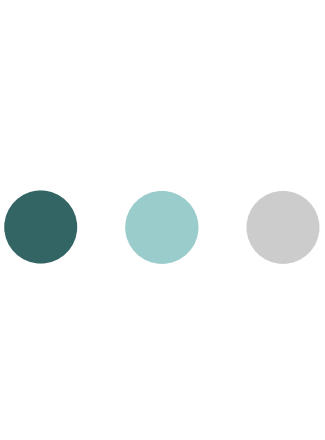

# CS519: Computer Networks

Lecture 4, Part 4: Feb 25, 2004

*Internet Routing:*

# Practical aspects of OSPF (Open Shortest Path First)

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- Link-state protocol
  - 189 pages long!!!
  - (versus 31 pages for RIP)
- 2-level hierarchy
  - Virtual links
- Designated router on LANs
- Hop-by-hop security
- External routes

Note: The term “Open” was a marketing attack against cisco, whose routing protocol was proprietary

# OSPF scalability

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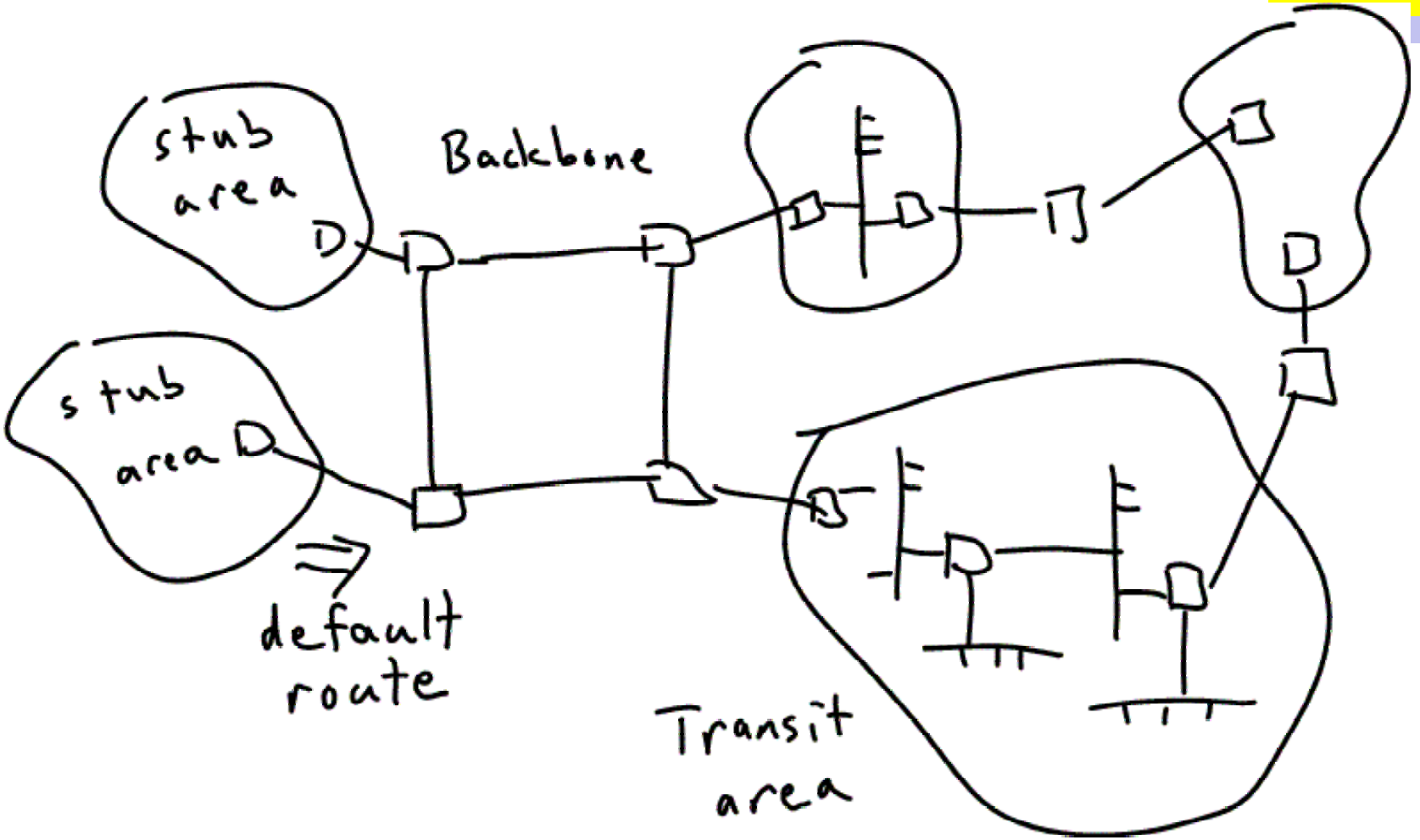
- OSPF runs in a single Autonomous System (AS)
  - But an AS can be big
- To improve scalability, the AS can be partitioned into areas
  - Area is composed of subnets and routers
  - Areas are connected by a single backbone
- Two level hierarchy

