Protocols and Layers

- What is a networked system?
- Protocols and Layering

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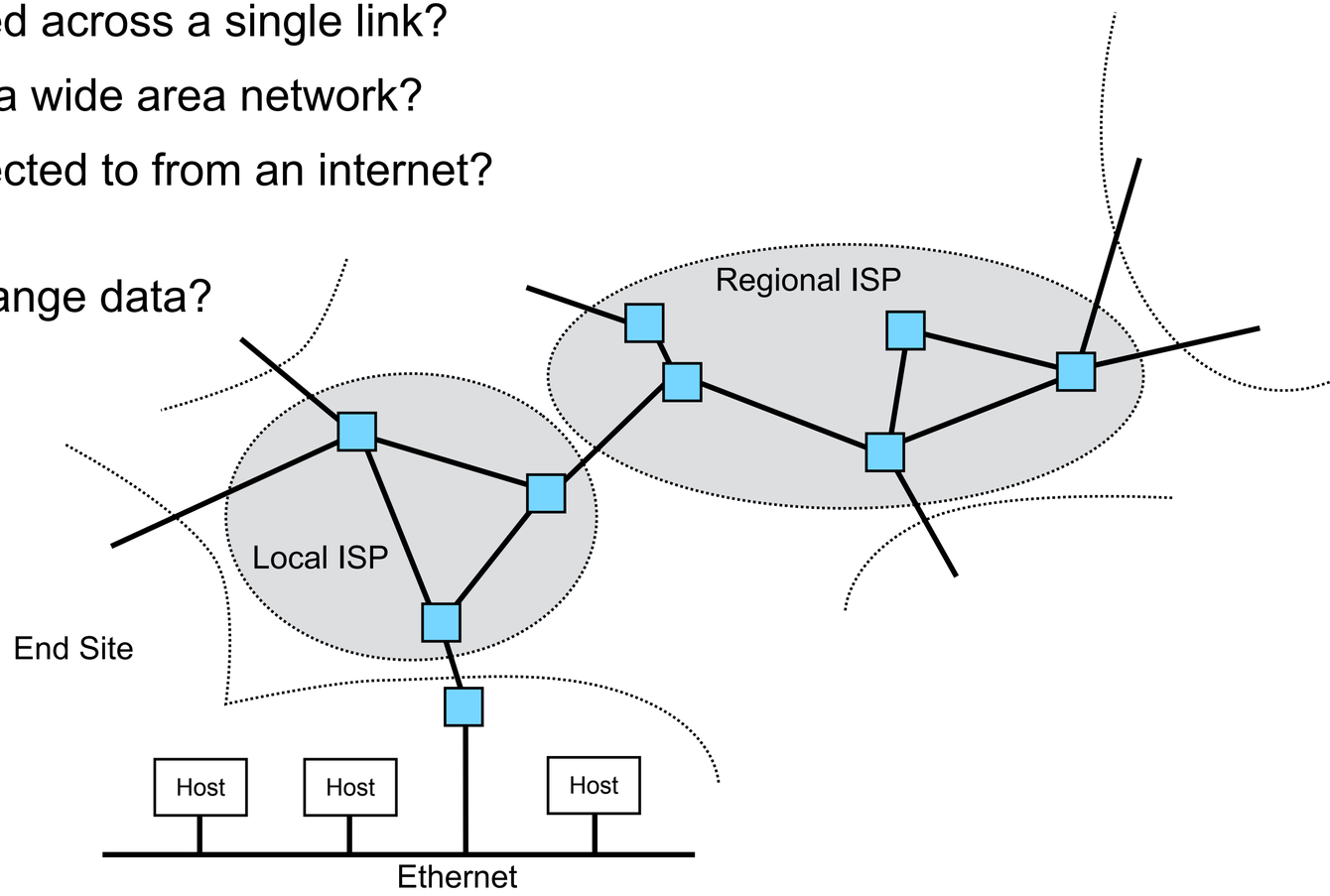
What is a Networked System?

