OSPF to the customer

Why, how and what about security

Presenter information

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Network design
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Established 1991

Complete IT solutions
Networking, servers
Virtualization
IP security systems

Goal

- Show peering options for providers to peer with their customers using OSPF

- Test this setup in a network simulator using a virtual simulated network
  - using MikroTik in GNS3

Agenda

- OSPF basics and concepts
- OSPF area and LSA types
- Example topologies
- route-filters and security
- Topology simulation

OSPF (Open Shortest Path First)

- Dynamic routing protocol
- Interior routing based on link-state
- Used for inter-AS prefix distribution

- OSPFv2 for IPv4, OSPFv3 for IPv6

Why OSPF?

- A dynamic routing protocol
- Will give redundancy to the customer

- Can provide easy load-balancing to the customer

Why OSPF and not BGP?

- OSPF is faster
- OSPF is easier to configure

- OSPF is supported on all business-class devices, even on cheap routers these days

OSPF Basics

- Gathers link state information from available routers and constructs a topology map of the network.
- Full CIDR support (opposed to legacy RIP)
- A path through network is formed based on “shortest-path” through a network mesh – the shortest distance
- Each interface has a “distance” parameter.

OSPF Basics

- OSPF routes IP (L3) traffic, but uses IP as its own transport protocol as well.
- Own L4 protocol – proto 89
- Multicast used for packet delivery in a single L2 domain

Link state protocol

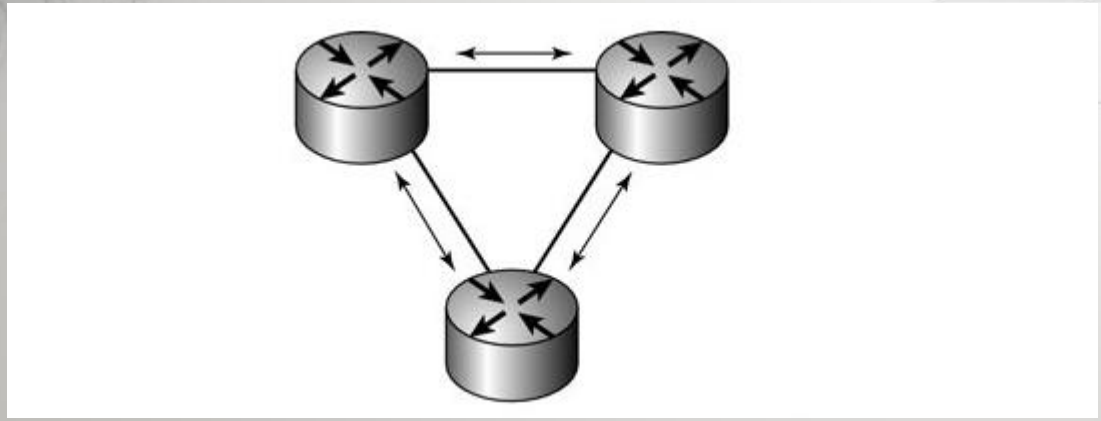
- Each router interface – a link

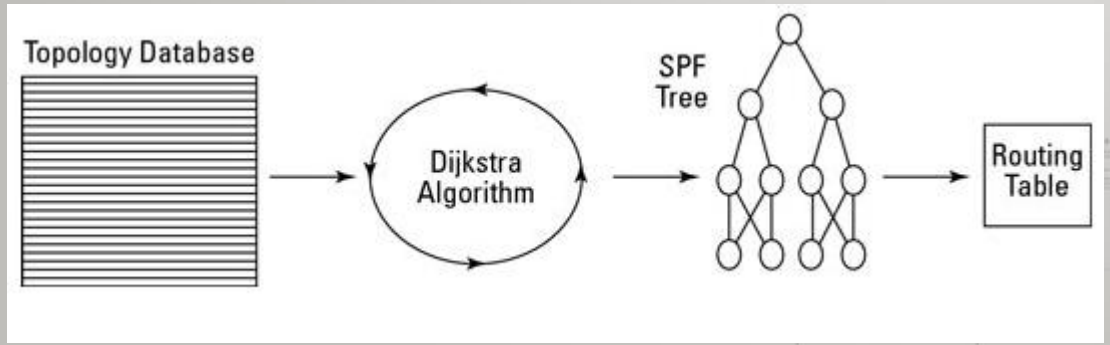
- OSPF sends LSAs to its neighbors:
  - Link State Advertisement (LSA): A simple update on a router's link status, so one will be sent when a link is connected, disconnected, or otherwise changed