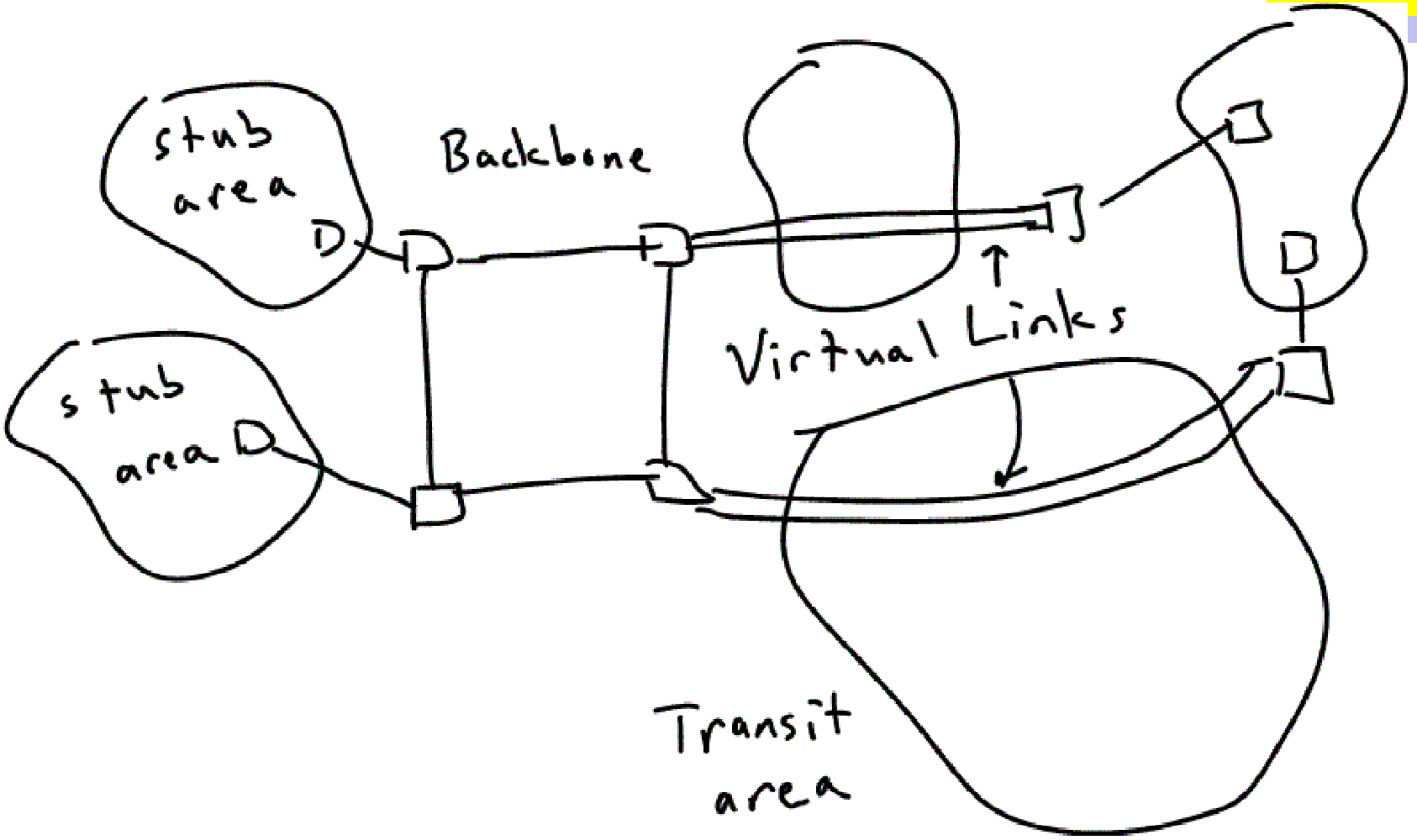
# OSPF backbone and areas





# Backbone is logically (but not necessarily physically) contiguous





# Designated routers on LAN

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- A single broadcast LAN with N routers logically looks like $N^2$ point-to-point links
- Silly to advertise all of these $N^2$ links
- Rather, the LAN is advertised as a multi-access link
- One router is dynamically elected as a *designated router* to advertise the link and adjacent routers
  - A backup is also elected
- Spanning tree algorithm modified to cope with multi-access links

# OSPF security model

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- Security is *hop-by-hop*
- Each router authenticates its neighbors
  - But does not authenticate LSUs!
- If a single rogue router joins the algorithm, it can bring down the network
  - Claim to have an interface with all subnets!

