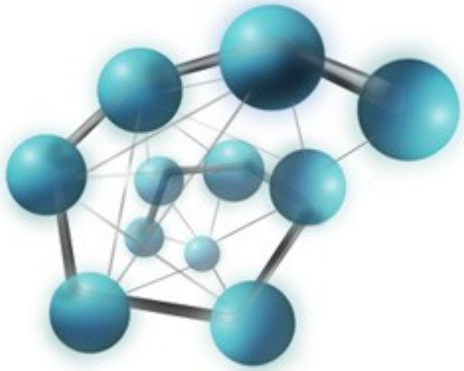


OSPF – Areas

Why OSPF *is* Complicated

Part 2

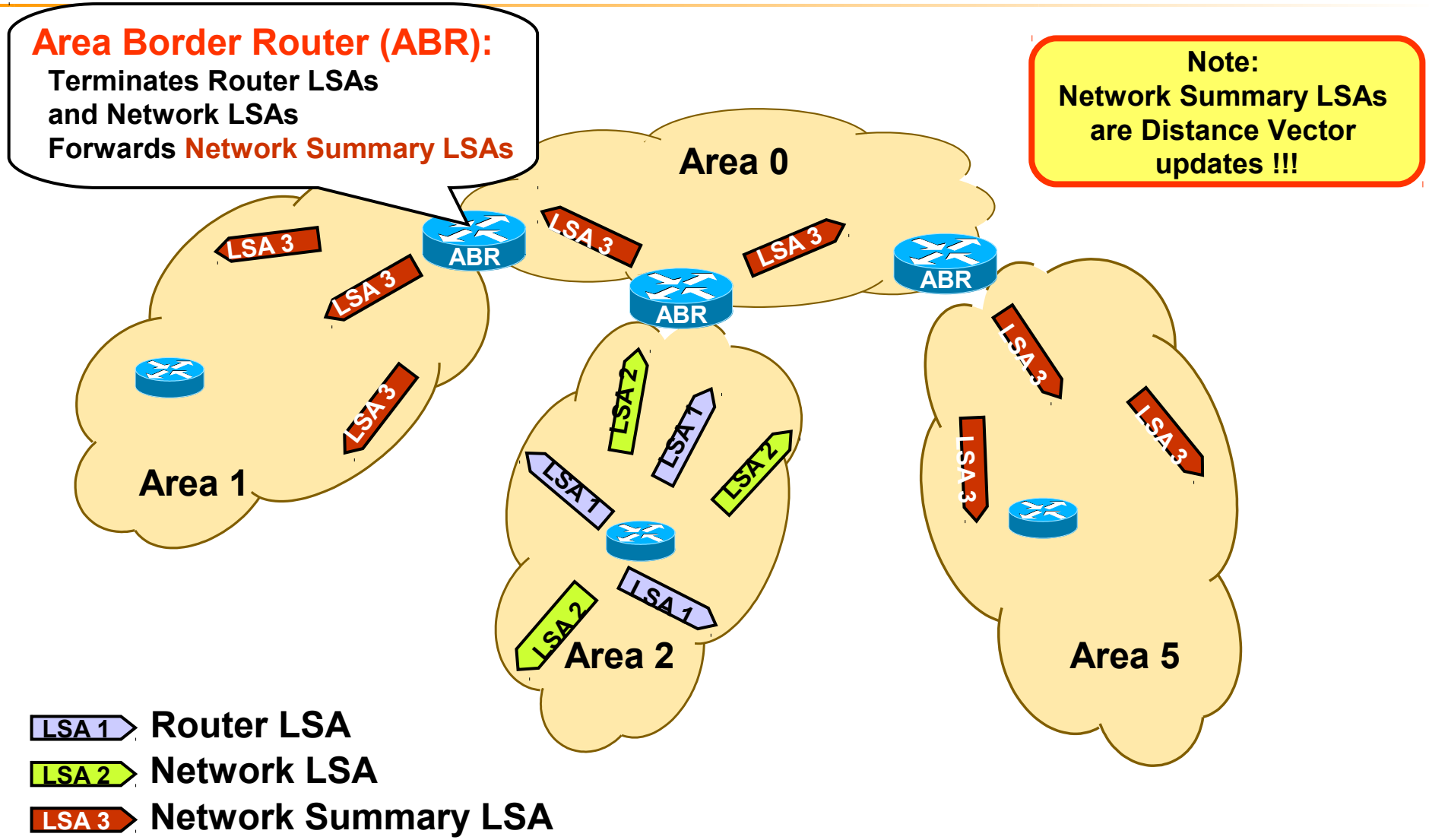
“An algorithm must be seen to be believed”

