OSPF – Introduction

The IETF Routing Master
Part 1
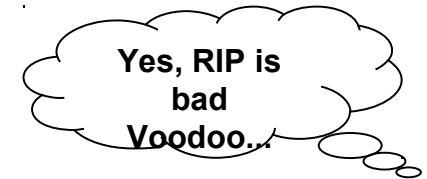
"Dijkstra probably hates me"

Linus Torvalds in kernel/sched.c

"Open Shortest Path First"

- **Official (IETF) successor of RIP**
  - ◆ **RIP is slow**
  - ◆ **RIP is unreliable**
  - ◆ **RIP produces too much routing traffic**
  - ◆ **RIP only allows 15 hop routes**
- **OSPF is a link-state routing protocol**
  - ◆ **Inherently fast convergence**
  - ◆ **Designed for large networks**
  - ◆ **Designed to be reliable**

Yes, RIP is bad Voodoo...

OSPF Background

- **OSPF is the IGP recommended by the IETF**

- **"Open" means "not proprietary"**

- **Dijkstra's Shortest Path First algorithm is used to find the best path**

- **OSPF's father: John Moy**
  - **Version 1: RFC 1131**
  - **Version 2: RFC 2328 (244 pages !!!)**
  - **And a lot of additional OSPF related RFCs available...**

Dijkstra's SPF Algorithm

- **Used in graph theory**
- **Very efficient**
- **Calculates all paths to all destinations at once**
- **Creates a (loop-free) tree with local router as source**
- **See SPF section for more details**

Edsger W. Dijkstra (1930-2002)

OSPF Ideas

- **Metric: "Cost" = 10^8/BW (in bit/s)**
  - ◆ **Therefore easily configurable per interface**
- **OSPF Routers exchange real topology information**
  - ◆ **Stored in dedicated topology databases**
- **Now Routers have a "roadmap"**
  - ◆ **Instead of signposts (RIP)**
- **Incremental updates**
  - ◆ **NO updates when there is NO topology change**

What is Topology Information?

- **The smallest topological unit is simply the information element ROUTER-LINK-ROUTER**

- **So the question is: Which router is linked to which other routers?**
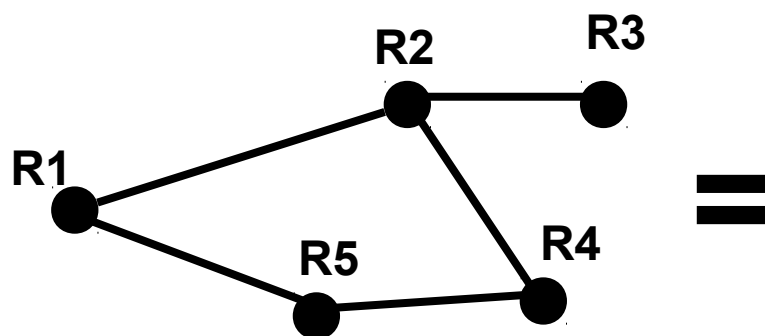
Link Database:

R1– R2
R1– R5
R2– R3
R2– R4
R4– R5

=

The Link Database exactly describes the roadmap

OSPF Routing Updates

- **The routing updates are actually link state updates**
  - ◆ **Parts of link state database are exchanged**
  - ◆ **Instead of parts of routing table (RIP)**
- **Applying the SPF algorithm on the link state database, each router can create routing table entries by its own**

OSPF Protocol

- **All OSPF messages are carried within the IP payload ("raw IP")**
  - ◆ **Protocol number 89**
- **Error recovery and session management is covered by OSPF itself**
- **Multicast address 224.0.0.5**
  - ◆ **"All OSPF routers"**

LSA Flooding

- **LSA's are small packets, forwarded by each router without much modifications through the whole OSPF area (!)**

- **Much faster than RIP updates**
  - ◆ **RIP must receive, examine, create, and send**

- **Convergence time**
  - ◆ **Detection time + LSA flooding + 5 seconds before computing the topology table = "a few seconds"**

OSPF Overview

- **Large networks: "Divide and conquer" into **areas****
  - **LSA-procedures inside each area**
  - **But *distance-vector updates between areas***
- **Additional complexity because of performance optimizations**
  - **Limit number of adjacencies in a multi-access network OSPF**
  - **Limit scope of flooding through "Areas"**
  - **Deal with stub areas efficiently**
  - **Learn external routes efficiently**
  - **Realized through different LSA types**
- **Fast convergence, almost no routing traffic in absence of topology changes**