# External routes

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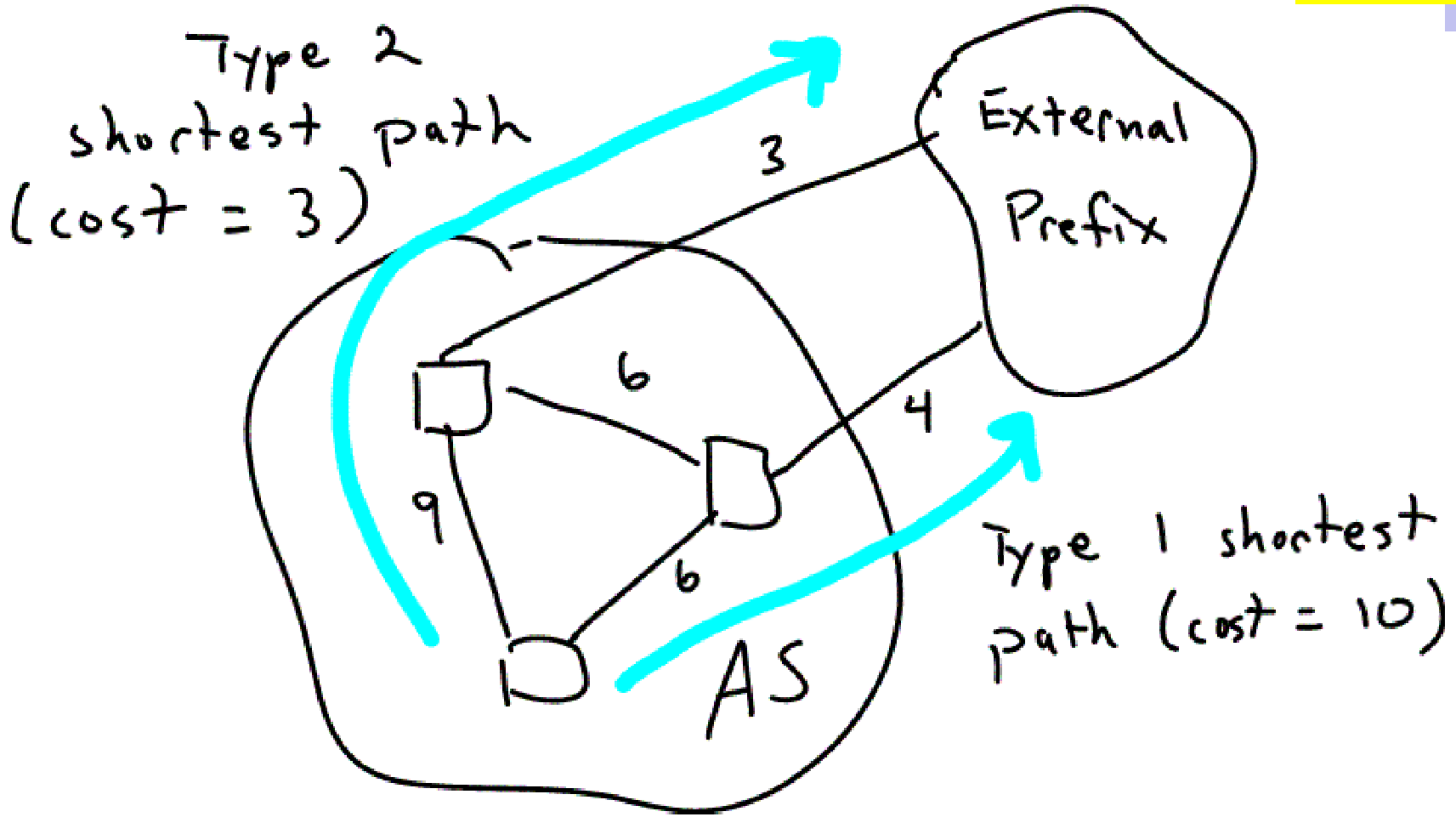
- As an AS, OSPF routers at the AS boundary can reach external IP prefixes
- These are advertised in OSPF as external routes
  - Can be “default route”
- Two types
  - Type 1:  Cost is the sum of intra-AS path and external metric
  - Type 2:  Intra-AS cost is ignored when calculating path