Donald .E. Knuth

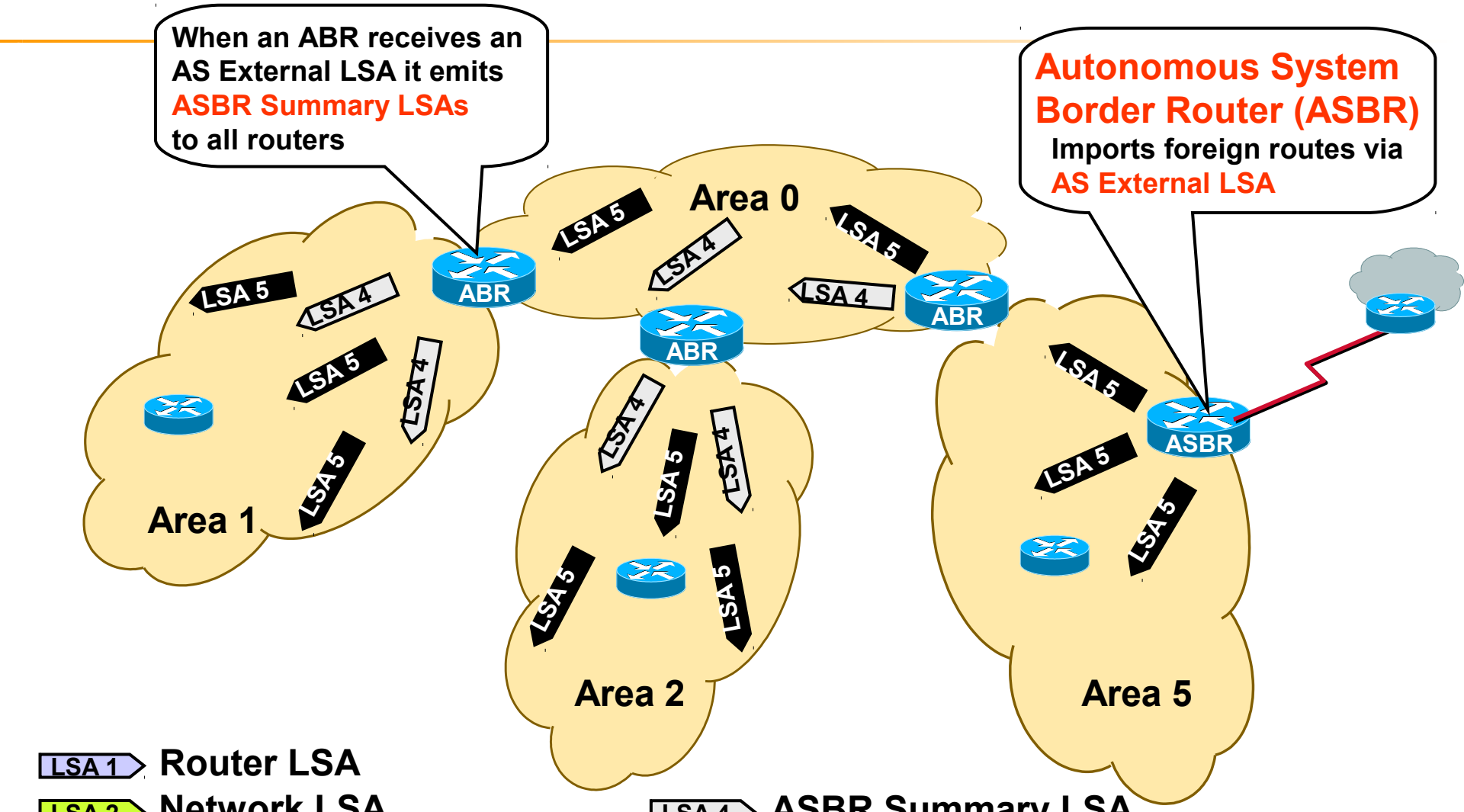
OSPF Areas

- To improve performance divide the whole OSPF domain in multiple Areas
- Restrict Router LSA and Network LSA within these Areas
- All areas must be connected to the so-called "Backbone Area"
  - "Area 0"

