Inter-Autonomous-System Routing: Border Gateway Protocol

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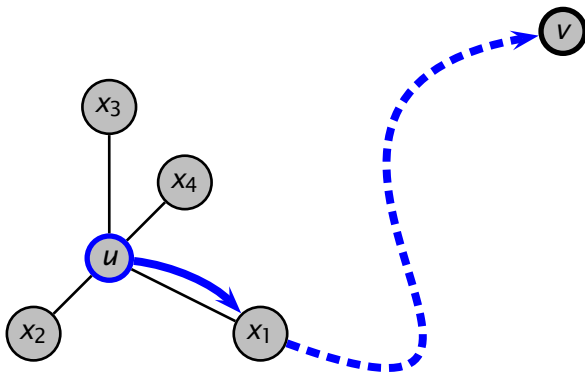# Outline

- Hierarchical routing

- BGP

Routing

- Goal: each router u must be able to compute, for each other router v, the next-hop neighbor x that is on the least-cost path from u to v
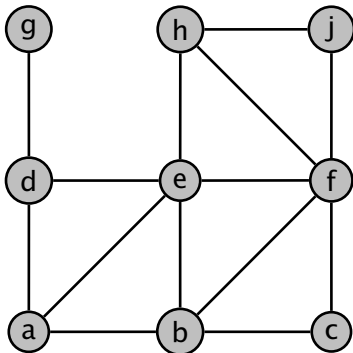
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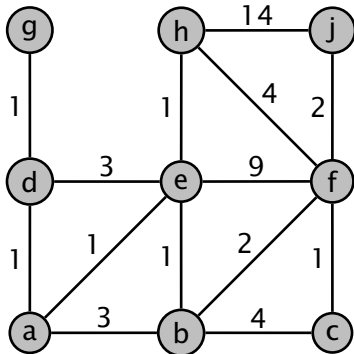
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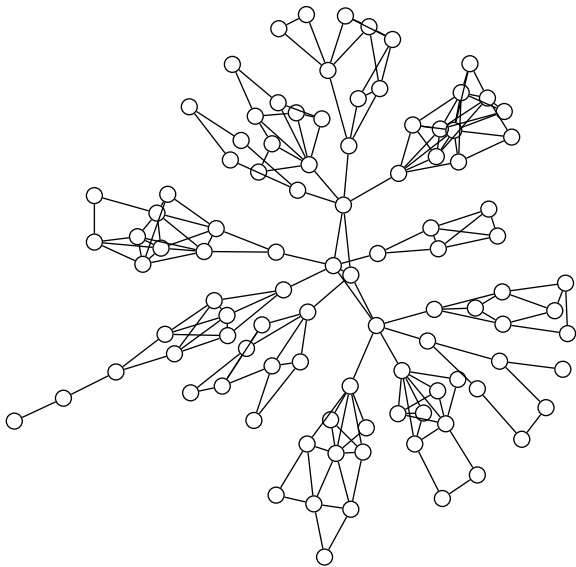- So far we have studied routing over a "flat" network model

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■ Also, our objective has been to find the least-cost paths between sources and destinations

