Overview of Research in Router Design
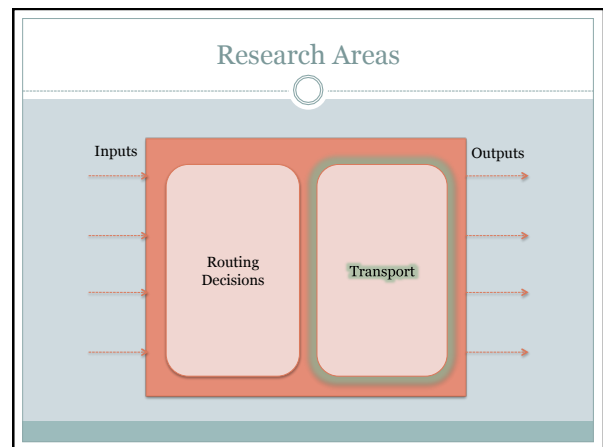
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Routers in a Nutshell

Router

Research Areas

Inputs

Outputs

Routing Decisions

Transport

## Research Areas

Inputs

Outputs

Routing Decisions
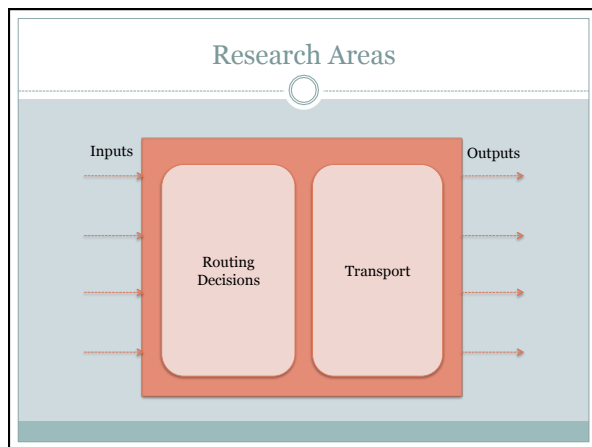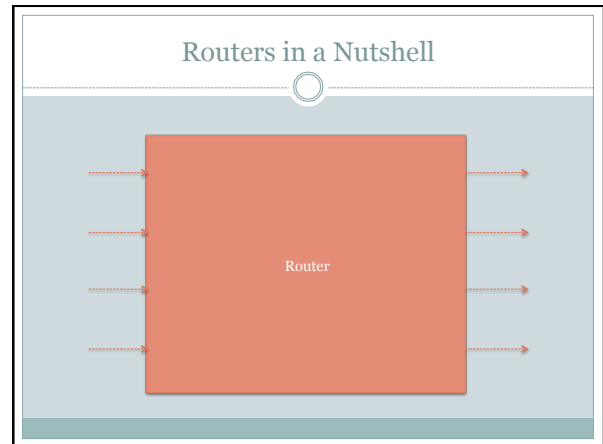
Transport

Switches vs Buses

- A Fast Switched Backplane for a Gigabit Switched Router
  - McKeown
  - 1997
- Key Ideas
  - Shared Buses are not fast enough
  - Switches combined with well designed algorithms improve performance

Transportation on a BIG router

- Scaling Internet Routers Using Optics
  - Keslassy et. al.
  - 2003
- Design Goals
  - Lots of Linecards (Input/Outputs)
  - High throughput requirements, with guarantees
    - Previous switched architecture and algorithms not good enough
  - Physical limitations
    - Power
    - Heat dissipation
    - Space
  - Easy configuration (linecard failures)
    - Consequence of two-level switched architecture

Research Areas

Inputs → | Routing Decisions | Transport | → Outputs
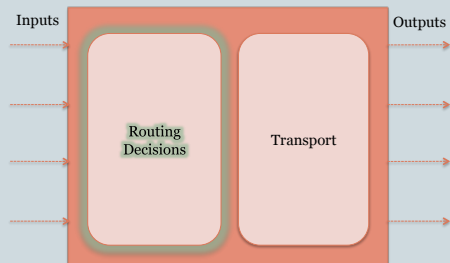
Data Structures for the Routing Table

- Make IP routing decisions fast with well designed data structures
- Small Forwarding Tables for Fast Routing Lookups
  - Degermark et. al.
  - 1997
- Key Points:
  - Why use specialized hardware when general-purpose processors can handle IP routing decisions?
  - Efficient algorithm to limit memory accesses
  - Make necessary accesses fast by ensuring they will be in the cache

QoS via Packet Classification

- How do you support differentiated services?
  - Need to make decisions at edge routers efficient
- Scalable Packet Classification
  - Baboescu and Varghese
  - 2000
- EffiCuts: Optimizing Packet Classification for Memory and Throughput
  - Vamanan, Voskuilen, and Vijaykumar
  - 2010
- Basic idea:
  - With good data structures and algorithms for matching packets up to rules, we can make QoS decisions efficiently