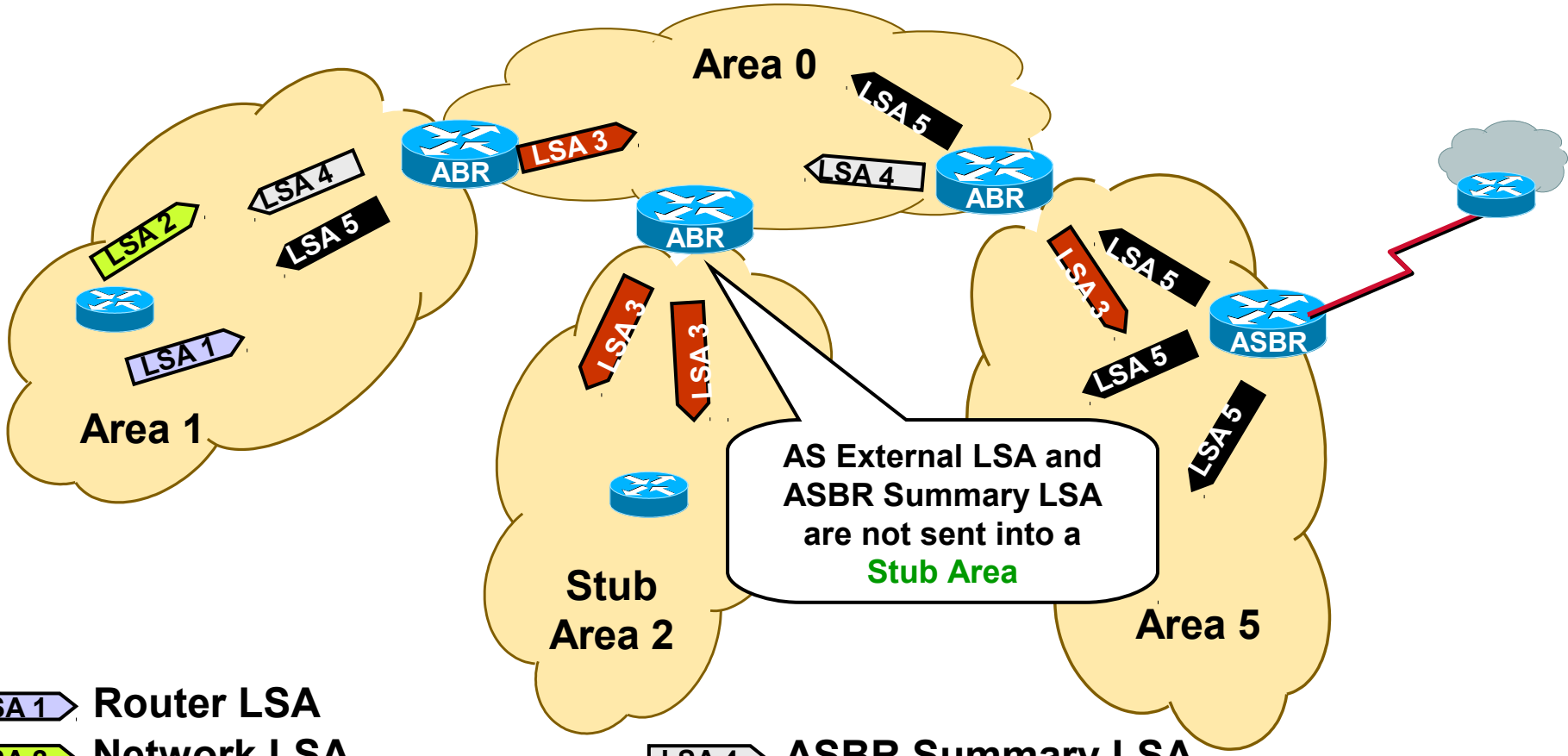
ABR


Area Border Router (ABR):
Terminates Router LSAs
and Network LSAs
Forwards Network Summary LSAs
Note:
Network Summary LSAs
are Distance Vector
updates !!!
Area 0
Area 1
Area 2
Area 5
ABR
ABR
ABR
LSA 3
LSA 3
LSA 3
LSA 3
LSA 3
LSA 3
LSA 3
LSA 3
LSA 1
LSA 1
LSA 1
LSA 2
LSA 2
LSA 2
LSA 1 Router LSA
LSA 2 Network LSA
LSA 3 Network Summary LSA