More Realistic Topologies

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Even More Realistic

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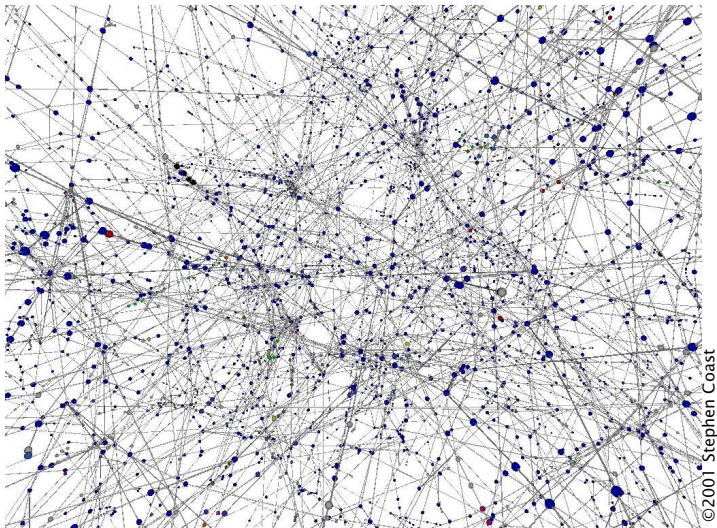
An Internet Map
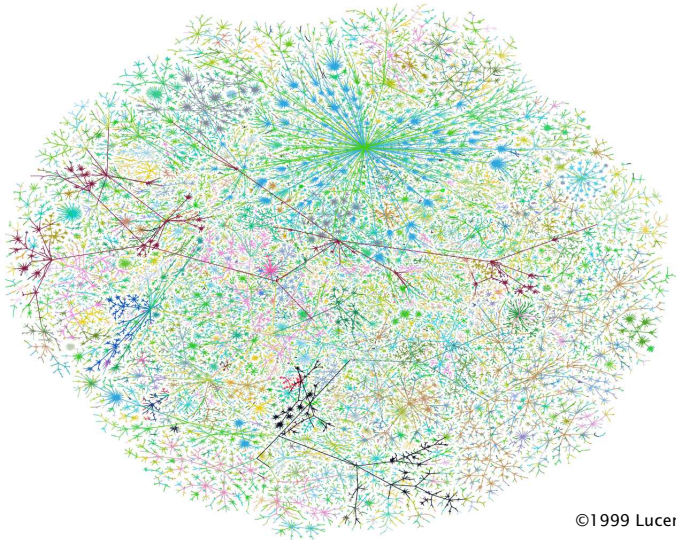
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  - an organization might not want to expose its internal network structure

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- An *intra-autonomous system routing protocol* runs within an autonomous system (e.g., OSPF)

  ▸ this protocol determines internal routes

    ▸ internal router ↔ internal router
    ▸ internal router ↔ gateway router
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Hierarchical Structure

