IPv6 Running on AWS

AWS Greater Denver MeetUp
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GTRI IS NOW ZIVARO

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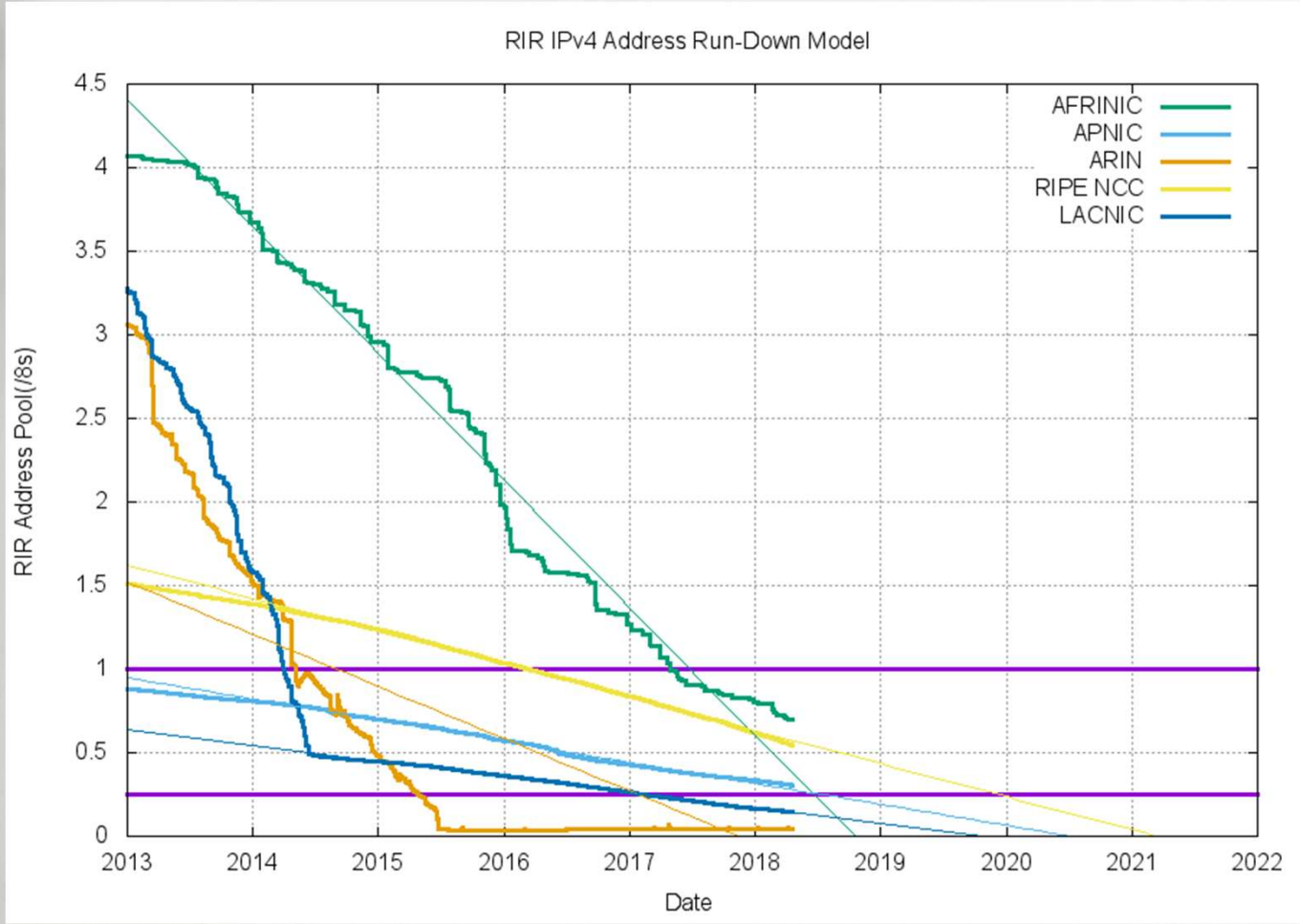
Today's Agenda

1. IPv6 Business Case, Quick IPv6 Background Information
2. IPv6 Features in AWS
3. Live Demonstration of AWS Dual-Protocol Environment
4. Summary, Resources, and Q&A