ASBR

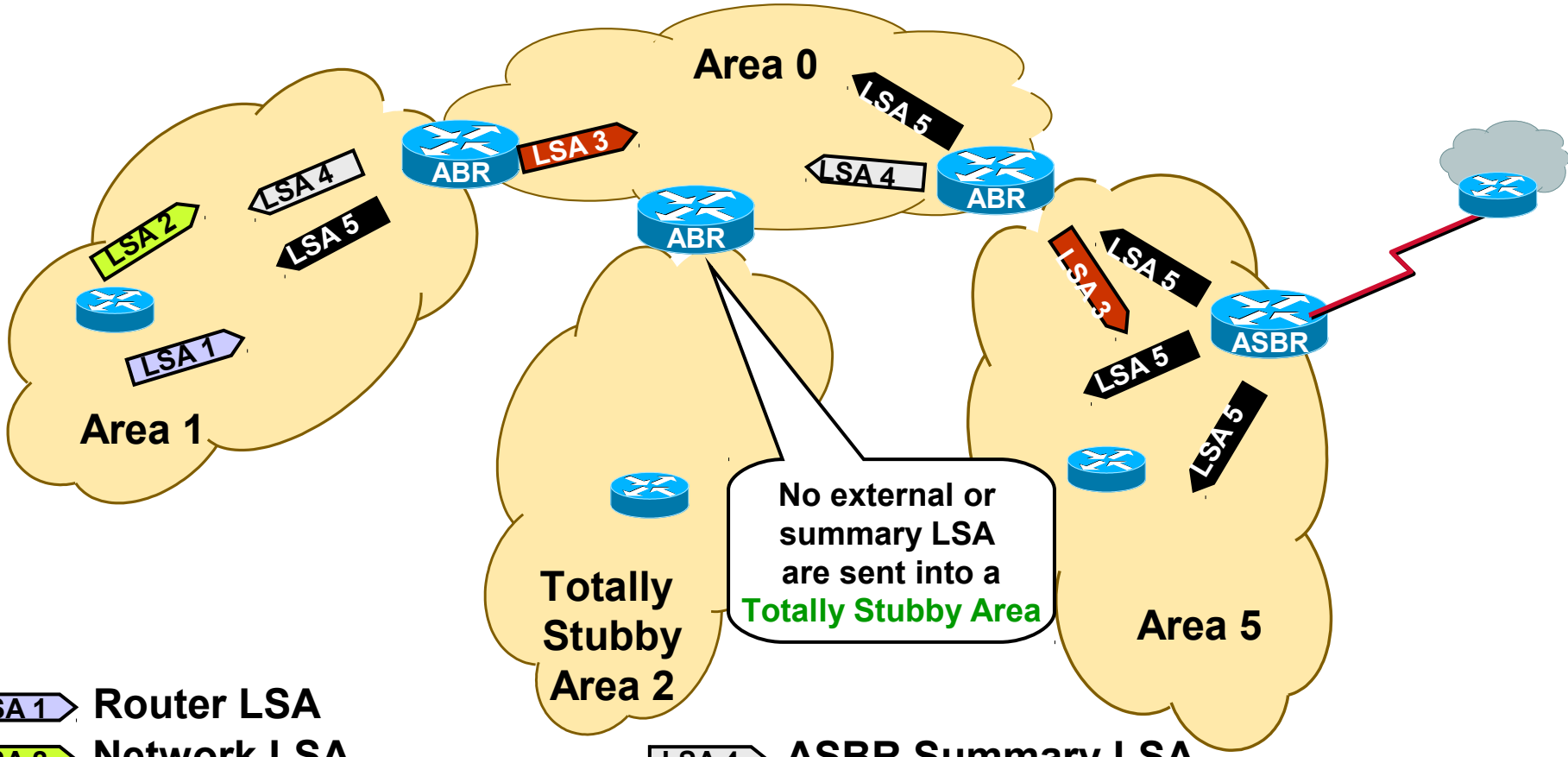

When an ABR receives an AS External LSA it emits ASBR Summary LSAs to all routers
Autonomous System Border Router (ASBR)
Imports foreign routes via AS External LSA
Area 0
Area 1
Area 2
Area 5
ABR
ABR
ABR
ASBR
LSA 1 Router LSA
LSA 2 Network LSA
LSA 3 Network Summary LSA
LSA 4 ASBR Summary LSA
LSA 5 AS External LSA