How a path is calculated

- Each OSPF router keeps a topological DB:
  - Topological database: A table in memory that contains link information about all known routers.
- A SPF algorithm is then user (Dijkstra algorithm) to calculate the shortest path to all destinations.
- SPF tree: A listing all of the routes to any destination with an order of preference

OSPF process





- Exchange LSAs
- Form topology DB
- Calculate SPF
- Inject into routing table

OSPF Areas

- An OSPF domain can (doesn’t have to) be divided into area.
- An OSPF domain needs to have a backbone area
- Each additional area needs to be connected to the backbone area
  - OSPF doesn’t impose a limit on the number of areas in an OSPF domain, only that they need to connect to the backbone area

OSPF Areas

- Each area has a unique area ID
  - Backbone: 0.0.0.0
- Each area has a type:
  - Standard
  - Stubby
    - Totally Stubby
  - NSSA (Not So Stubby Area)
    - Not So Totally Stubby Area

Area types:

- Each area type accepts and forwards different types of LSAs.

- LSA types:
  - *Type 1* - Router LSA
  - *Type 2* - Network LSA
  - *Type 3* - Summary LSA
  - *Type 5* - External LSA
  - *Type 7* - (NSSA) External LSA redistribution

OSPF basic config

- We need a routerID for OSPF
- This should be a reachable IP, on a loopback interface

Adding a loopback IP for routerID

```
/interface bridge
add name="br0 - loopback“

/ip address
add address=10.0.0.1/32 interface="br0 - loopback“

/routing ospf instance
set default router-id=10.0.0.1
```

Making the loopback reachable

- 2 Options:

/routing ospf instance
set default redistribute-connected=as-type-1

/routing ospf network
add area=backbone network=10.0.0.1/32

Default route for our network

- On our edge routes in our provider network, we redistribute a default route to the rest of our infrastructure

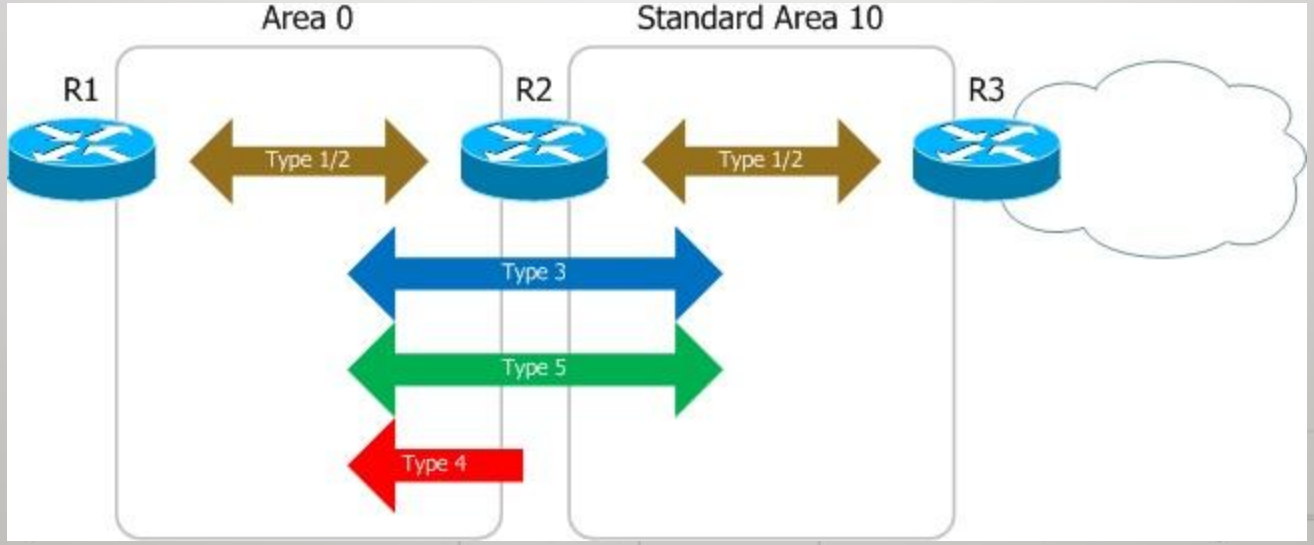
```
/routing ospf instance
set [ find default=yes ] distribute-default=if-installed-as-type-1
```