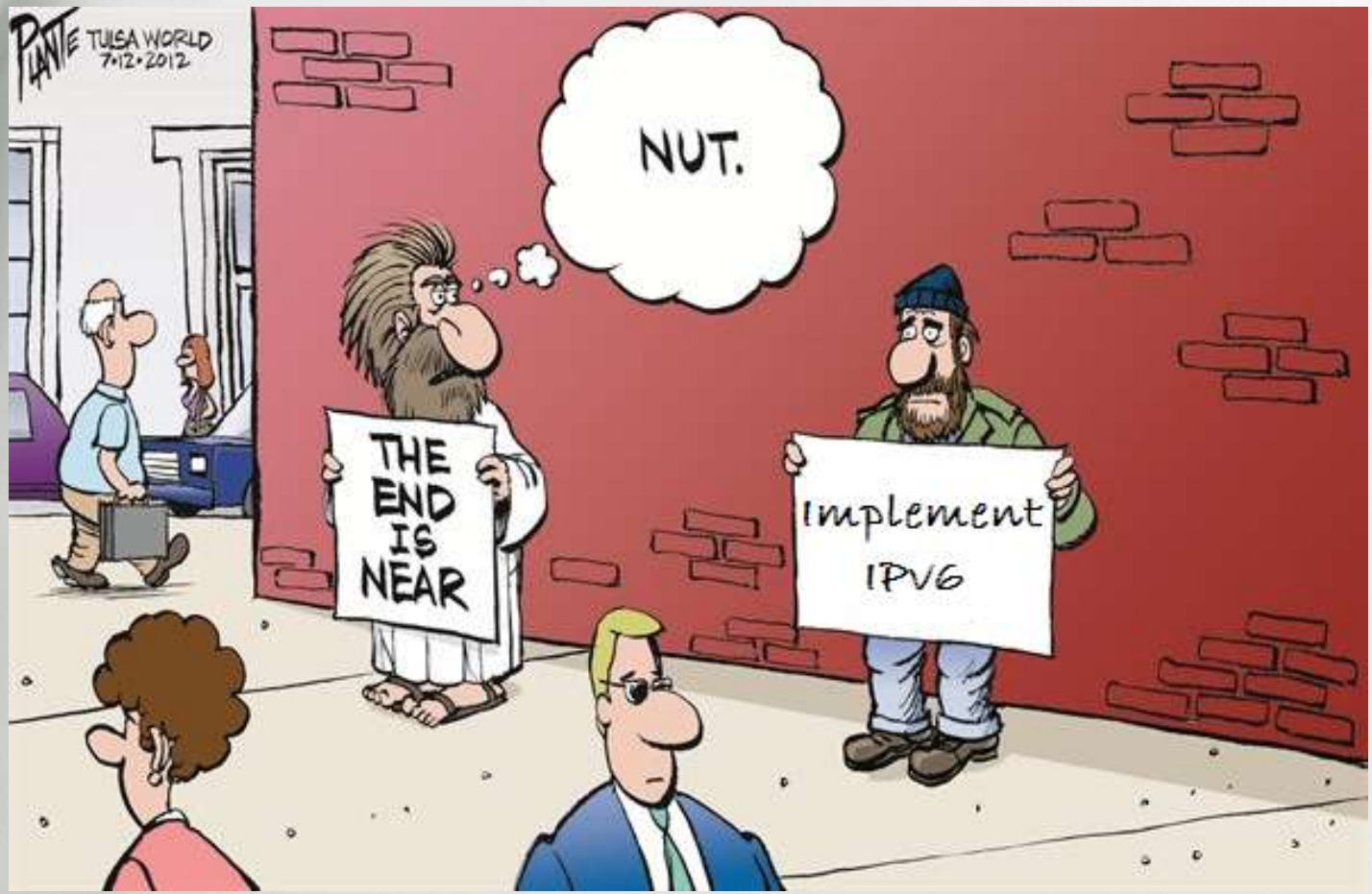
IPv6 Background

IPv4 Address Exhaustion

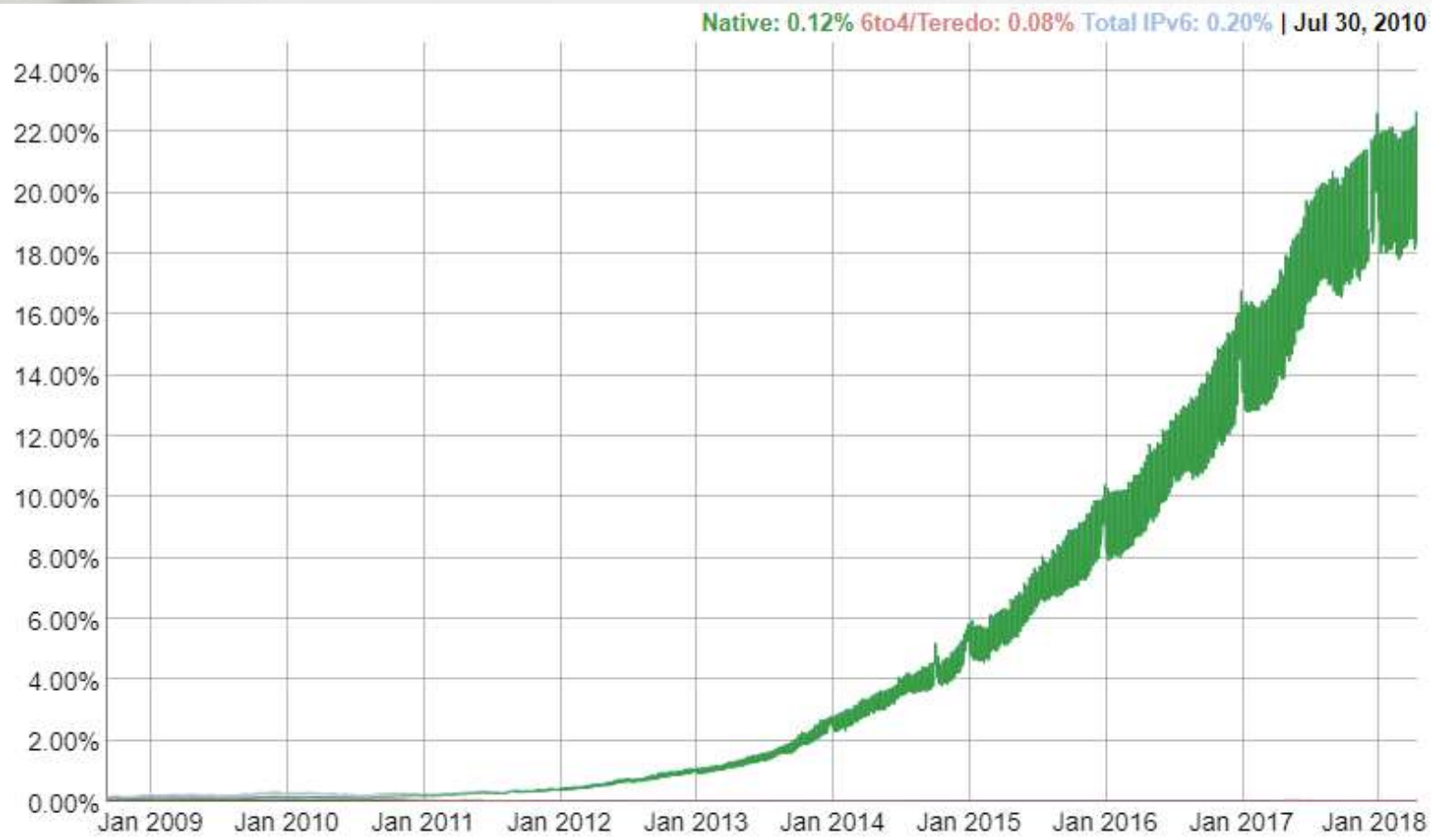


Source: http://www.potaroo.net/tools/ipv4/

IPv6 NOW!


PLANTE
TULSA WORLD
7-12-2012
NUT.
THE END IS NEAR
Implement IPV6

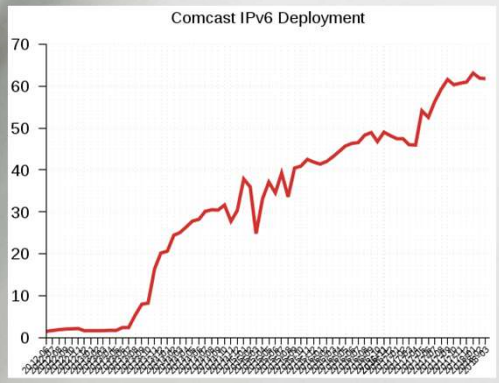
Google's IPv6 Statistics



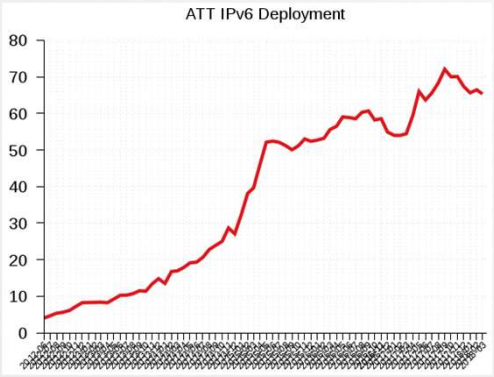
Source: https://www.google.com/intl/en/ipv6/statistics.html