Stub Area

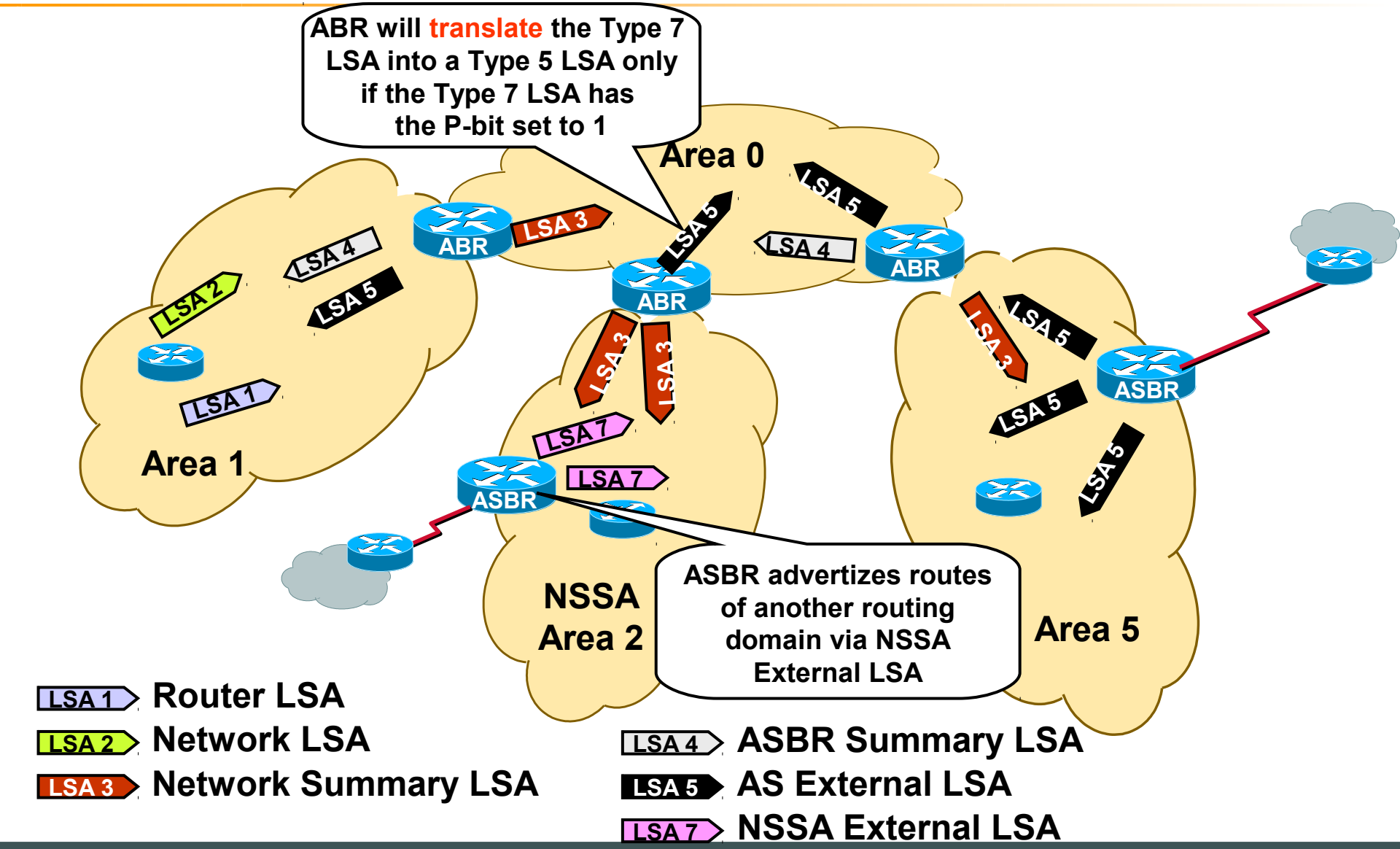

Area 0
LSA 5
LSA 4
ABR
LSA 3
ABR
ABR
LSA 4
LSA 5
LSA 2
LSA 1
Area 1
LSA 3
LSA 3
LSA 3
LSA 5
LSA 5
ASBR
LSA 5
AS External LSA and
ASBR Summary LSA
are not sent into a
Stub Area
Stub
Area 2
Area 5
LSA 1 Router LSA
LSA 2 Network LSA
LSA 3 Network Summary LSA
LSA 4 ASBR Summary LSA
LSA 5 AS External LSA

