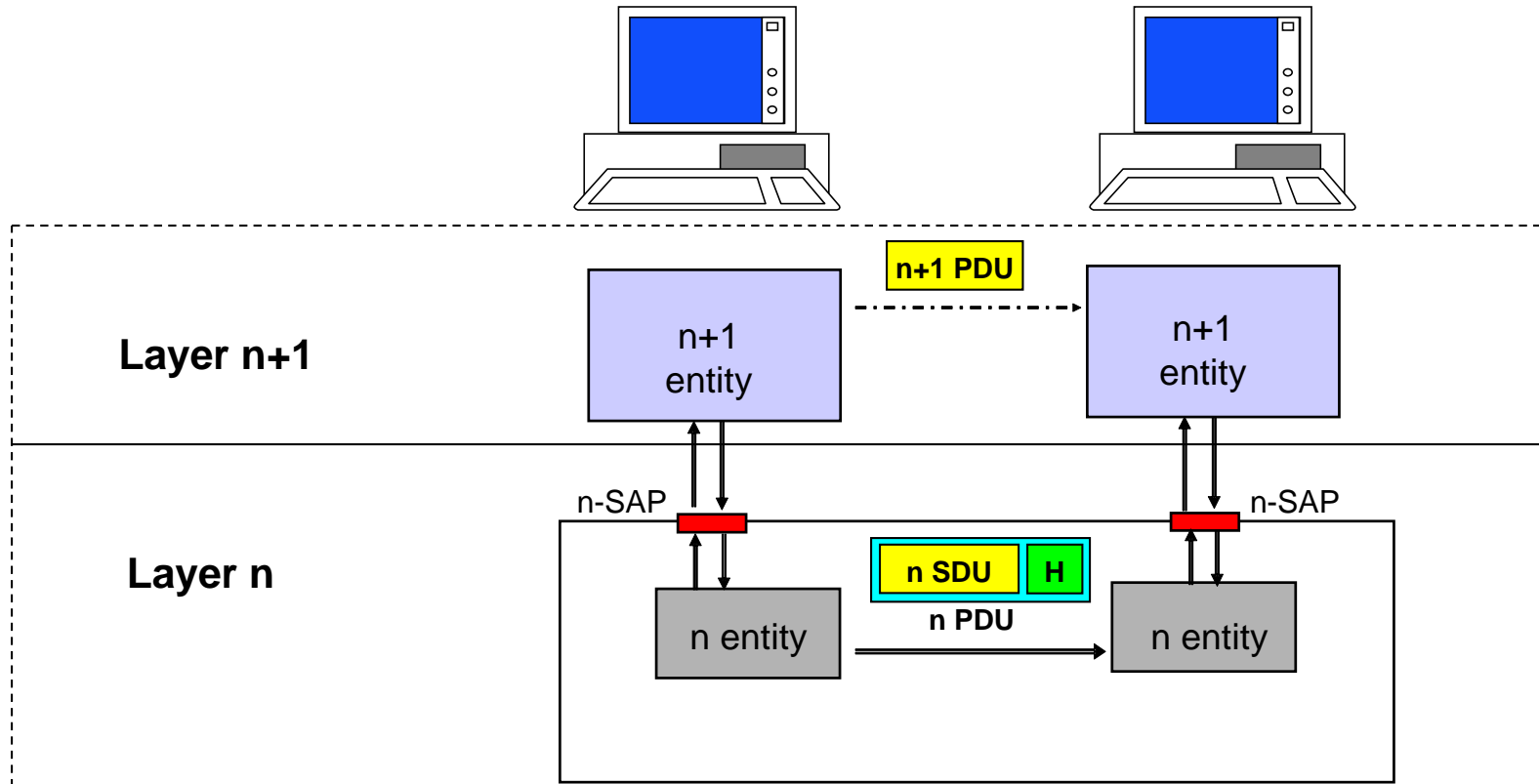
- layer-n peer processes communicate by exchanging **Protocol Data Units (PDUs)**

Service – can be accessed through **Service Access Points (SAP's)**

- layer n+1 PDU = layer n SDU (SDU = **Service Data Unit**)
- layer n process adds control information (**header**) to its SDU to produce layer n PDU – **encapsulation!**
- layer n does not interpret or make use of information contained in its SDU



Example [layering – vertical vs. horizontal flow of information]



Layered Architecture (cont.)