U.S. IPv6 Network Operator Stats

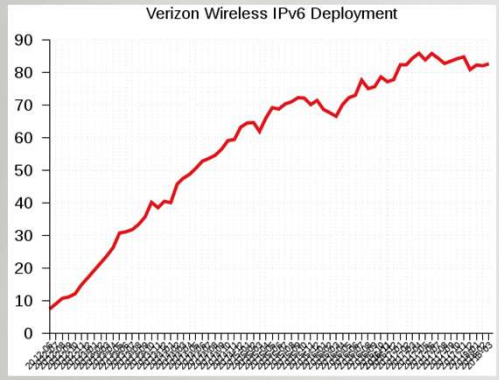
Comcast ~ 62%



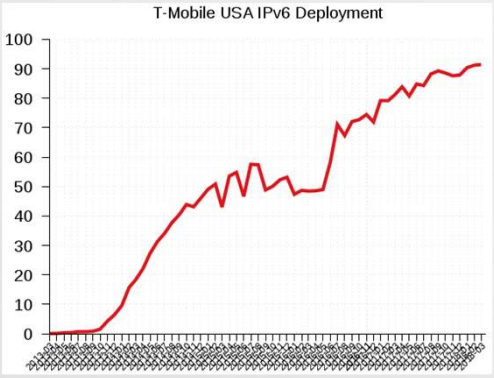
AT&T ~ 65%



Verizon ~ 83%

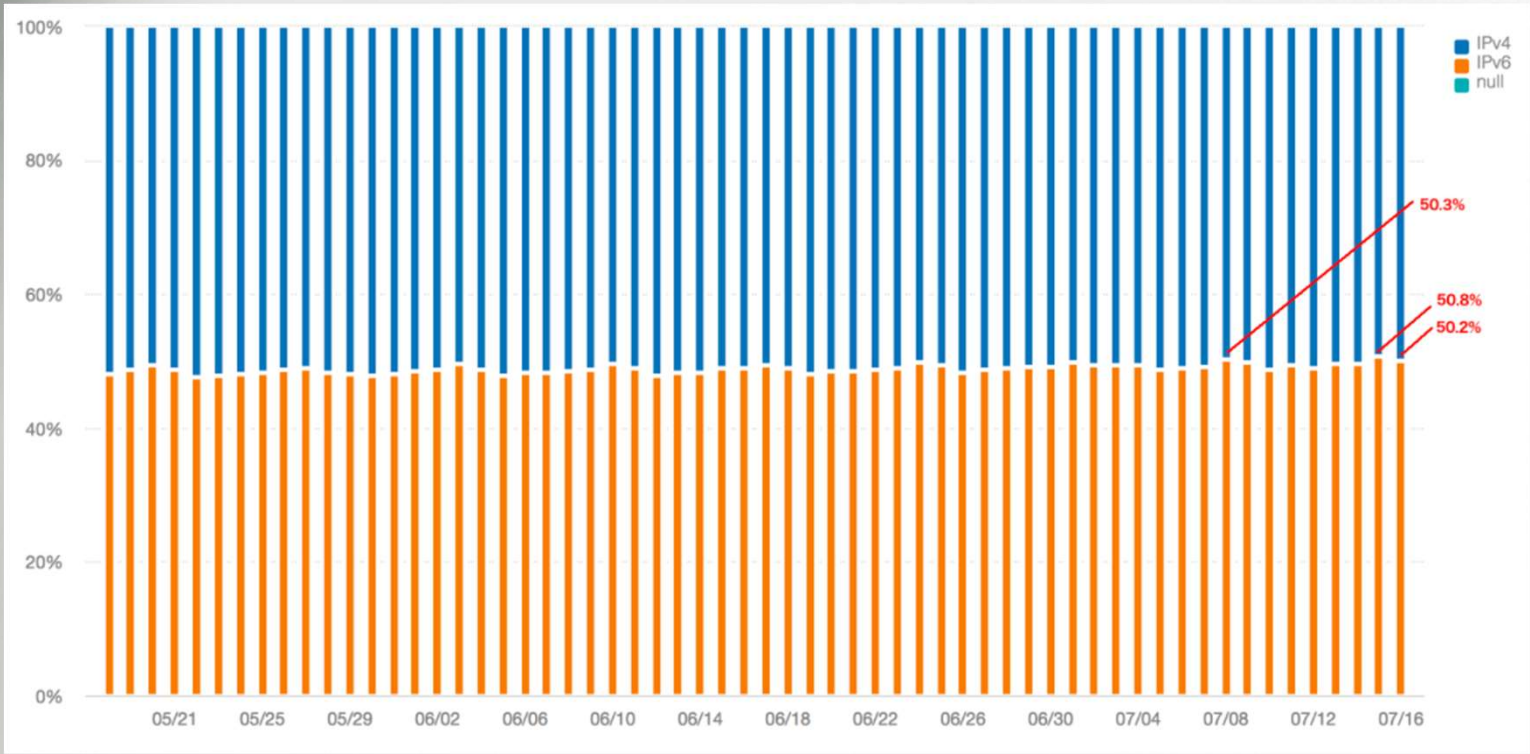


T-Mobile ~ 91%



IPv6 at LinkedIn

- LinkedIn passed 50%+ IPv6 Traffic in July 2017

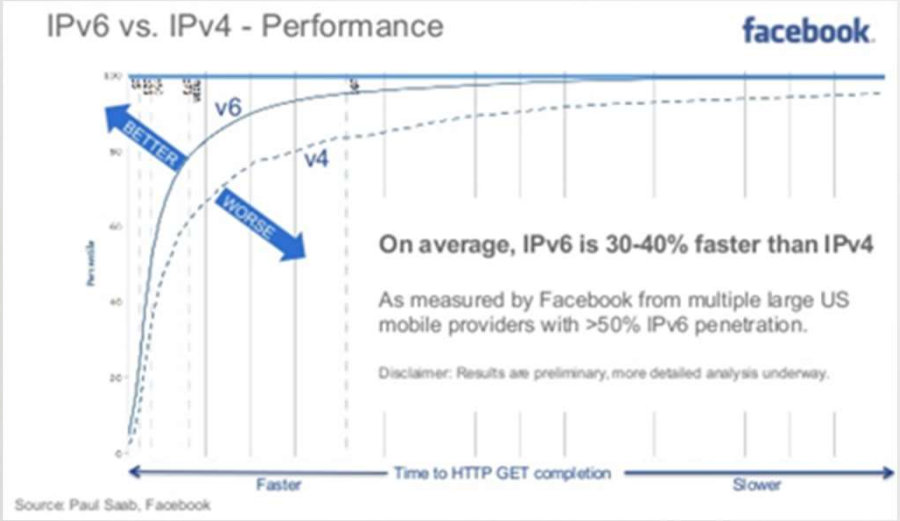


Percentage of page views over IPv6 for LinkedIn over the last two months

Source: https://engineering.linkedin.com/blog/2017/07/linkedin-passes-ipv6-milestone

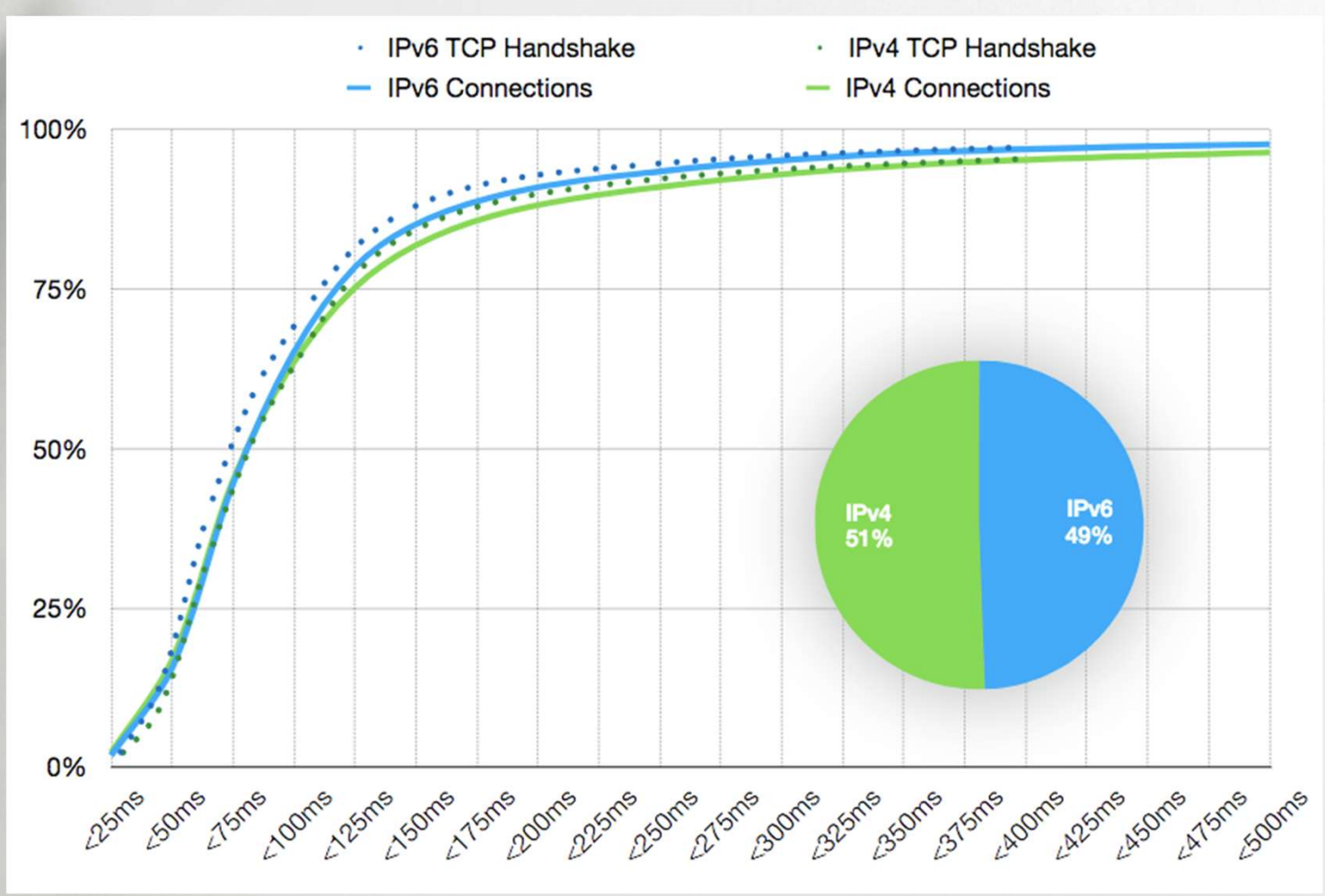
Is IPv6 Faster Than IPv4?