Totally Stubby Area

Cisco Specific

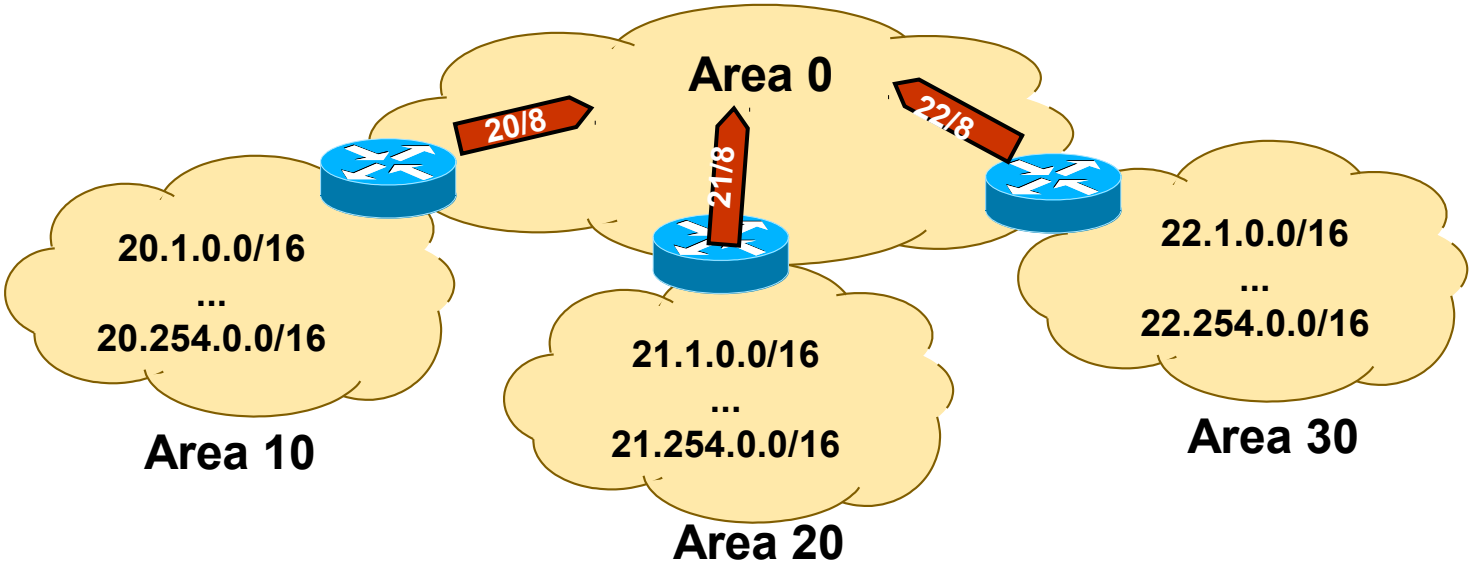


Not So Stubby Area (NSSA)



