DYNAMIC VPNS

How to make a poor mans DMVPN type system with RouterOS

WHO AM I?

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- Principal Engineer at Rackspace
- RouterOS user since early 2009
- Operating Systems & Applications focus with a bit of networking

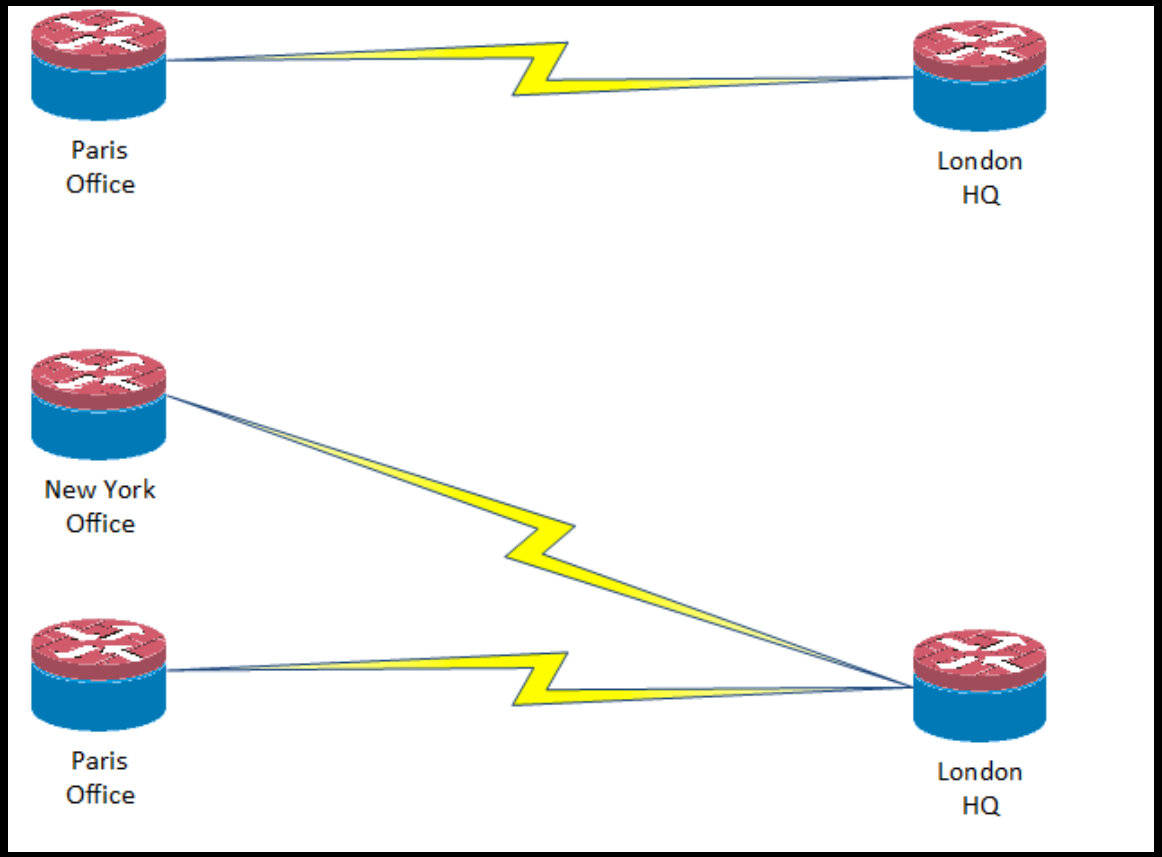
CRASH COURSE IN VPNS

- Private link between two systems
  - Site to Site
  - Client to Site
- Plethora of protocols
  - SSTP
  - L2TP
  - PPTP
  - GRE
  - IPSEC
  - EOIP
  - OVPN
- Do not require encryption

VPN DESIGN

- Simple Site to Site
  - HQ to Branch office
- Multiple Branch
  - Branches generally don’t connect to each other
  - Star Topology