- Paul Saab at Facebook has shows data from Mobile Proxygen that shows IPv6 is faster for them.
  - “Facebook says it has seen users’ News Feeds loading 20 percent to 40 percent faster on mobile devices using IPv6”.



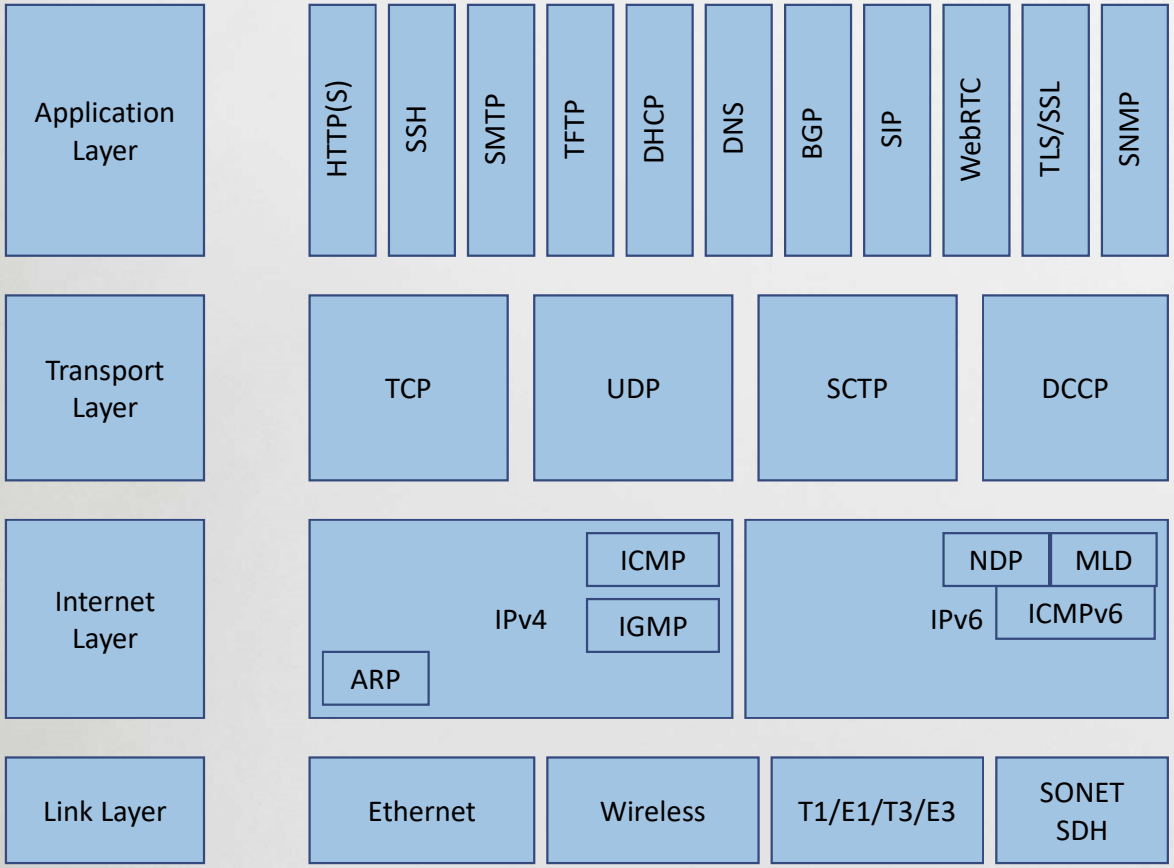
Can IPv6 Really Be Faster than IPv4? (Part 1)
https://community.infoblox.com/t5/IPv6-CoE-Blog/Can-IPv6-Really-Be-Faster-than-IPv4-Part-1/ba-p/6419
Can IPv6 Really Be Faster than IPv4? (Part 2)
https://community.infoblox.com/t5/IPv6-CoE-Blog/Can-IPv6-Really-Be-Faster-than-IPv4-Part-2/ba-p/6748

Apple: US Cellular RTT Values

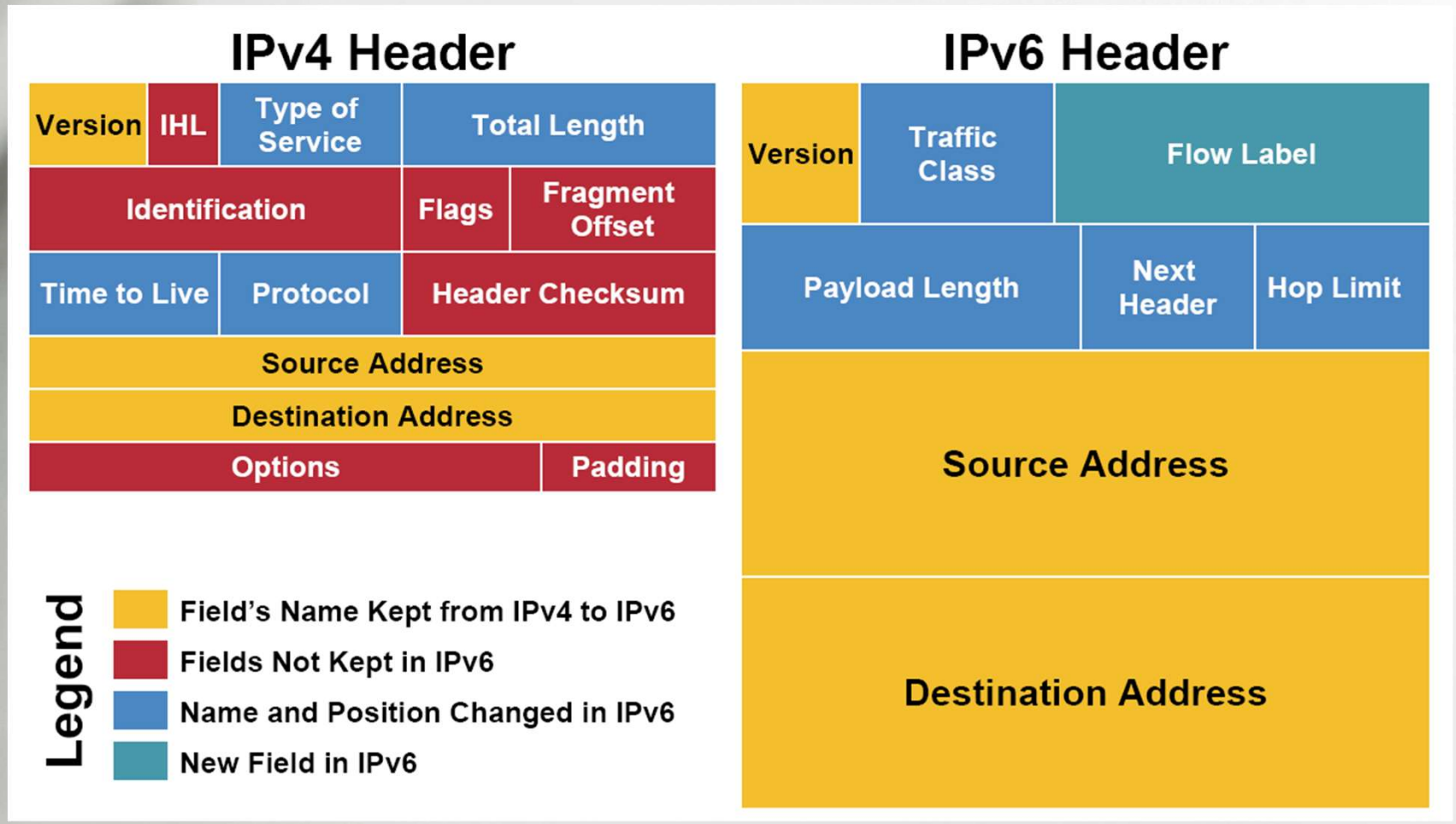


Source: IETF 101 London, March 2018

Dual-Protocol Protocol Stack



IPv4 and IPv6 Header Comparison



IPv6 Address Notation

- 128 bits get converted into more readable form
  - 0010 0000 0000 0001 1001 0000 1110 0000 0000 0000 0000 0011 0000 0000 0000 0000 / 0000 0000 0000 0000 0000 0000 0101 0000 0000 0000 0000 0000 0000 0000 0000 0000
- Convert bits to hex, 8 “chunks, hextets, words, groups, quads” each with 4 hex digits
  - Fully-expanded format with all leading zeros shown
  - 2001:90E0:0003:0000:0000:0050:0000:0000
- Reduce by removing leading zeros
  - 2001:90E0:3:0:0:50:0:0
- Use :: to consolidate multiple zeros – only once
  - Fully-compressed format
  - 2001:90E0:3::50:0:0 or 2001:90E0:3:0:0:50::
- Prefix format/notation
  - 2001:90E0:3::/64

