Routing

Core Architecture

in the early stage of internet, only two levels. A special routing protocol called the Gateway-to-Gateway Protocol (GGP) was used within the core of the internetwork, while another protocol called the Exterior Gateway Protocol (EGP) was used between non-core and core routers. The non-core routers were sometimes single, stand-alone routers that connected a single network to the core, or they could be sets of routers for an organization.

This architecture served for a while, but itself did not scale very well as the Internet grew. The problem was mainly due to the fact that there was only a single level to the architecture: every router in the core had to communicate with every other. Even with peripheral routers being kept outside the core, the amount of traffic in the core kept growing.

AS Architecture

TCP/IP Interior Routing Protocols (RIP, OSPF, GGP, HELLO, IGRP, EIGRP)

- two of the most popular TCP/IP interior routing protocols: the Routing Information Protocol (RIP) and Open Shortest Path First (OSPF).
- two obsolete historical interior routing protocols; (the Gateway-to-Gateway Protocol (GGP) and the HELLO Protocol.)
- and two proprietary ones developed by networking leader Cisco Systems. (IGRP and EIGRP)

RIP : distance-vector algorithm

RIP versions 1 and 2 for IP version 4 and RIPng (next generation) for IP version 6

On a regular basis, each router in the internetwork sends out its routing table in a special message on each of the networks to which it is connected, using UDP. simple hop-count metric used in RIP.

RIP only supports a maximum of 15 hops between destinations, making it unsuitable for very large autonomous systems, and this cannot be changed.

technicals to prevent loop

count-to-infinity problem

http://technet.microsoft.com/en-us/library/cc940478.aspx

http://en.wikipedia.org/wiki/Split_horizon

- split horizon route advertisement rule: prohibits a router from advertising a route back out the interface from which it was learned.

- split horizon with poison reverse : advertise the route back to the router that is used to reach the destination, but marks the advertisement as unreachable.

OSPF : link-state or shortest path first((SPF).) routing algorithm

- AS <->AS router: boundary router that runs exterior protocol on external side and OSPF in internal side;

the official name is : ASBR: The Autonomous System Boundary Router

- within AS

1) all peers in a single group

2) two-level hierarchy

The two-level hierarchy consists of the lower level containing individual areas, and the higher level that connects them together, which is called the backbone and is designated as “Area 0”. The routers are no longer all peers, but in fact play different roles depending on where they are located and how they are connected. There are three different labels applied to routers in this configuration:

* Internal Routers: These are routers that are only connected to other routers or networks within a single area. They maintain an LSDB for only that area, and really have no knowledge of the topology of other areas.

* Area Border Routers(ABR): These are routers that connect to routers or networks in more than one area. They maintain an LSDB for each area of which they are a part. They also participate in the backbone.

* Backbone Routers: These are routers that are part of the OSPF backbone. By definition, this includes all area border routers, since those routers pass routing information between areas. However, a backbone router may also be

a router that connects only to other backbone (or area border) routers, and is therefore not part of any area (other than Area 0).

To summarize: an area border router is always also a backbone router, but a backbone router is not necessarily an area border router

Unlike RIP, OSPF does not send its information using the User Datagram Protocol (UDP). Instead, OSPF forms IP datagrams directly, packaging them using protocol number 89 for the IP Protocol field. OSPF defines five different message types, for various types of communication:

http://www.tcpipguide.com/free/t_OSPFGeneralOperationandMessageTypes.htm

DR,BDR

DR, BDR: A Designated Router/Backup DR. The key idea with a DR and backup DR (BDR) is that they are the ones to generate LSAs(Link State Advertisements)

http://networkninja.co.za/cisco-systems/open-shortest-path-first-ospf-fundamentals-dr-and-bdr/

DRs and BDRs are only useful on multi-access links because they reduce adjacencies. The concept of a DR is not used nor usefull on point-to-point links because there can only be one adjacency.

What 2 types of network have DR and BDR assigned? -- Broadcast & NBMA (no Point-to-Point/Multipoint types)

This means that instead of exchanging routing information with all other routers the routers exchange information with the DR and BDR. Then in turn the DR and BDR relay the information(LSDB) to other routers.

DR is selected based on priority+ IP address. NOTE: designated routers do not preempt, that means DRs are inherently seen as stable entities once elected into the position, even if a Router joins a network with a “greater” priority the DR will not change.

IS-IS

IS-IS is an Interior Gateway Protocol (IGP) . Both IS-IS and OSPF are link state protocols, and both use the same Dijkstra algorithm for computing the best path through the network. As a result, they are conceptually similar.

The protocol was defined in ISO/IEC 10589:2002 as an international standard within the Open Systems Interconnection (OSI) reference design. IS-IS is not an Internet standard, however IETF republished the standard in RFC 1142 for the Internet community. so the protocol is in the same stack level as IP, not as OSPF that packet is encapsulated in IP packet. a fact that may have allowed OSPF to be more widely used.

OSPF had achieved predominance as an IGP (Interior Gateway Protocol) routing protocol, particularly in medium-to-large-sized enterprise networks. IS-IS, in contrast, remained largely unknown by most network engineers and was used predominantly in the networks of certain very-large service providers.Detailed analysis tends to show that OSPF has traffic tuning features that are especially suitable to enterprise networks while ISIS has stability features especially suitable to ISP infrastructure.

others

GGP : distance-vector algorithm

HELLO protocol : uses a distance-vector algorithm. however, is that unlike RIP and GGP, HELLO does not use hop count as a metric. Instead, it attempts to select the best route by assessing network delays and choosing the path with the shortest delay.

IGRP : distance-vector routing protocol . IGRP overcomes two key limitations of RIP: the use of only hop count as a routing metric, and the hop count limit of 15.

RIP only allows the cost to reach a network to be expressed in terms of hop count, IGRP provides a much more sophisticated metric. In IGRP, the overall cost to reach a network is computed based on several individual metrics, including internetwork delay, bandwidth, reliability and load.

EIGRP is still a distance-vector protocol,

IGRP/EIGRP forms IP datagrams directly, packaging them using protocol number 9/88 for the IP Protocol field.

TCP/IP Exterior Gateway/Routing Protocols (BGP and EGP)

BGP : a path-vector algorithm, or Hybrid Routing Protocol Algorithms

BGP uses TCP as a reliable transport protocol, so it can take advantage of the many connection setup and maintenance features of that protocol.

Routers in the AS that are connected only to other routers within the AS are usually called internal routers, while those that connect to other ASes are called border routers in BGP, or can be named as boundary routers in OSPF.

EGP

Exterior Gateway Protocol (EGP). This is an obsolete protocol that was used for communication between non-core routers and the router core in the early Internet, and is described briefly for both completeness and historical interest.

Source: http://manoftoday.wikidot.com/network#toc13