OSPF areas

- An OSPF domain can be divided into areas
- Areas are implemented in OSPF for performance, network topology separation and security reasons

Area LSA forwarding

- Default area:



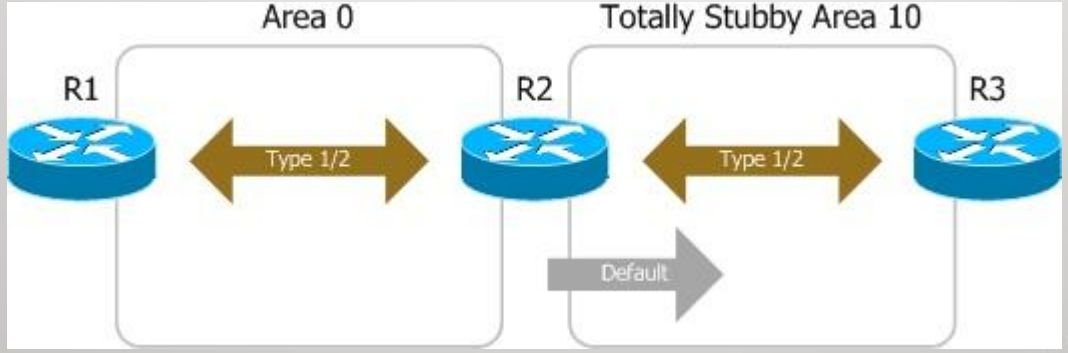
Default area

- Used inside of our network

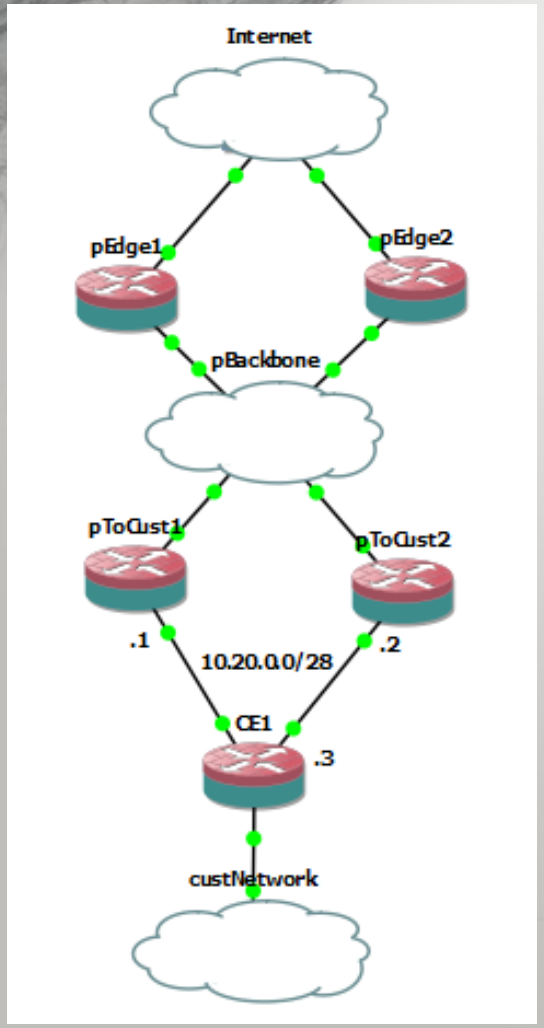
- Not secure to peer with customers
  - Customers can see all our internal routes, could inject routes to us, etc.