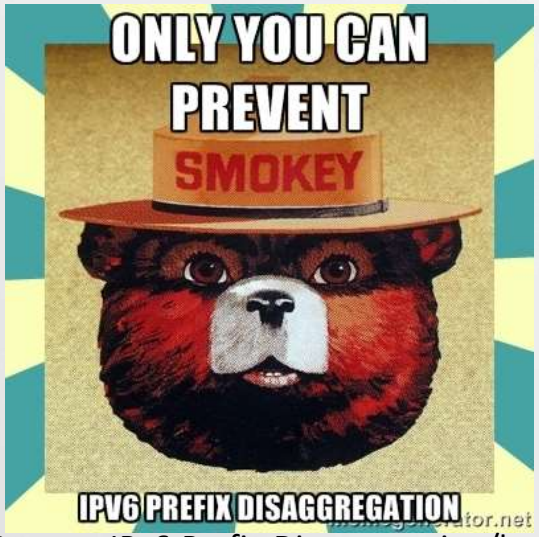
IPv6 Address Types

Address Type/Scope:	Binary:
Aggregatable Global Unicast Addresses (2000::/3)	001
Unique Local (FC00::/7) (FC00::/8 & FD00::/8)	1111 110
Link Local Use Addresses (FE80::/10)	1111 1110 10
Multicast Addresses (FF00::/8)	1111 1111

AWS's IPv6 Addresses

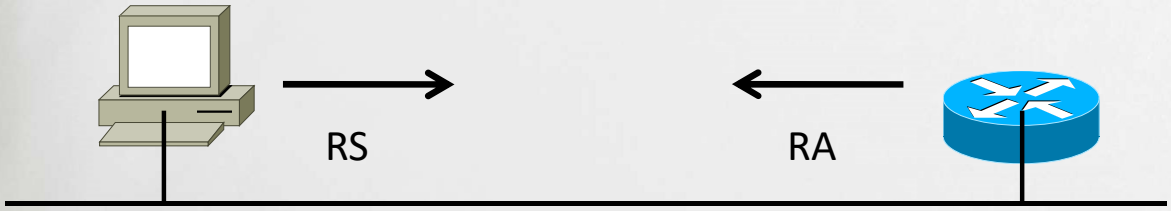
https://ip-ranges.amazonaws.com/ip-ranges.json

- 2a05:d000::/25 = AWS Ireland (AS16509)
- 2a01:578::/32 = AWS (AS16509)
- 2600:9000::/32 = AWS (AS16509)
- 2600:1f00::/32 = AWS (AS16509)
  - 2600:1f11::/36 = AWS Canada (AS16509)
  - 2600:1f18::/33 = AWS (AS14618)
  - 2600:1f1e::/36 = AWS Brazil (AS16509)
- 2406:da00::/32 = AWS Asia-Pacific (AS16509)
- 2403:b300::/32 = AWS Australia (AS16509)
- 2400:6500::/32 = AWS Singapore (AS38895 & AS16509)
- 2400:6700::/32 = AWS Japan (AS38895 & AS16509)
- 2804:800::/32 = AWS Brazil



Only You Can Prevent IPv6 Prefix Disaggregation
https://community.infoblox.com/t5/IPv6-CoE-Blog/Only-You-Can-Prevent-IPv6-Prefix-Disaggregation/ba-p/4201

Router Solicitations and Router Advertisements



Nodes send RSs (ICMPv6 Type 133)
On bootup when they can't wait
200 seconds for the next RA

Source: FE80::/10
Link-Local address of Node
Destination: FF02::2 (all routers)

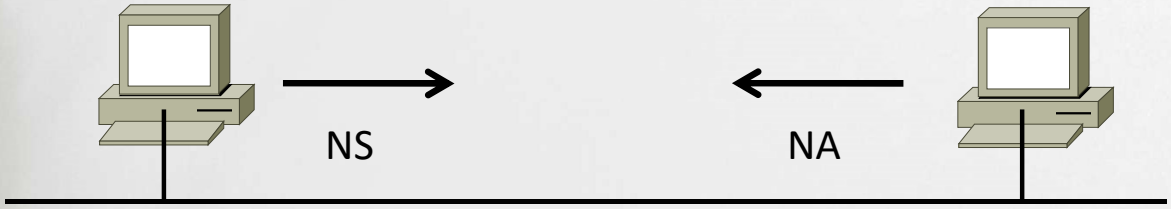
Data: Query to send RA,
Source LL Addr

Routers send RAs (ICMPv6 Type 134)
Every 200 seconds or
Responding to an RS message

Source: FE80::/10
Link-Local address of Router
Destination: FF02::1 (all nodes)

Data: Options, subnet prefix,
lifetime, autoconfig flags (M&O bits)

Neighbor Solicitations and Neighbor Advertisements



Nodes send NSs (ICMPv6 Type 135)
When sending IPv6 packet to Another node

Source: Unicast IPv6 Address
Destination: Solicited Node Multicast Address FF02::1:FFAA:BBCC

Data: Target link-layer address
Query: What is your link-layer address?

Routers send NAs (ICMPv6 Type 136)
Responding to an NS message

Source: Unicast IPv6 Address
Destination: Unicast Address of Requestor or FF02::1 (all nodes)

Data: R/S/O Flags, Target's Link-layer address
Response: Here is my IPv6 and link-layer address.