- A cooperating set of autonomous computing devices that exchange data to perform some application goal
  - Communication – how is information exchanged across a single link?
  - Networking – how are links connected to form a wide area network?
  - Internetworking – how are networks interconnected to from an internet? How is data routed across that network?
  - Transport – how do end-systems reliably exchange data?



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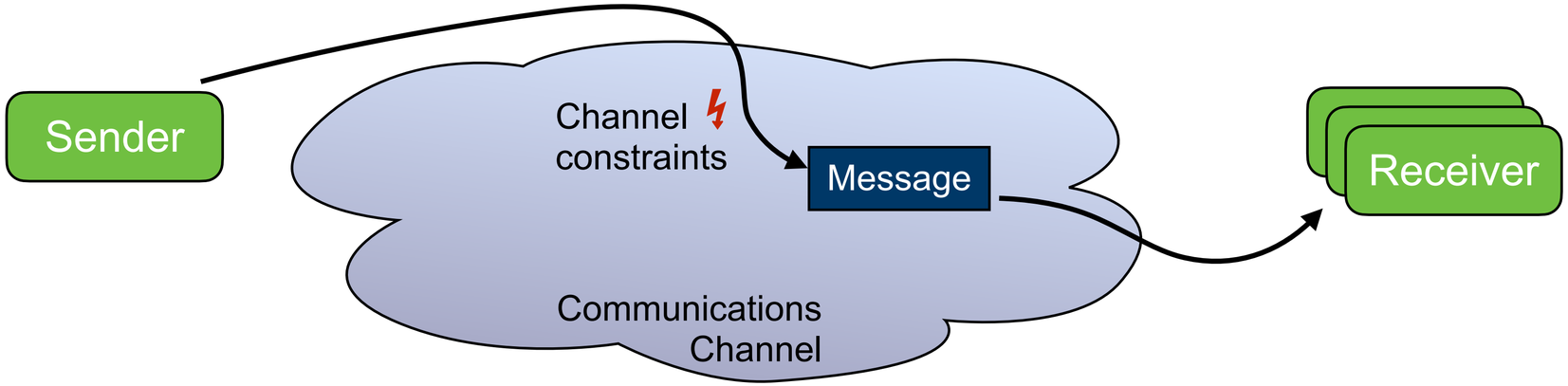
Communication Protocols



- Channel constraints bound communications speed and reliability
- The message syntax, semantics, and communication patterns form a **network protocol** – HTTP, TCP, IP, etc.
- Protocols can be composed and layered to raise level of abstraction