Area LSA forwarding

- Totally stubby area:



- We can use this to peer with our customers
  - Only default route to the customer



Basic example

- Provider wants to provide redundancy for the customer
- OSPF peer with the customer
- This should remove 95% of outages for the customer (outages caused by provider network problems)

How to configure

/routing ospf area

add area-id=0.0.0.1 inject-summary-lsas=no name=toCustomer1 type=stub

/routing ospf network

add network=10.20.0.0/28 area=toCustomer1

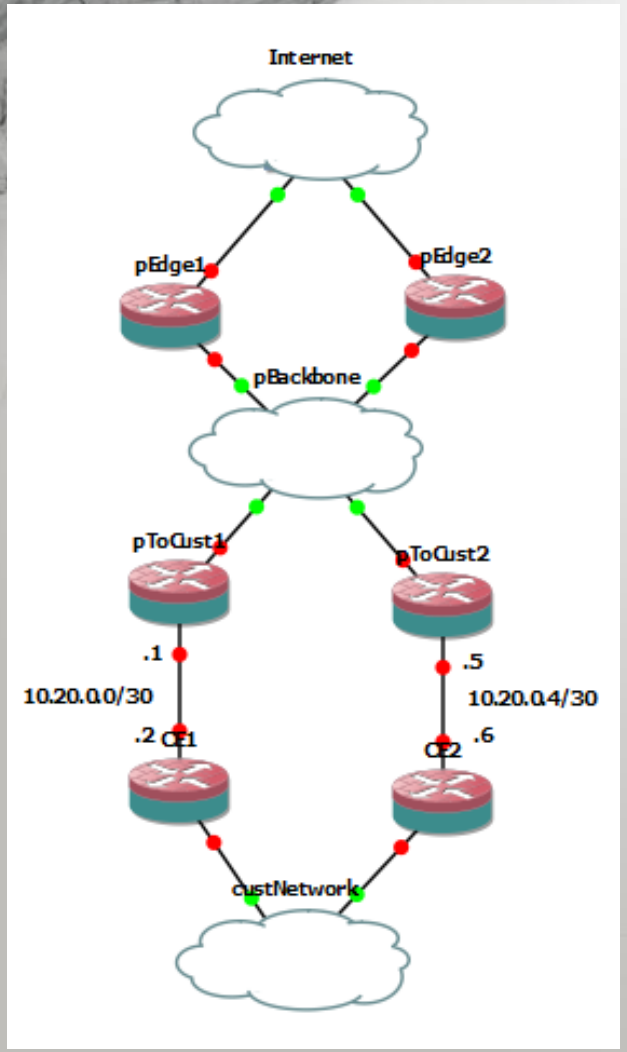
/routing ospf interface

add interface=toCustomer authentication=md5 authentication-key=password

OSPF security part 1

- Always secure your OSPF interfaces with authentication

- Prevents un-authorized routers to establish an OSPF session



Customer redundancy

- Customer can add a second router to his edge
- This provides full redundancy for the customer

Config on provider routers

- On pToCust1 and pToCust2:

```
/routing ospf area
add area-id=0.0.0.1 inject-summary-lsas=no name=toCustomer1 type=stub
/routing ospf network
add network=10.20.0.x/30  area=toCustomer1
/routing ospf interface
add interface=toCustomer authentication=md5 authentication-key=password
```