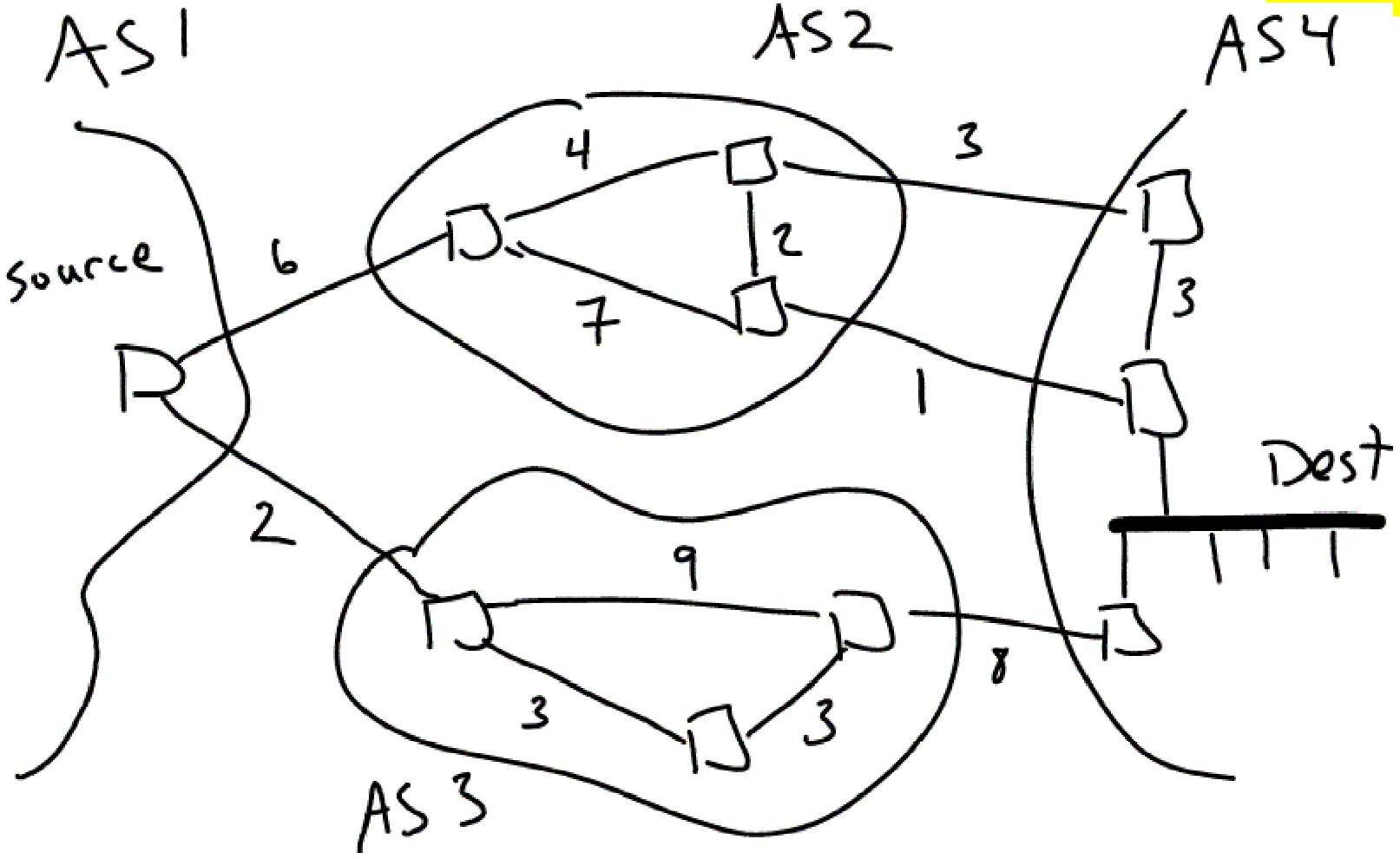
# External routes example





# Which path should be taken here?





# The usual answer: it depends

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- The dilemma of inter-domain routing is that each AS sets its metrics independently
  - No way to impose uniformity
  - (as least not in the “unregulated” Internet)
- Though an AS can autonomously determine how to view external routes