

ECSE-6600: Internet Protocols

Informal Quiz #02

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**Review of Networking Concepts (II):
[i.e. slide set #3]
Informal Quiz**

T F **Review of Networking Concepts (II)**

- Without layering, you would need to translate between all possible combinations of applications and networking systems functions
- The interface between layers seldom outlives the technology used to implement each layer
- The service interface defines the message formats and conventions exchanged with the peer.
- A layer can use the services provided by the layer just above it in the layering stack
- One key difference between the Internet and the Telephone network is that the latter (I.e. telephone network) places its intelligence at the end-systems
- The end-to-end argument strongly encourages placement of the functions at the highest layer where it can be completely and correctly implemented.
- The end-to-end argument precludes function-placement at lower layers at all costs, and does not even allow it for performance gains
- The end-to-end argument is a principle, I.e. it can never be violated in Internet design

TF **Review of Networking Concepts (II)**

- Network architecture should specify both the placement of functions and detailed guidelines on how to best implement them
- The application-layer framing suggests that it would be advantageous to have application visibility and control mechanisms into as many networking functions as possible
- RTP is a protocol designed to fit the ALF philosophy, I.e. it provides an application-extensible transport layer format and functionalities
- Performance considerations are always absolute (I.e. relative performance questions such as: how much is A faster than B are not entertained)
- A useful rule of thumb from Amdahl's law is that we should focus our performance improvement efforts on the portion of the system that accounts for a significant share of performance (I.e. the "common case")
- Performance objectives and metrics depend upon the perspective taken (operator/user vs designer/implementor)
- A useful general rule of thumb in system design is to tradeoff scarce resources and optimize on abundant resources (I.e. be frugal about what is already abundant)

T F Review of Networking Concepts (II)

- To apply Amdahl's law, you first need accounting of the performance contribution due to individual components or interactions between components.
- When capacity is cheap, we would design a system that optimizes capacity.
- When capacity is costly, we would design a system that optimizes capacity.
- The impact of technology trends is that the relative costs of components (eg: memory capacity vs memory access bandwidth vs optical link capacity) may change dramatically.
- When the relative cost structure of components is expected to change in the future, the system design should allow options for re-composition, while identifying appropriate interfaces that are likely to be stable despite the changes in technology (eg: using techniques like modularity).
- Putting the "brains" or system intelligence in end-systems limits the scope for system-wide disruption when a single end-system fails (aka limited fate-sharing scope).
- Edge-boxes can be considered to be a "higher" level than core-routers when applying the e2e principle, and deciding where to place QoS functions.
- The E2E principle first focuses on performance optimization, and only then on correctness and completeness as a secondary objective
- Cross-layer design across adjacent layers that are implemented by the same entity are not uncommon (eg: PHY/MAC layer, transport/application layer).
- The danger with cross-layer design is that it may impede technological progress enabled by Moore's law etc in the name of short run performance optimization

Part II: Evolution of The Internet Architecture (covered later in class)

T F **Review of Networking Concepts (II)**

- □ A key problem in evolving the Internet architecture today is to account for conflicting interests and goals that may not be resolved in the technical sphere, while still facilitating innovation.
- □ An aspect of the tussle argument is that modularization must be first done at the level of tussles, and only then principles like e2e applied within the scope of a tussle-free zone
- □ Designing for choice (rather than outcome) means that the architecture should be flexible and facilitate information transfer and negotiation between tussle parties.
- □ Layered naming is an example of how several layers of indirection can be designed to isolate tussles about name-space semantics, mobility of data objects, name-space management and incorporation of middleboxes as first-class citizens.
- □ Virtualization and overlays (over common infrastructure like Planetlab) can be used as the means to deploy new technologies despite the hardening of the IP core infrastructure.
- □ The pluralist view (eg: active networks) implies that architecture is specified by a universal protocol.
- □ Active networking allows flexible, application-specified customization of forwarding services.
- □ In active networking, the code is always carried in packets
- □ Internet protocols are usually robust to fail-stop failures, but not to malicious misbehavior of nodes or software bugs or semantic failures.
- □ Lightweight byzantine-like/consensus techniques are needed to improve the robustness of internet protocols