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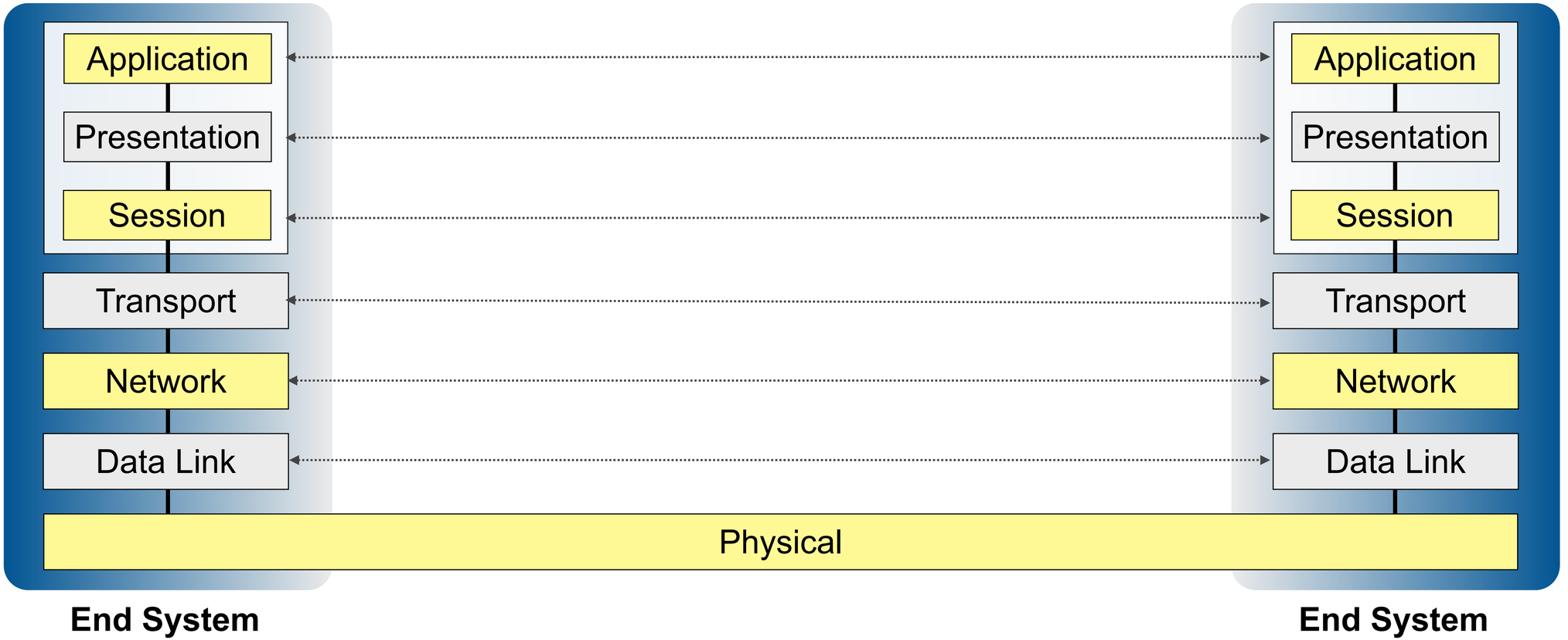
Protocol Layering: The OSI Reference Model



ISO/IEC 7498-1(1994) "Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model"

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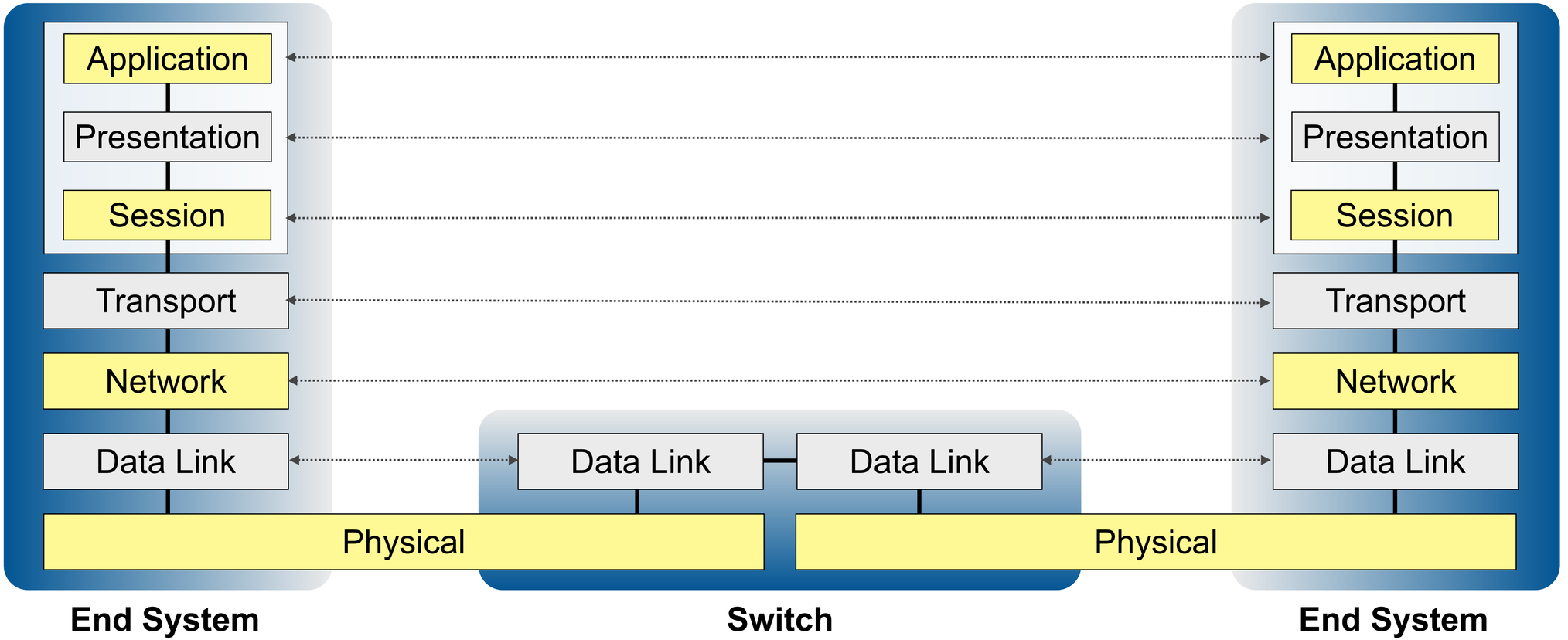
Protocol Layering: The OSI Reference Model



