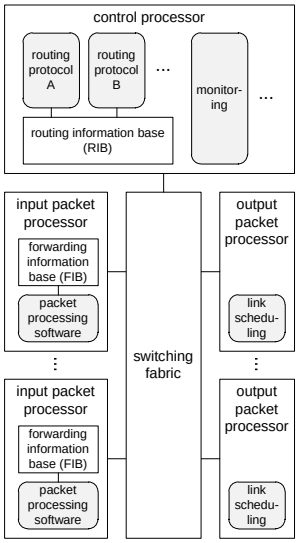
ECE 671 – Lecture 12

Routers

Prefix lookup

Prefix lookups for packet forwarding

- Match of IP destination address with prefixes specified in FIB
  - Longest matching prefix
- Typical core router
  - Hundreds of thousands of prefixes
  - Millions of lookups per second
- Efficient data structures and algorithms essential for lookup



Example prefixes

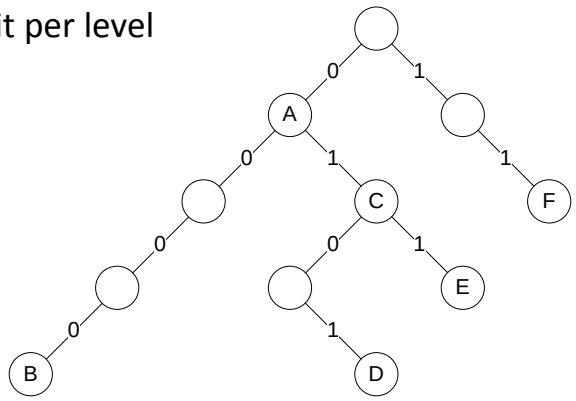
- Prefixes used for example data structures

Prefix name	Binary notation
A	0/1
B	0000/4
C	01/2
D	0101/4
E	011/3
F	11/2

- How to find match for an address (e.g., 01001111)?

Binary tree

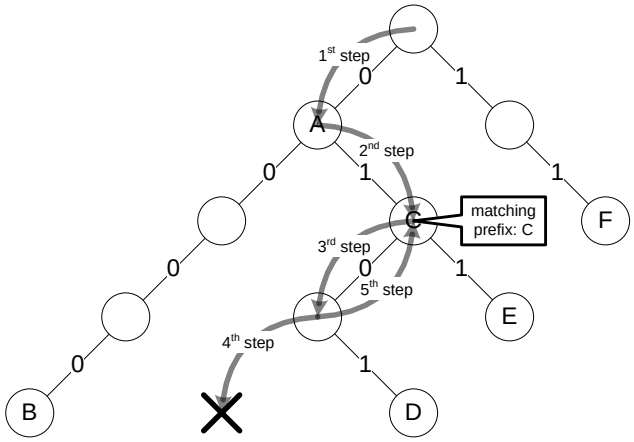
- One bit per level



- How to do lookup?

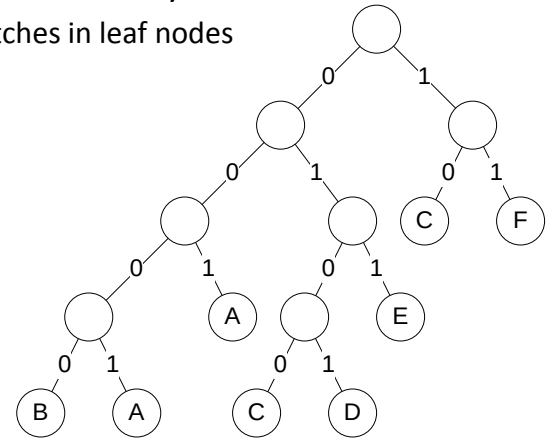
Binary tree

- Lookup may require backtracking (or memory):



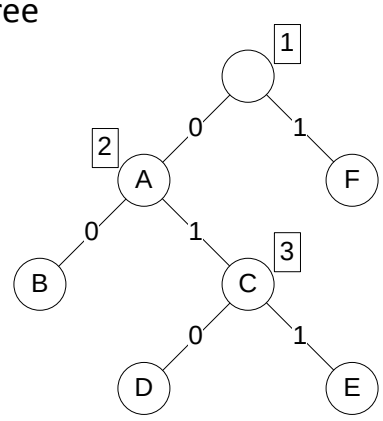
Leaf pushing

- Disjoint prefix binary tree
  - All matches in leaf nodes



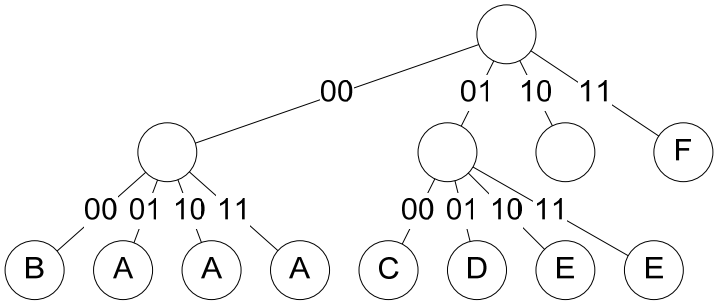
Path compression

- Path-compressed binary tree
  - Avoids long branches with only one node
  - Annotation to determine which bit to compare
  - Final node needs to be checked – otherwise backtracking



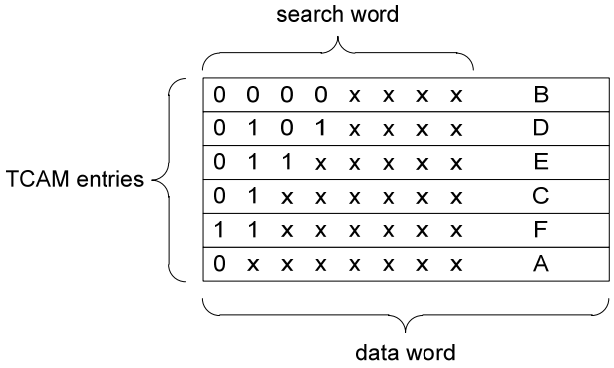
Tries

- Check multiple bits per step



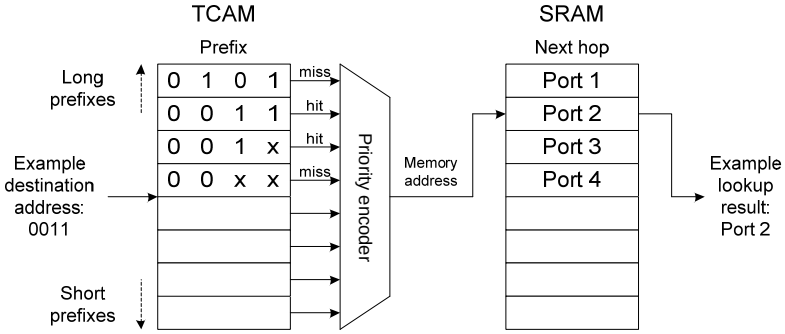
Hardware implementation

- Ternary content-addressable memory (TCAM)
  - Parallel lookup across all entries
  - 'x' indicates "don't care"



Hardware implementation

- TCAM operation



Prefix lookup issues

- Performance concerns
  - Lookups per second
  - Memory requirements
  - Power requirements
  - Ability to handle updates
- Lots of research in past years
  - Many specialized solutions

Router wrap-up