AS3

AS2

AS1

AS4
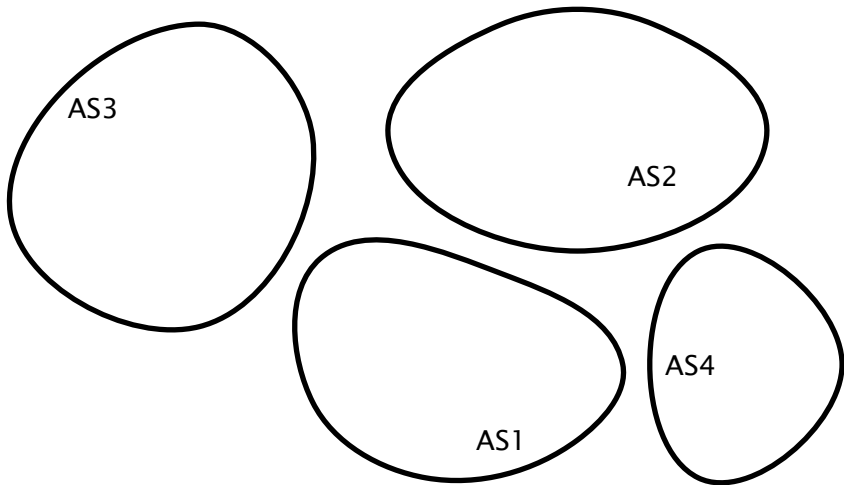
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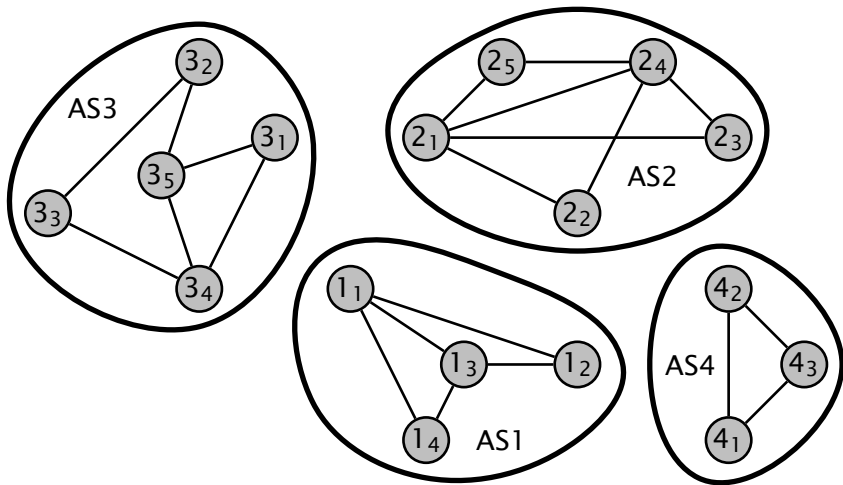
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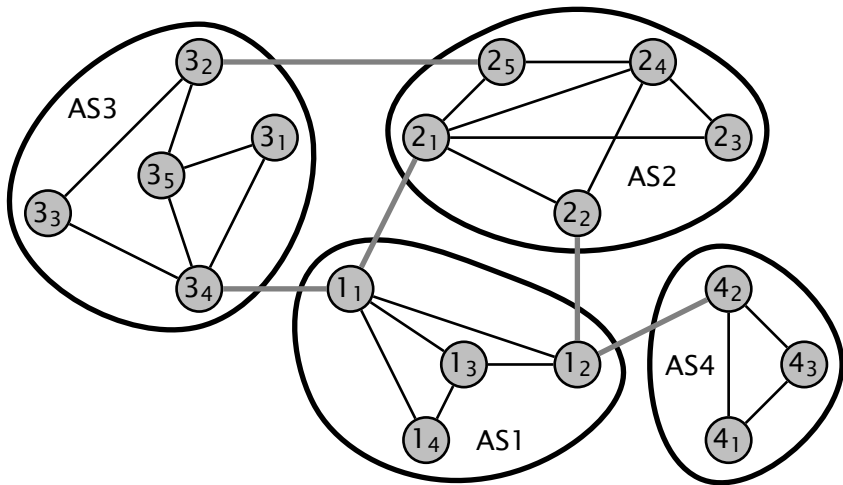
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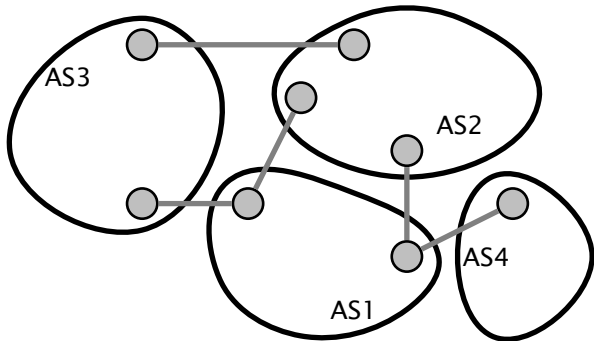
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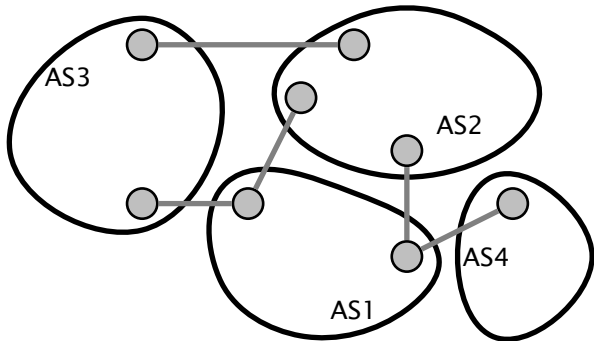
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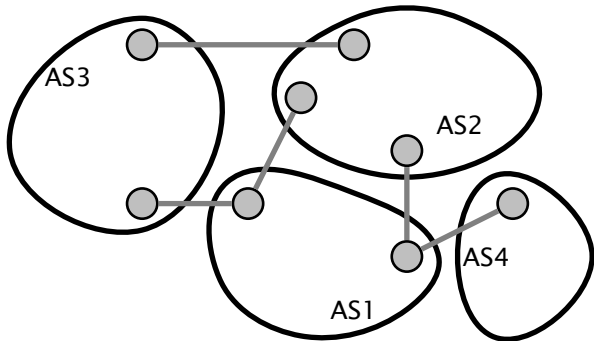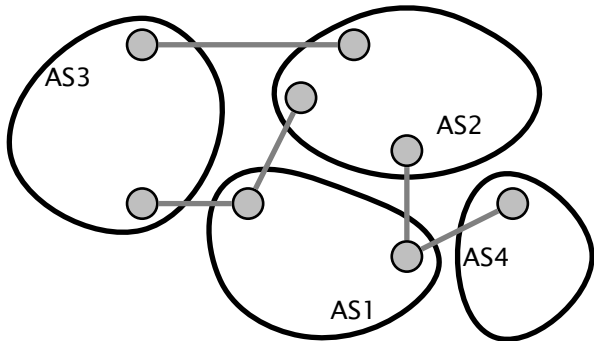