AWS IPv6 Features

IPv6 in ELB

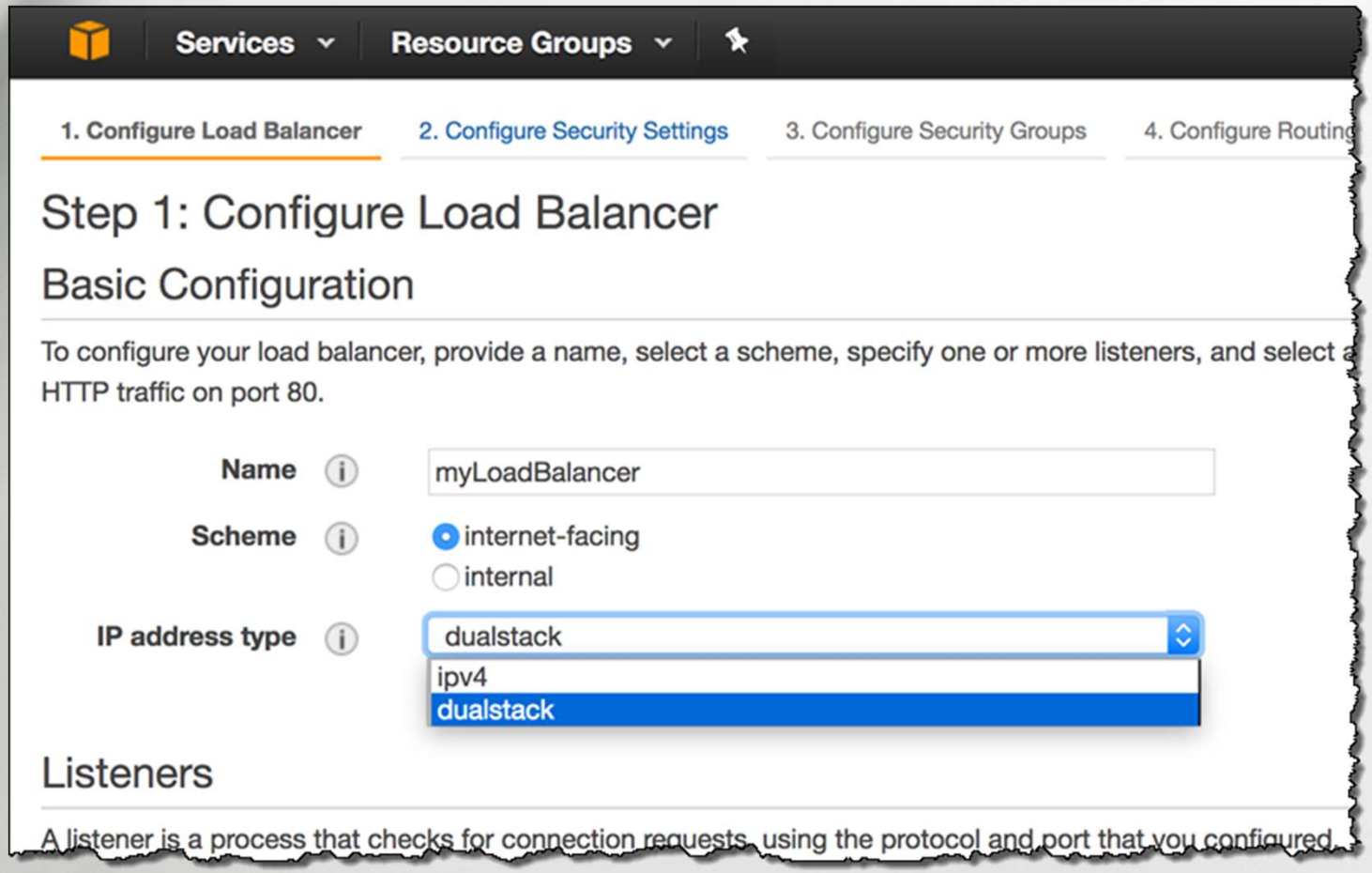
- IPv6 support for Elastic Load Balancer (ELB) since 2011
  - You can create an IPv6 Virtual IP (VIP) listener but the real-servers EC2 instances are IPv4-only within their VPCs
  - This is a way to present an IPv6 public address to the Internet while keeping your application using IPv4-only
  - https://aws.amazon.com/blogs/aws/elastic-load-balancing-ipv6-zone-apex-support-additional-security/
- AWS Started to provide more IPv6 support in the Fall of 2016 and ahead-of and during their November 2016 re:Invent conference.

AWS re:Invent

IPv6 in ALB

- Application Load Balancer (ALB) has native IPv6 support in a VPC
- ALB in the US East (N. Virginia), US West (N. California), US West (Oregon), South America (São Paulo), EU (Ireland), Asia Pacific (Tokyo), Asia Pacific (Singapore), Asia Pacific (Sydney), and AWS GovCloud (US) Regions now support IPv6 in dual-stack mode.
- ALBs automatically receive IPv4 and IPv6 addresses when you select the IP address type = “dualstack”
- ALB then uses VPCs and subnets, but those subnets need IPv6 or you get the descriptive error
  - “Selected subnets must have the CIDR block required by the IP address type.”
- Then DNS resolutions for the ALB name will return A and AAAA records
- Target Groups are IPv4-only on the back-end

IPv6 in ALB


Services
Resource Groups
1. Configure Load Balancer
2. Configure Security Settings
3. Configure Security Groups
4. Configure Routing
Step 1: Configure Load Balancer
Basic Configuration
To configure your load balancer, provide a name, select a scheme, specify one or more listeners, and select
HTTP traffic on port 80.
Name
myLoadBalancer
Scheme
internet-facing
internal
IP address type
dualstack
ipv4
dualstack
Listeners
A listener is a process that checks for connection requests, using the protocol and port that you configured.

IPv6 in S3

- IPv6 Support for Amazon S3 (August 2016)
  - https://aws.amazon.com/blogs/aws/now-available-ipv6-support-for-amazon-s3/
- Bucket names use the “dualstack” moniker
  - https://BUCKETNAME.s3.dualstack.AWSREGION.amazonaws.com
  - https://s3.dualstack.AWSREGION.amazonaws.com/BUCKETNAME
- IPv6 domain names for S3 buckets in CFTs
  - March 28, 2017 - CloudFormation release notes
    - https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/ReleaseHistory.html
  - AWS::S3::Bucket
    - You can now specify IPv6 domain names for your Amazon S3 buckets.
- IPv6 is also supported for S3 Transfer Acceleration

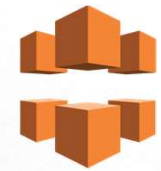
IPv6 in IAM Policies

- IPv6 is also supported in IAM policies, e.g. S3 Bucket policies

```
{   "Version": "2012-10-17",   "Statement": [     {
      "Sid": "IPAllow", "Effect": "Allow", "Principal": "*", "Action": "s3:*",
"Resource": "arn:aws:s3:::mybucketname/*", "Condition": {
          "IpAddress": {
             "aws:SourceIp": [ "123.45.67.0/24", "2001:DB8:1234:5678::/64" ]
          }
        }
      }
  ]
}
```

- `ping -6 ipv6.s3.dualstack.us-west-2.amazonaws.com`

IPv6 in CloudFront



- IPv6 Support for AWS CloudFront, AWS WAF & S3 Transfer Acceleration (Oct 2016)
  - https://aws.amazon.com/about-aws/whats-new/2016/10/ipv6-support-for-cloudfront-waf-and-s3-transfer-acceleration/
- CloudFront edge locations have IPv6 connectivity
- CloudFront will resolve AAAA records for blahblah.cloudfront.net distributions
- CloudFront distributions will have IPv6-enabled by default
  - IPV6Enabled property added to the DistributionConfig property type
- Connections to origin servers will remain IPv4-only
- CloudFront access logs will contain the client's IPv6 address in the "c-ip" field
- IPv6 addresses will be carried in the X-Forwarded-For header to the origins

IPv6 in WAF

- IPv6 Support for AWS CloudFront, AWS WAF & S3 Transfer Acceleration (Oct 2016)
  - https://aws.amazon.com/about-aws/whats-new/2016/10/ipv6-support-for-cloudfront-waf-and-s3-transfer-acceleration/
- AWS WAF can be used with CloudFront or an ALB
- WebACLs can contain IP rulesets (blacklists or whitelists) that contain IPv4 and/or IPv6 addresses
- IP Match Conditions can use IPv4 and/or IPv6 addresses (using / notation)
- WAF supports /16, /24, /32, /48, /56, /64, and /128 IPv6 address ranges

IPv6 in Route 53

- Route 53 Public DNS service now supports IPv6 (Oct 2016)
  - https://aws.amazon.com/about-aws/whats-new/2016/10/amazon-route-53-now-supports-dns-queries-over-ipv6-networks/
- Route 53 supports queries over IPv4 and IPv6 transport and can provide authoritative DNS for IPv4 and IPv6 resource records
- Recursive DNS resolvers on IPv6 networks can now use either IPv4 or IPv6 transport to send DNS queries to Amazon Route 53
- AAAA records and Reverse IPv6 PTR records are supported
- Route 53 health checks can be performed over IPv6 transport for IPv6 addresses (but Route 53 will perform IPv4 health checks for domain names)