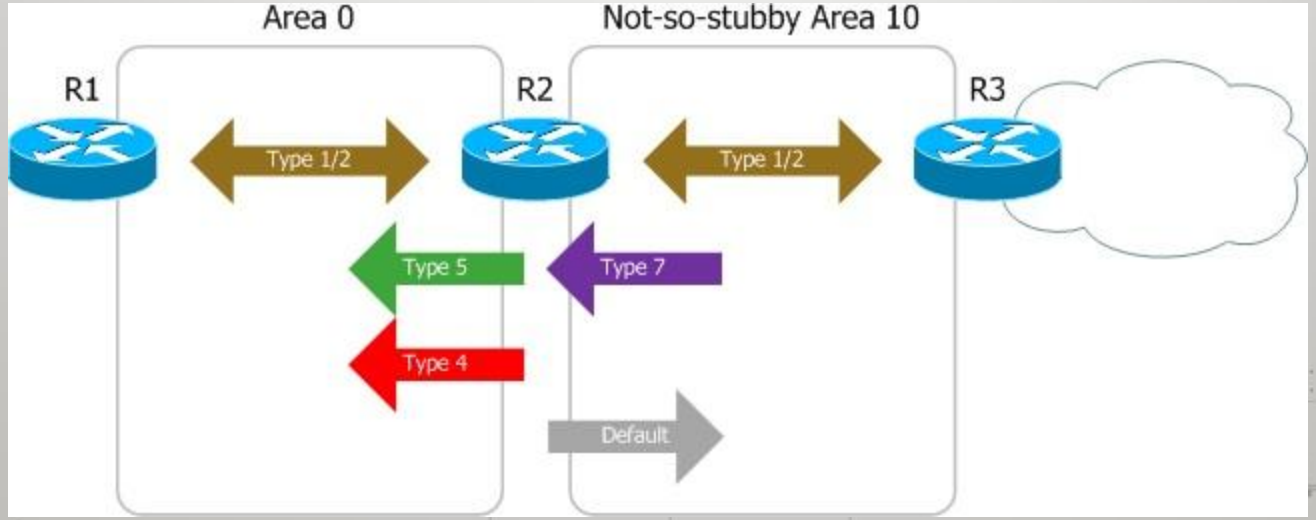
Customer wants more

- We are giving the default route to the customer redundantly

- Customers at this level usually need public IPs
  - these should also be redundant and usable anywhere in the customer network

Area LSA forwarding

- Totally NSSA



Setup on provider routers

- On pToCust1 and pToCust2:

```
/routing ospf area
add area-id=0.0.0.2 inject-summary-lsas=no name=toCust2 \
    type=nssa translator-role=translate-always
/routing ospf network
add network=10.20.0.x/30  area=toCustomer1
/routing ospf interface
add interface=toCustomer authentication=md5 authentication-key=password
```

What we configured

- Customers will get a default route from us
- Customers will be able to inject routes into our OSPF domain now

Security

- Customers could inject routes into our routing tables to route traffic to them that is not supposed to be going to them