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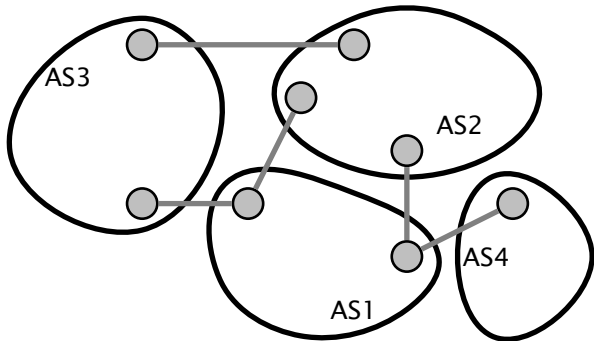
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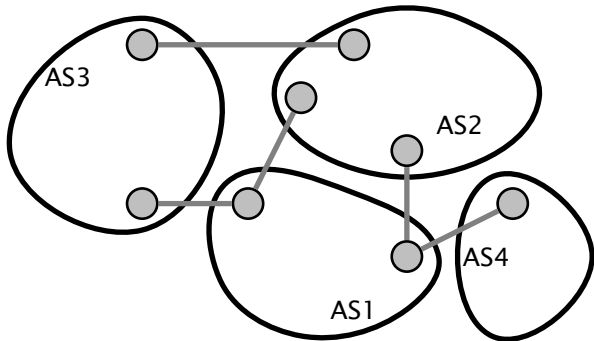
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- Both *inter-AS* and *intra-AS* routing information is used to compile the forwarding tables

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    - what if x is reachable through multiple gateway routers $G_x, G'_x, \ldots$?

        - use *intra-AS* routing information to determine the costs of the (least-cost) paths to $G_x, G'_x, \ldots$

        - "hot-potato" routing: send it through the closest gateway

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■ External subnet addresses are likely to "aggregate" in groups that admit compact representations

  ▸ this process is called *supernetting*

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  - ▸ BGP is a *path-vector* protocol

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- *BGP external session (eBGP):* a session across two autonomous systems

- *BGP internal session (iBGP):* a session within an autonomous system
  - note that internal sessions carry *inter-AS* information
  - *intra-AS* routing uses a separate protocol (e.g., OSPF)

Gateway Routers and *eBGP*
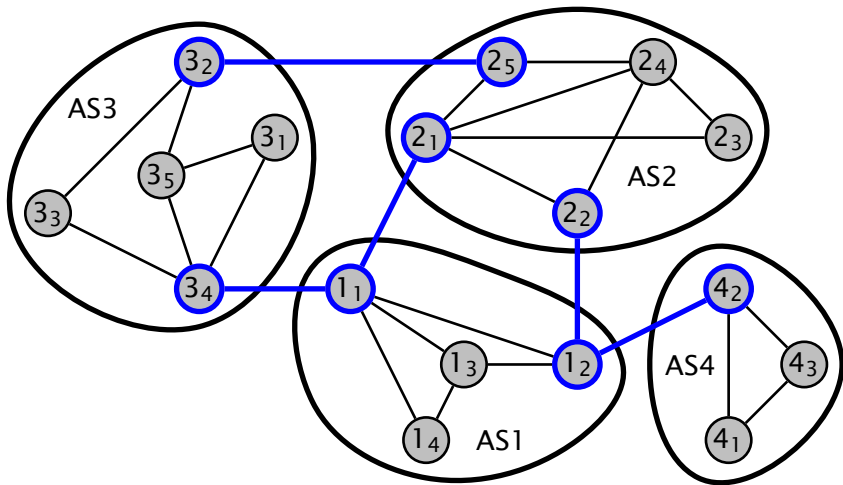
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- *BGP import policy:* used to decide whether to accept or reject the route advertisement

  - e.g., a router may not want to send its traffic through one of the AS listed in *AS-PATH*

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