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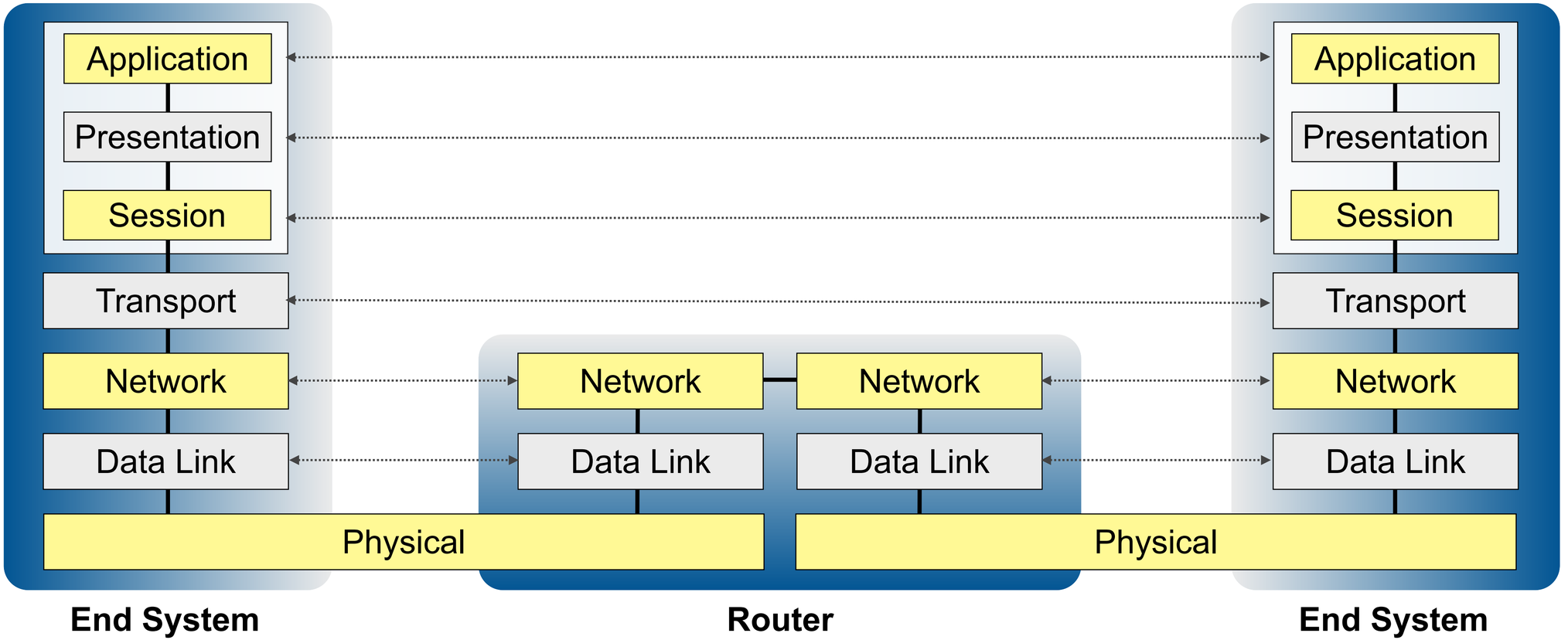