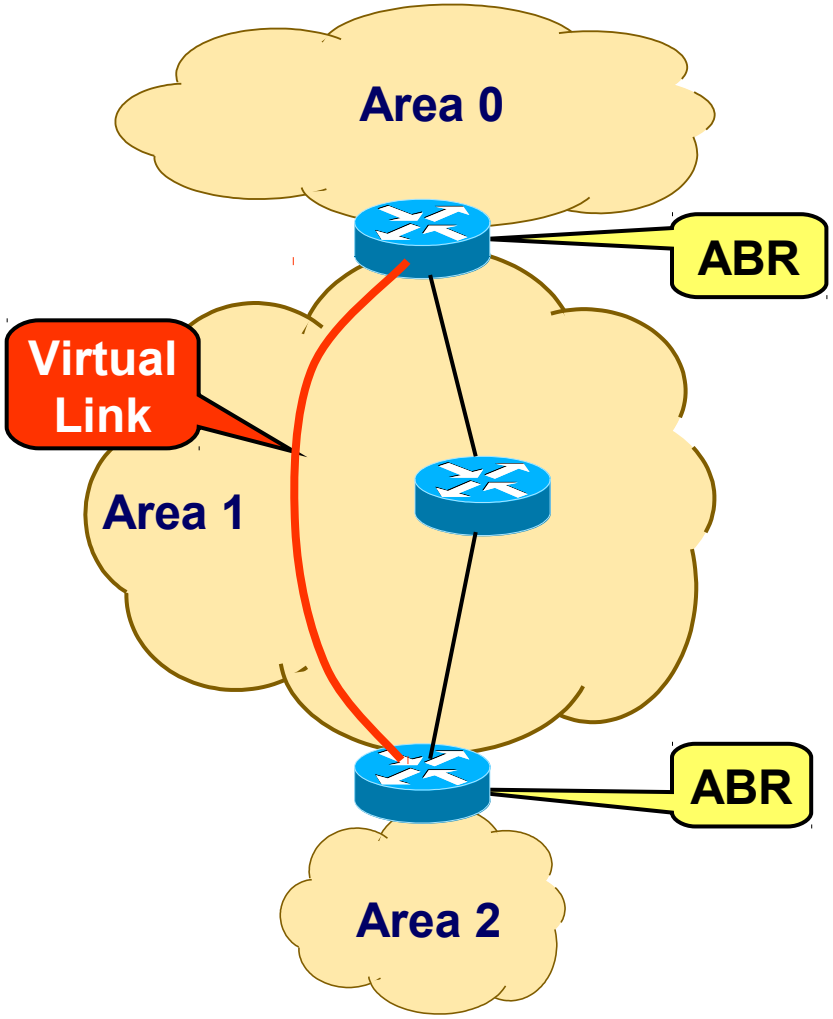
Summarization

- Efficient OSPF address design requires hierarchical addressing
- Address plan should support summarization at ABRs



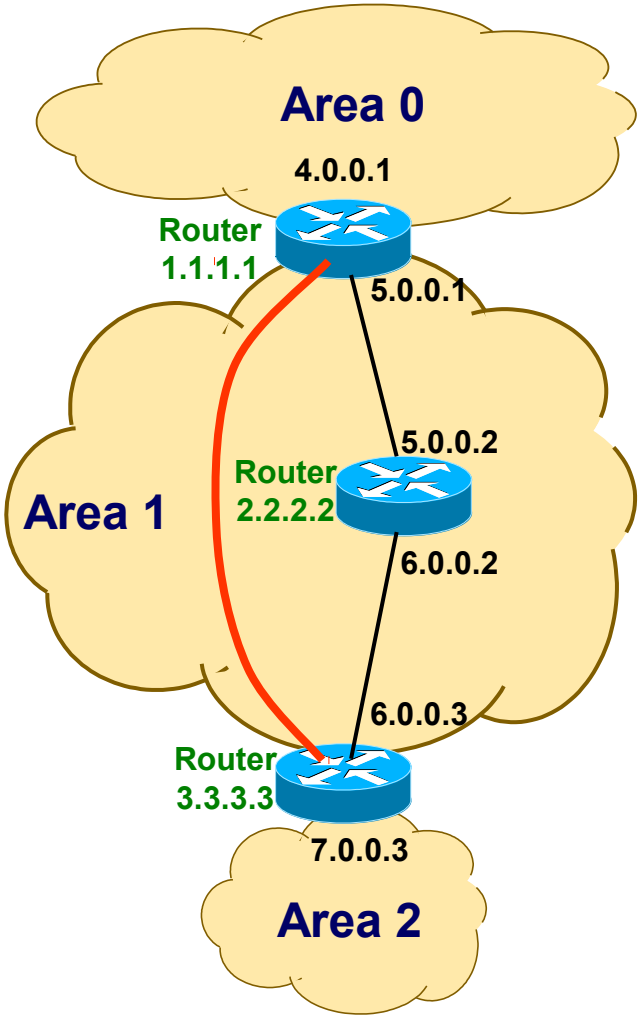
Virtual Links

- Another way to connect to area 0 using a point-to-point unicast tunnel
- Transit area must have full routing information
  - Must *not* be stub area
- Bad Design!