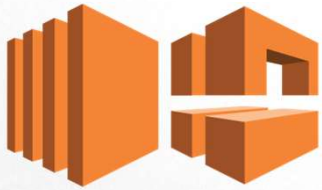
IPv6 in Route 53

- Route 53 can use any of these addresses when doing IPv6 health checks

```
2600:1f1c:07ff:f800::/53
2a05:d018:0fff:f800::/53
2600:1f1e:07ff:f800::/53
2600:1f1c:0fff:f800::/53
2600:1f18:3fff:f800::/53
2600:1f14:07ff:f800::/53
2600:1f14:0fff:f800::/53
2406:da14:07ff:f800::/53
2406:da14:0fff:f800::/53
2406:da18:07ff:f800::/53
2406:da1c:07ff:f800::/53
2406:da1c:0fff:f800::/53
2406:da18:0fff:f800::/53
2600:1f18:7fff:f800::/53
2a05:d018:07ff:f800::/53
2600:1f1e:0fff:f800::/53
```

```
2620:0107:300f::36b7:ff80/122
2a01:0578:0003::36e4:1000/122
2804:0800:ff00::36e8:2840/122
2620:0107:300f::36f1:2040/122
2406:da00:ff00::36f3:1fc0/122
2620:0108:700f::36f4:34c0/122
2620:0108:700f::36f5:a800/122
2400:6700:ff00::36f8:dc00/122
2400:6700:ff00::36fa:fdc0/122
2400:6500:ff00::36fb:1f80/122
2403:b300:ff00::36fc:4f80/122
2403:b300:ff00::36fc:fec0/122
2400:6500:ff00::36ff:fec0/122
2406:da00:ff00::6b17:ff00/122
2a01:0578:0003::b022:9fc0/122
2804:0800:ff00::b147:cf80/122
```

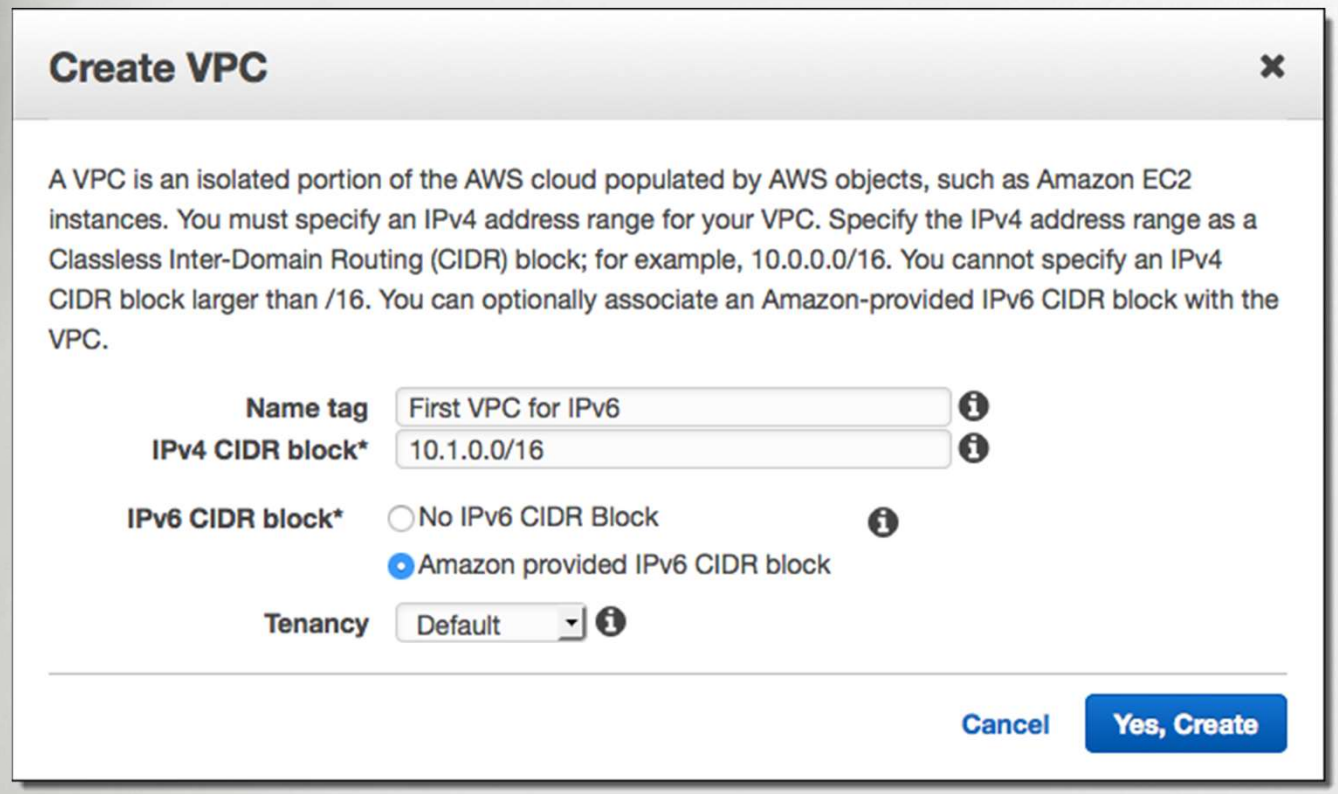
IPv6 in EC2 and VPCs



- IPv6 Support for EC2 Instances in VPCs (Dec 2016)
  - https://aws.amazon.com/blogs/aws/new-ipv6-support-for-ec2-instances-in-virtual-private-clouds/
- AWS assigns /56 IPv6 prefix to VPCs

- You configure /64 IPv6 prefixes to your subnets within the VPC
- IPv4 and IPv6 addresses are configured in the NACLs associated to the subnets
- EC2 ENIs can have IPv6 addresses (Set “Auto-assign IPv6 IP” = Enable)
- Security Groups can have IPv4 or IPv6 addresses
- Subnets have route tables and those route tables can have IPv4 and IPv6 routes

IPv6 in EC2 and VPCs



IPv6 Routing in VPCs

- Internet Gateway (IGW) used for IPv4 egress from VPC
  - IGW performs a NAT function for Public IPs and EIPs
  - NAT Instance or NAT Gateway is required for IPv4 private subnets
- Egress Only Internet Gateway (EOIGW) used for IPv6

  - EOIGW doesn't perform any NAT functionality
  - No need for NAT with IPv6 – the addresses are already global/public
  - IPv6 default route ::/0 needs to go to IGW for public subnets
  - IPv6 default route ::/0 needs to point to the EOIGW for private subnets
- IPv6 routing works for static or dynamic routing (e.g. route propagation)
- IPv6 routing works over VPC peering connections

  - http://docs.aws.amazon.com/AmazonVPC/latest/PeeringGuide/peering-configurations-partial-access.html

IPv6 and Direct Connect

- IPv6 is supported for Direct Connect links to your VPCs
- AWS allocates /125 for interconnection
- AWS accepts /64 or shorter prefixes from CGW
- CGW will receive ~2000 prefixes from AWS
- BFD support for BGP peerings
  - AWS has set the BFD liveness detection minimum interval to 300, and the BFD liveness detection multiplier to 3.
- BGP over IPv4 and IPv6 transport using two eBGP peering sessions
- Direct Connect Public VIFs & Private VIFs both support IPv6
- Direct Connect Gateway (recently launched) - also supports IPv6

DHCPv6

- AWS operates DHCPv6 relay on VPC subnet router ".1", AWS DNS on ".2"
- IPv6 is automatically enabled on Amazon Linux 2016.09.0 or later, or Windows Server 2008 R2 or later, otherwise, you need to verify/enable DHCPv6
- Example for configuration dhclient on Ubuntu OSs
- /etc/network/interfaces.d/50-cloud-init.cfg
  - auto eth0
  - iface eth0 inet dhcp
- /etc/network/interfaces.d/60-default-with-ipv6.cfg
  - iface eth0 inet6 dhcp
- Reboot the instance or restart the network interface (sudo ifdown eth0 ; sudo ifup eth0)

IPv6 and VPC Flow Logs

- VPC Flow Logs capture IP traffic on VPC interfaces for deeper analysis
- Inspection of IP traffic going to/from network interfaces in your VPC - metadata about traffic (Like NetFlow)
  - Traffic to/from ENIs, Subnets, or VPCs
  - Not traffic to/from AWS DNS/DHCP or VPC router ".1" or metadata 169.254.169.254
- Flow Logs show connection data for IPv4 and IPv6 packets:
  - 2, AWS Acct#, ENI, Src IPv4/IPv6, Dest IPv4/IPv6, Src Port, Dest Port, Protocol, # of packets, # of bytes, Capture Start/End, Accept/Reject, OK

```
2 123456789010 eni-f41c42bf
2001:db8:1234:a100:8d6e:3477:df66:f105
2001:db8:1234:a102:3304:8879:34cf:4071 34892 22 6 54 8855
1477913708 1477913820 ACCEPT OK
```