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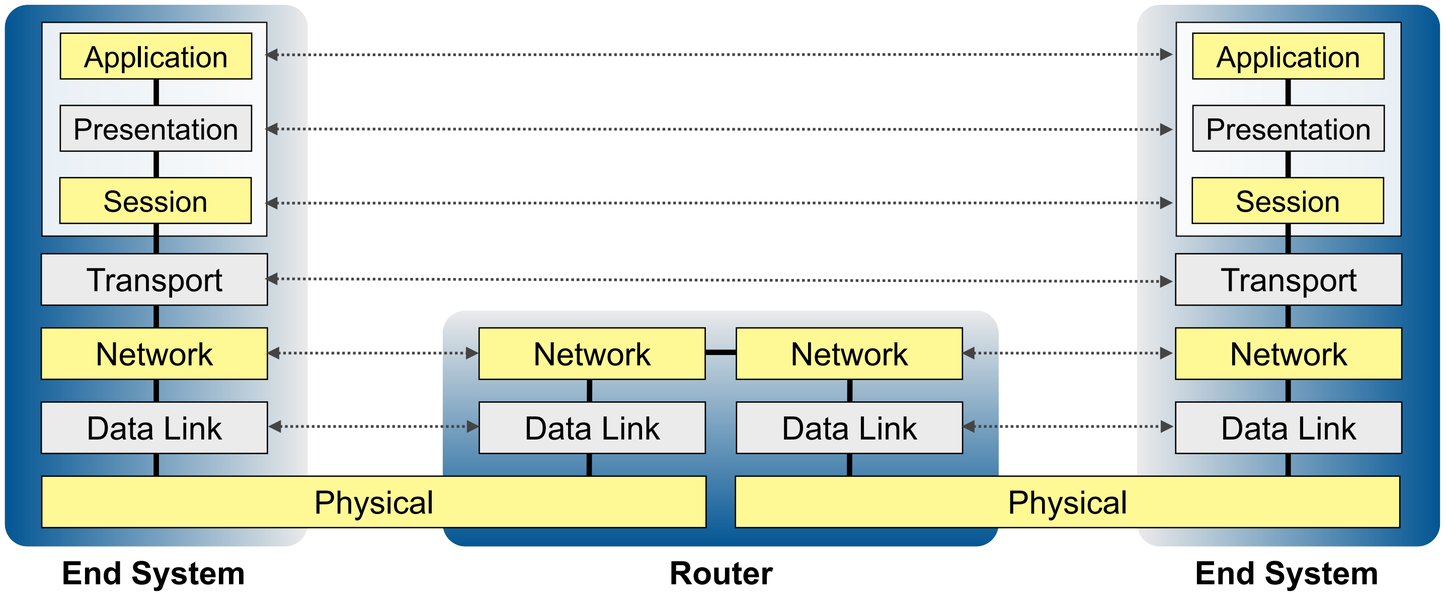
Protocol Layering: The OSI Reference Model



- A standard model of layered protocol design – **real networks don't follow this model –** they're more complex, and layer violations, sublayers, and tunnels are commonplace
- A layered model is extremely useful for helping structure discussions about networks

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See also: J. Macculey, S. Shenker, and G. Varghese, "**Extracting the Essential Simplicity of the Internet**", Communications of the ACM, Volume 66, Number 2, February 2023. DOI: 10.1145/3547137.
https://www.youtube.com/watch?v=XY6fJVMaawI

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