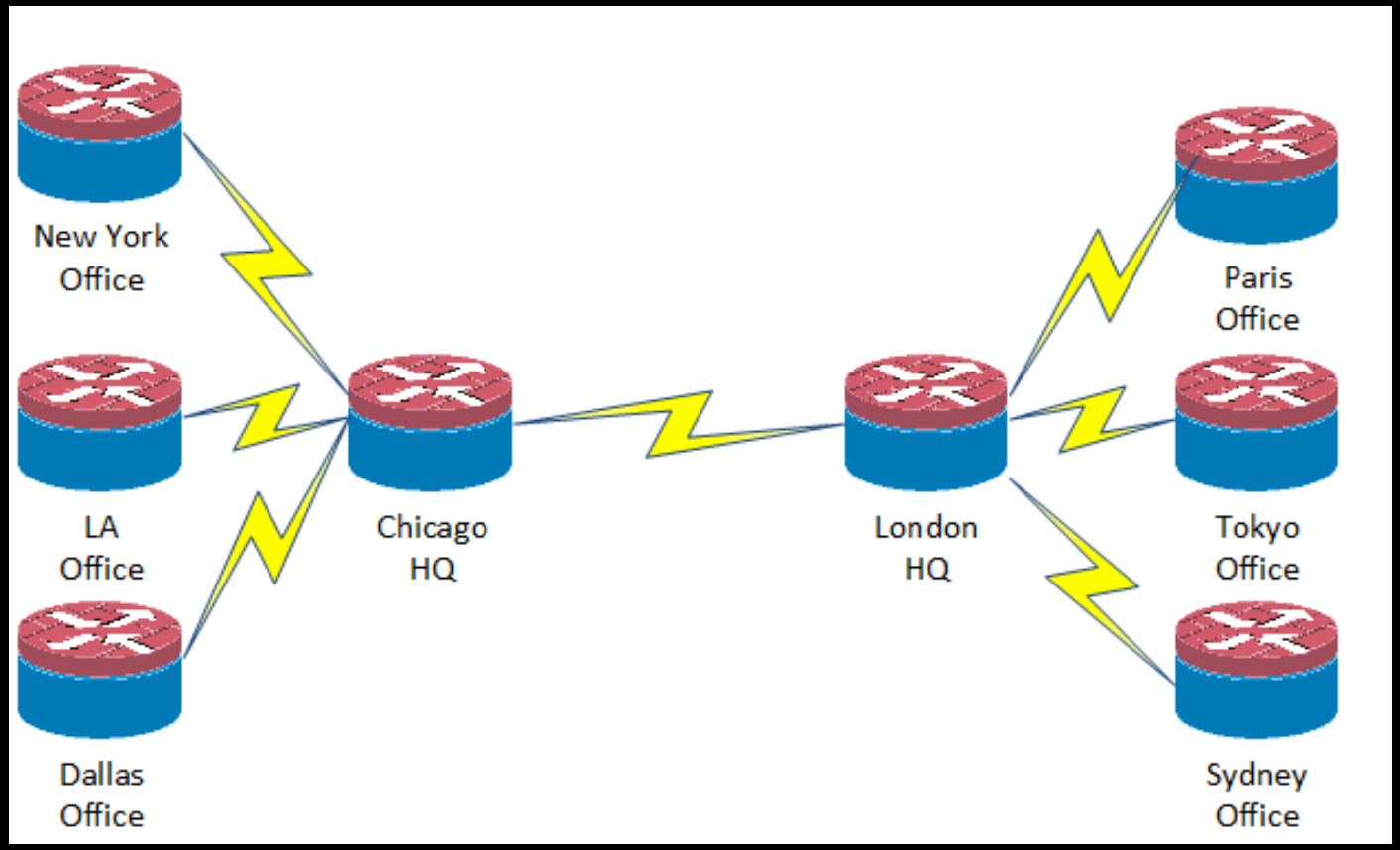
SIMPLE VPN EXAMPLES



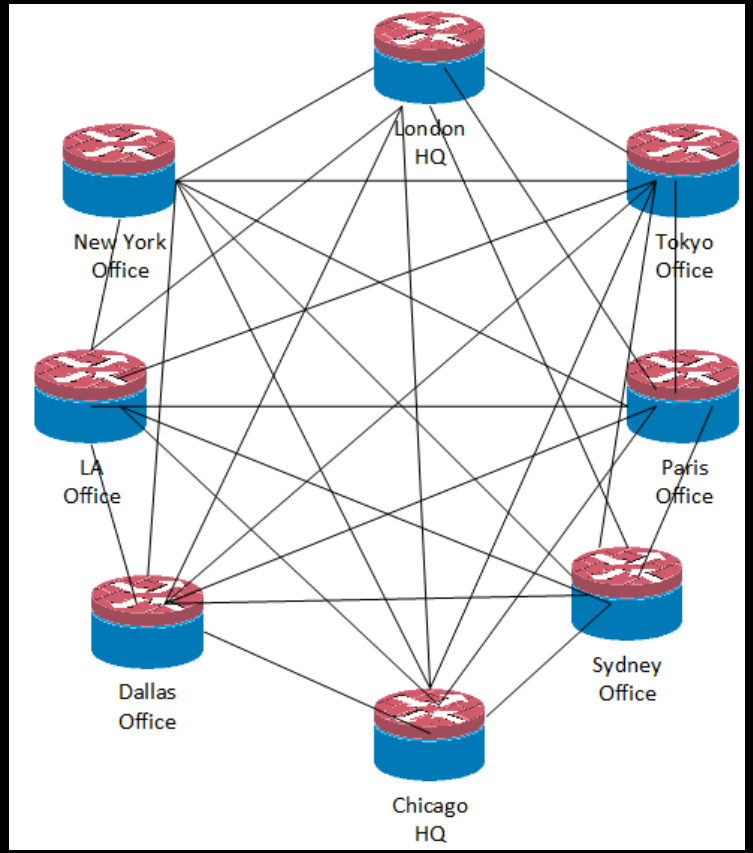
COMPLEX VPN DESIGN

- Multiple HQ or Branches
  - Major management overhead
  - One change at HQ can mean a change at each branch
  - Bandwidth limitations at HQ can cause issues
- Partial / Full Mesh VPN
  - Plain IPSec becomes a nightmare to manage
  - BW Issues are mitigated
  - Sanity can be lost

