NSWI184 – Řízení počítačových sítí

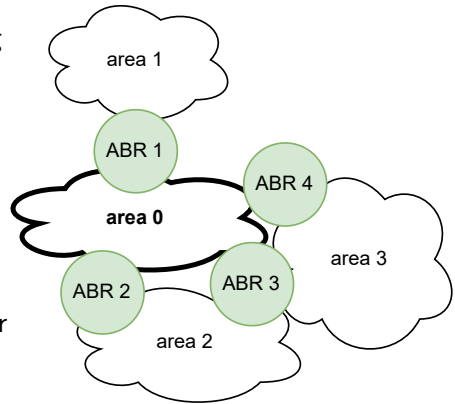
Přednáška třetí

Ondřej Zajíček, Kateřina Kubecová

15. října 2025

OSPF Area Overview

- OSPF uses areas to create hierarchical routing
- Areas form hub-and-spoke topology, centered around backbone
- Network topology is propagated only within each area
- SPF algorithm is calculated for each area independently
- Inter-area routes are translated by Area Border Routers (ABR)

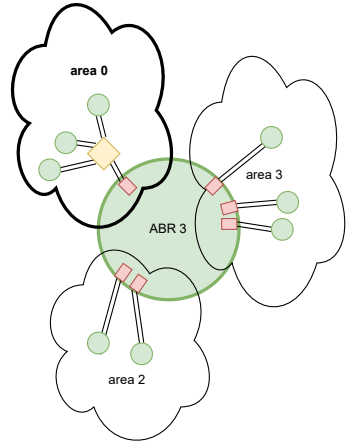


Why Use Areas?

- Limits LSA propagation scope
- Reduces SPF calculations
- Allows aggregation of routes
- Improves fault isolation

Area Border Router

- Connected to multiple areas (including backbone)
- Each interface is associated with a specific area
- Does SPF computation independently for each area
- Has a set of configured address ranges for each area
- Key role: Route summarization and translation

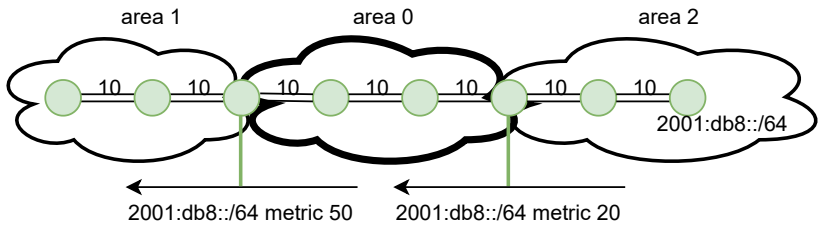


LSA Types

1. Router LSA: Router and its links
2. Network LSA: Information about multi-access network
3. **Net-summary LSA: Inter-area routes**
4. **Rt-summary LSA: ASBR location**
5. External LSA: External routes
7. **NSSA External LSA: External routes in NSSA areas**

Route Translation

- Based on routing table from SPF
- For each connected area, for paths not associated with that area:
  - Intra-area routes are summarized and translated to Net-summary LSAs
  - Inter-area routes are just translated to Net-summary LSAs
  - ASBR router entries are translated to Rt-summary LSAs
  - External routes are not translated
- Originated summary LSA has cost based on distance in routing table entry



Route Summarization - Motivation

- Company with a /48 prefix
- Each branch a separate area with /56 prefix
- Each branch consists of several /64 networks
- Backbone – headquarters with VPN concentrators

Route Summarization - Overview

- Based on configured address ranges (sets of prefixes)
- Routing table entries are matched against these prefix sets
- matching $\rightarrow$ only one summary LSA is originated for the prefix
- non-matching $\rightarrow$ summary LSA originated non-aggregated
- Prefix can have DoNotAdvertise flag or fixed metric

Route Summarization - Example

Configured address ranges:
2001:db8:10:100::/56
2001:db8:10:200::/56

Routing table entries:
2001:db8:10:203::/64 metric 10
2001:db8:10:217::/64 metric 20
2001:db8:10:314::/64 metric 30

Summarized entries:
2001:db8:10:200::/56 metric 20
2001:db8:10:314::/64 metric 30

Stub Areas

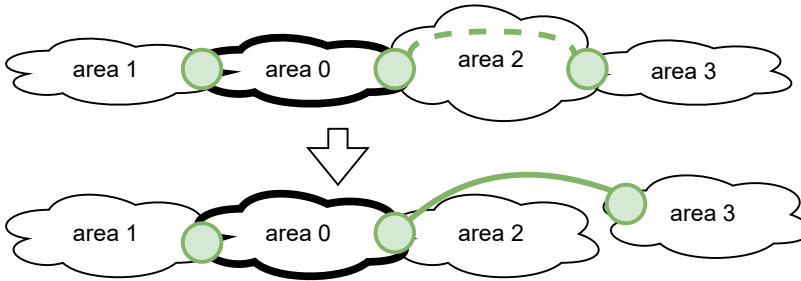
- Block External LSAs (external routes)
- Do not use Rt-summary LSAs
- ABR injects default route
- Cannot contain ASBRs / announce external routes

Not-So-Stubby Areas (NSSA)

- Alternative / extension to stub areas
- Allow NSSA LSAs for external routes
- NSSA LSAs are translated to External LSAs at ABR
- Allow summarization during translation
- More flexible than stub areas

Transit Areas

- Can OSPF areas be attached to just a non-backbone area?
- Yes – from traffic flow PoV
- No – from OSPF information flow PoV
- Every ABR is attached to backbone, but this attachment can be virtual
- Transit area – regular area with virtual links



Virtual Links

- Logical connections through non-backbone area
- When area cannot physically connect to backbone
- Create tunnel between ABRs for OSPF information
- Workaround for partitioned backbone
- Better to avoid if possible

Area tradeoffs

- Areas restrict Router and Network LSAs, but add Summary LSAs
- No summarization – not much savings
- More ABRs – more translated instances
- Intra-area path always preferred over inter-area path, even if longer

Area best practices

- Well-connected redundant backbone
- Areas for administrative boundaries
- Areas aligned with prefix boundaries
- 2 ABRs – minimal redundant border
- Consider stub or NSSA areas for edge networks