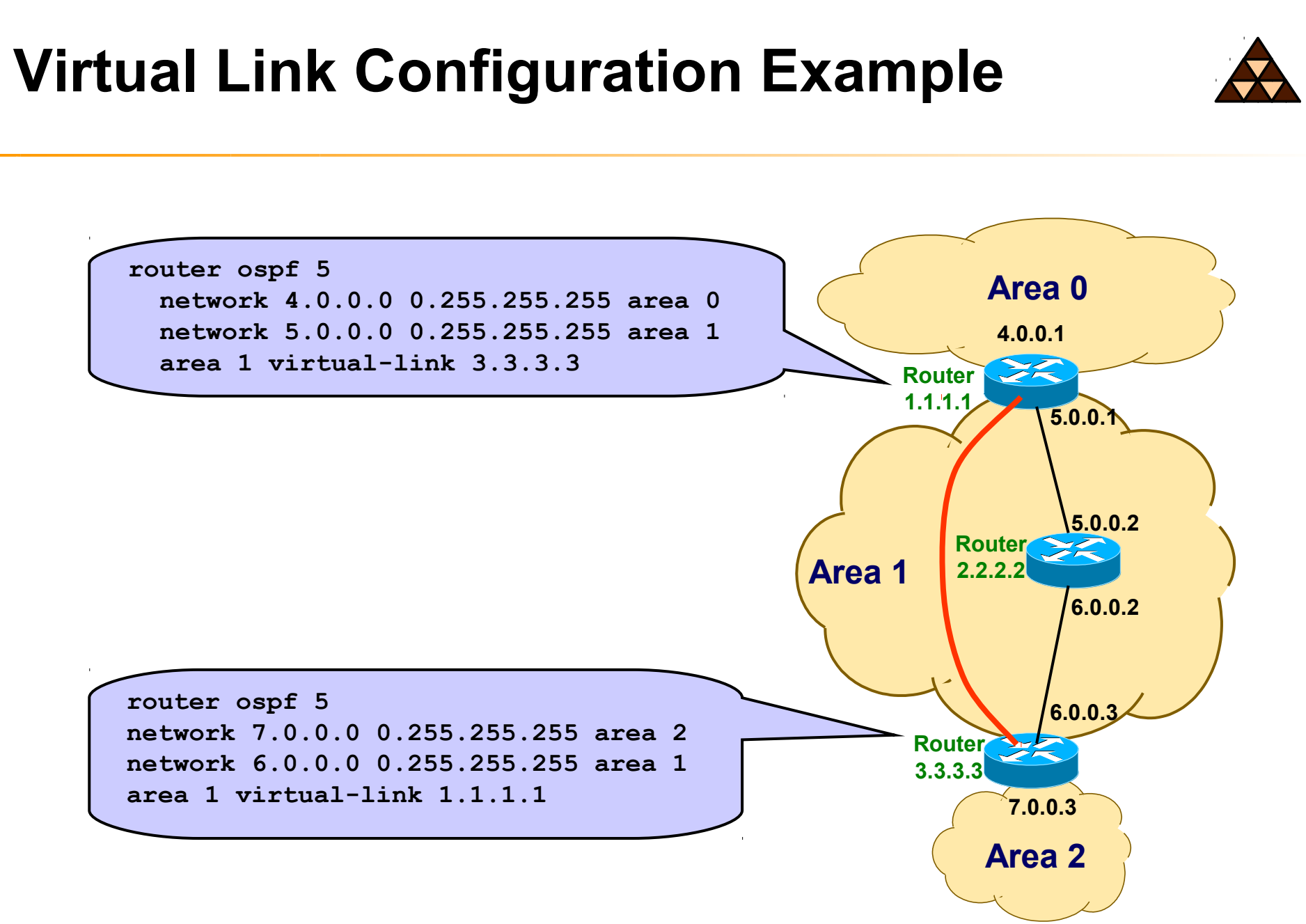


Virtual Link Example

- Now router 3.3.3.3 has an interface in area 0
- Thus router 3.3.3.3 becomes an ABR
  - Generates summary LSA for network 7.0.0.0/8 into area 1 and area 0
  - Also summary LSAs in area 2 for all the information it learned from areas 0 and 1



Virtual Link Configuration Example



GRE instead of Virtual Link

- Alternative solution
- Good: Transit area can be a also a stub area
- Bad: All traffic is encapsulated
  - Not only routing traffic
  - Increased overhead

Summary

- Area concept supports large networks
  - Keeps topology table small
  - Reduces routing traffic
- But additional LSA types necessary
- Inter-Area Routing is Distance Vector
- Originally OSPF designed for ToS routing – too resource greedy!

Quiz

- When should we split the OSPF domain into areas?
- What about Areas and addressing plans?
- Why must all areas be connected to the backbone area?