MULTIPLE-HUB & SPOKE



MESH VPN


London
HQ
New York
Office
Tokyo
Office
LA
Office
Paris
Office
Dallas
Office
Sydney
Office
Chicago
HQ

SOLUTIONS FOR MESH VPN

- Different vendors have implemented their own
- Cisco
  - DMVPN
    - Multipoint GRE Tunnel
    - ‘Easy’ Config
      - Single tunnel interface created on Hub and Spokes
    - Uses proprietary protocol for identifying correct GRE endpoint
    - OSPF (or other Dynamic Routing Protoocl) can be used to distribute routes
- Juniper
  - GET-VPN
    - Also supported by Cisco – ish

ROUTEROS

- No support for DMVPN (no NHRP)
- No GET-VPN support
- We do however have the prereqeusites for a system
  - GRE
    - Works on a number of platforms
  - IPSec
    - Works on most platforms
    - PSK or CA
  - Dynamic Routing
    - Pick a protocol!

HOW DO WE ACHIEVE THIS

- The feather in the hat for RouterOS

Scripting!

- Leaves our options open
- Not perfect however
  - When coming from a full OS perspective, it can be quite a shock.
- Would be interested in a more "common" language being used
  - Python/Perl/Ruby etc – Obviously some security concerns
  - Lua – What happened?
  - Even TCL - If it's good enough for F5 in their TMOS, I'm sure it's fine for RouterOS!

WHY IS SOME OS GUY SPEAKING ABOUT THIS?

- As a general rule, Operating systems folk shy away from networking
- As the lines between networking and systems are blurring thanks to ‘SDNs’ both sides need to learn parts of the others craft
- Labs are ‘boring’
  - Participation from Home
  - Large numbers of peers
  - ‘Complex’ network
  - Overlapping Network ranges
  - Reduces anxiety around the subject
- Increases knowledge of OS as well as networking

HOW HAVE WE DONE IT?

- Group of about 10-15 friends / collogues
- Mostly RouterOS
  - Most folks have started with RB(7|9)51's
- Some Linux & FreeBSD
  - Some people just aren't ready to give up that control
- "TheVPN"
  - CA
  - Ipsec
  - GRE
  - BGP
  - RouterOS Script

HOW DOES IT WORK

- Central Server(s)
  - Python Web App running on Cloud
- User signs up for account
  - Approval by existing member
- User adds router
  - Provides: DNS, Router Type
  - Is provided: API Key, Router's AS Number, CA Cert, Router Cert + Key
- User can request a number of IP ranges
  - Assigned to a Router (and in turn an AS)

ROTUEROS SCRIPT

- Ensures Global config is in place
  - BGP Instance
  - Route Filters
  - Interface List
- Gets peers from the Web App
  - String manipulation on RouterOS is a PITA

    NAME | DNS | PROTO | PORT | BGPIP | BGPAS | LOCIP | REMIP

    welby | welbys.dns.for.home | GREIPSEC | 0 | 1.2.3.4 | 65500 | 4.3.2.1 | 1.2.3.4,
  - Creates Tunnel for each Peer
    - GRE Interface
    - IPSec Peer & Policy

ROTUEROS SCRIPT

- Removes old Tunnels
  - GRE
  - IPSec Peer & Policy
- Puts all tunnels in interface list
- Create BGP Peers for missing peers
- Remove unneeded BGP Peers

ISSUES?

- Misconfiguration
  - If you don't control it. Don't trust it
  - Without the route filters in place, someone injected a default route.
- Dynamic DNS
  - Home ISPs generally don't give any static Ips
  - Script resolves the DNS on each run.
- Bandwidth
  - UK & US generally have awful upstream
- Latency
  - Some people use Virgin Media – The Roller coaster of latency

FUTURE IMPROVEMENTS

- Multiple Uplinks
  - Currently no support for multiple addresses.
- Manipulating AS-Path on latency
  - The Script could potentially do a latency check to a remote and change the AS-Path length
- Queues
  - We're toying with the idea of using queues to limit BW
- Other protocols
- Scripts for other devices
- FW Rules & Route Filters
- Looking Glass
- Your Suggestions are welcome!

CAN I USE THIS

- All code is Open Source
- MIT License
- https://github.com/welbymcroberts/thevpn.co.uk/
- Web App is being re-developed
- Commercial Use is allowed by License
  - It is however asked that if you are to use it in a commercial setting that a donation is made to a charity listed on the GitHub page, or an equivalent charity of your companies choice.
  - Individuals can also donate to their charity of choice☺
- Contribute changes / feature requests / improvements!

QUESTIONS?