- Dangerous, needs to be secured somehow

Routing Filters

/routing filter

add action=accept chain=cust1-out prefix=10.0.0.x/30

add action=accept chain=cust1-out prefix=0.0.0.0/0 prefix-length=0

add action=discard chain=cust1-out

add action=accept chain=cust1-in prefix=10.0.0.x/30

add action=accept chain=cust1-in prefix=22.33.1.0/28 prefix-length=29-32

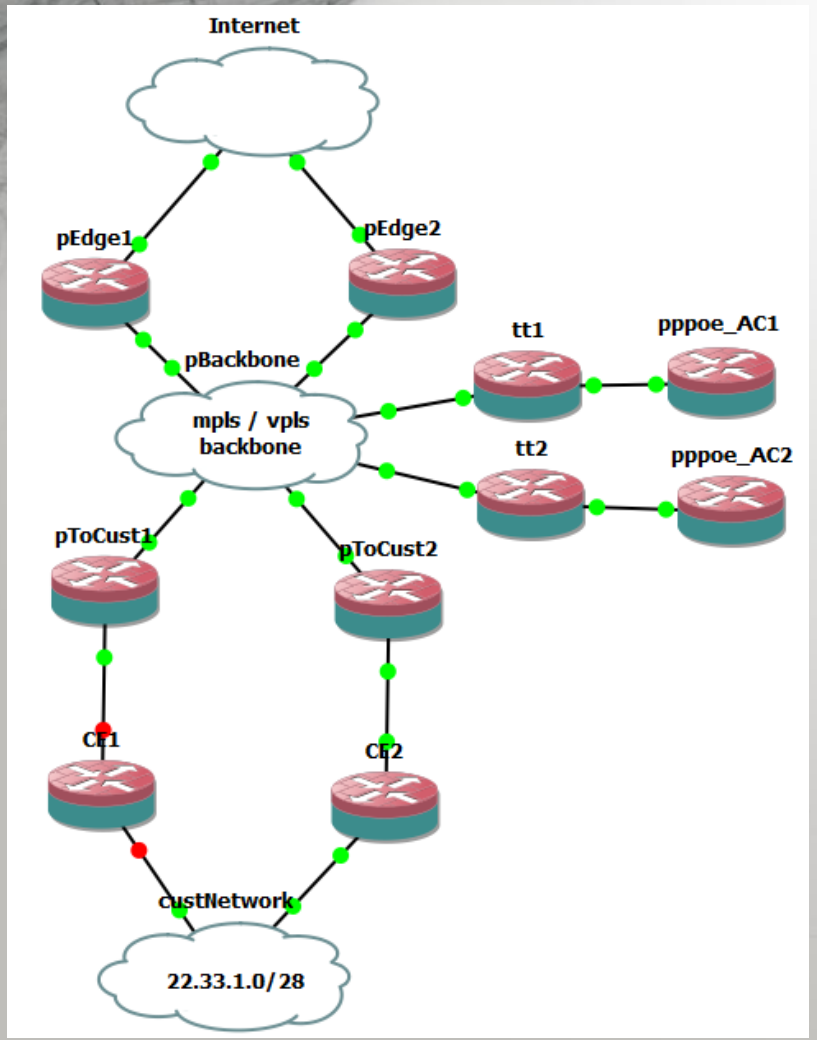
add action=discard chain=cust1-in

Result

- Customers will be able to inject routes for their IP ranges into our routing tables
- Redundancy will work
- OSPF peering with customer is secured

Load balancing using OSPF

- Customers can load-balance their outgoing traffic to us as they likes over the 2 connections
- Customers can load balance their incoming traffic by manipulating the OSPF path costs within their OSPF sessions to us - ECMP
- We achieved full load-balancing, and the customers can configure it how they like and change it without causing reconfiguration on our end – all by manipulating their OSPF interface costs



Complex topology

- ISP provides connectivity over PPPoE
- OSPF peering inside PPPoE
- Works with same config as above

GNS3 with MikroTik example

Simulating MikroTik networks

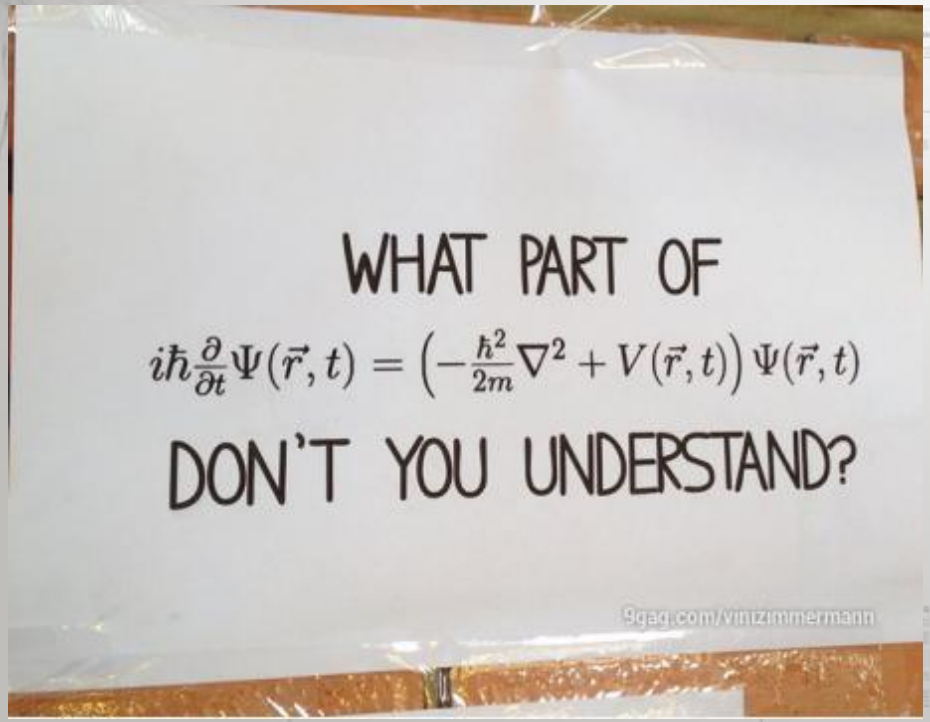
Final notes:

- This presentation is by no means a complete ready-to-implement solution.
- Advances OSPF knowledge is necessary to implement these topologies
- This presentation is not a full copy-paste solution, please test before deploying in production

More material

- US12:
  - Bandwidth-based load-balancing without MPLS TE
- EU13:
  - Building a scalable IPSec infrastructure with MikroTik
- US13:
  - MPLS for ISPs (PPPoE over VPLS)

- Available on www.tiktube.com



If you have any questions, please ask now, or find me after the presentation.

Thanks for listening

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