IPv6 in AWS Regions

- AWS IPv6 Update – Global Support Spanning 15 Regions & Multiple AWS Services (Jan 2017)
  - “IPv6 support for EC2 instances in new and existing VPCs is now available in … (15 regions) … and you can start using it today!”
  - https://aws.amazon.com/blogs/aws/aws-ipv6-update-global-support-spanning-15-regions-multiple-aws-services/
- AWS IPv6 EC2 and VPC Regional Expansion (Jan 2017)
  - “We now support IPv6 in all AWS regions, except regions in China.”
  - https://aws.amazon.com/about-aws/whats-new/2017/01/announcing-internet-protocol-version-6-ipv6-support-for-ec2-instances-in-amazon-virtual-private-cloud-vpc-regional-expansion/

IPv6 and AWS WorkSpaces

- AWS WorkSpaces can use IPv6
- Using native IPv6 for Internet connectivity
- AWS WorkSpaces (Value, Standard, Power work with IPv6, but not Performance and Graphics bundles) can use IPv6 to access the Internet from your VPC

IPv6 and API Gateway

- API Gateway is now IPv6 enabled (Nov 2017)
- Announced a few weeks ago - “regional endpoint”
- Use CloudFront to front-end your API gateway
- https://aws.amazon.com/about-aws/whats-new/2017/11/amazon-api-gateway-supports-regional-api-endpoints/

IPv6 and IoT

- AWS IoT has supported IPv6 for a few years now (Dec 2015)
  - https://aws.amazon.com/about-aws/whats-new/2015/12/aws-iot-now-generally-available/
- IPv6 application interactions with IoT services can use IPv6
- IoT Device Gateway now supports IPv4 and IPv6 using the same endpoint
- You can use AWS to facilitate MQ Telemetry Transport (MQTT) client interactions with the AWS IoT service using IPv6

AWS IPv6 Limitations

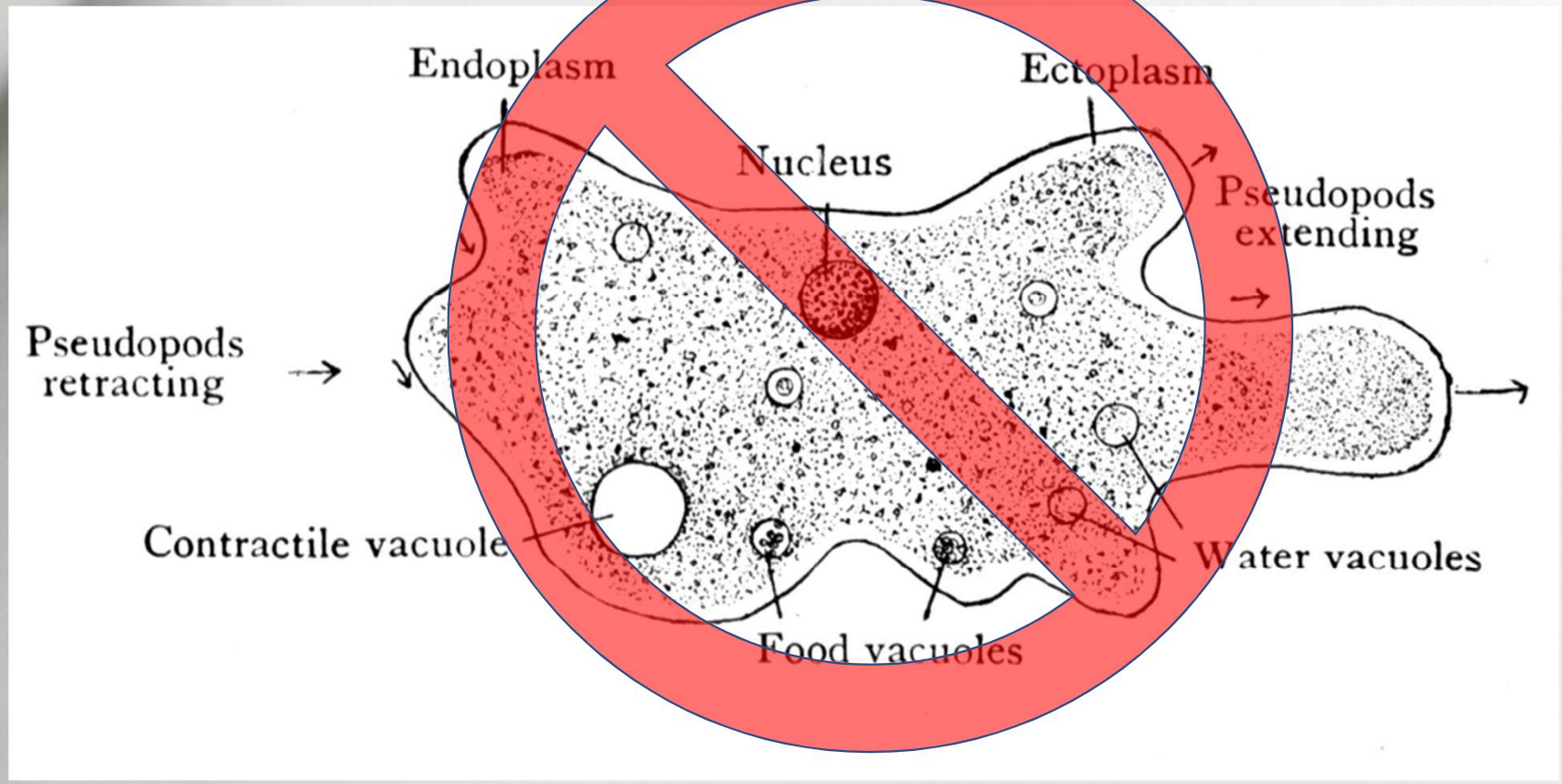
- IPv6 is not supported in EC2-Classic mode. Use VPCs!
- EC2 Instance metadata can only show the local and public IPv4 addresses, use AWS Console to see an instance's IPv6 addresses or via API call.
- No IPv6 for G2/M3 instances.
- No support for IPv6 traffic over a VPN connection.
  - IPv6 traffic can be routed through a virtual private gateway to an AWS Direct Connect connection
  - Use OpenSWAN VPN or some other method of instance-to-instance VPC overlap
- All VPCs and subnets must have IPv4 CIDR blocks. Can't have an IPv6-only subnet.
- Can't choose the IPv6 prefix or prefix size. Prefixes for VPC come from AWS's IPv6 as /56.
- VPCs do not support EIPs for IPv6.
- IPv6 does not work for inter-region VPC peering.

AWS IPv6 Limitations (Cont.)

- No IPv6 support in HyperPlane (EFS, NLB, PrivateLink, etc.).
- NLBs do not support IPv6.
- ALB Target Groups are IPv4-only.
- CloudFront distributions communicate IPv4-only back to the origins (Similar to ALBs).
- No IPv6 support for RDS, RDS drops all IPv6 packets, Read Replicas only use IPv4
- VPC Endpoints and PrivateLink are IPv4-only.
- VPC Endpoints, interface endpoints and gateway endpoints, are IPv4-only.
- No ULA, No NPT, No NAT for IPv6!

Live Demonstration of IPv6 Running on AWS

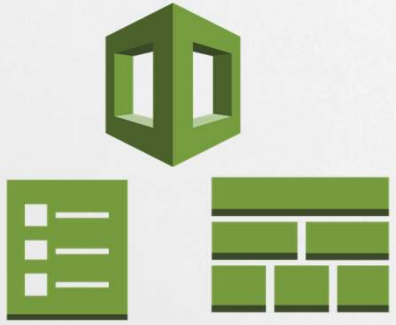
No Amoebas!


Endoplasm
Ectoplasm
Nucleus
Pseudopods extending
Pseudopods retracting
Contractile vacuole
Water vacuoles
Food vacuoles

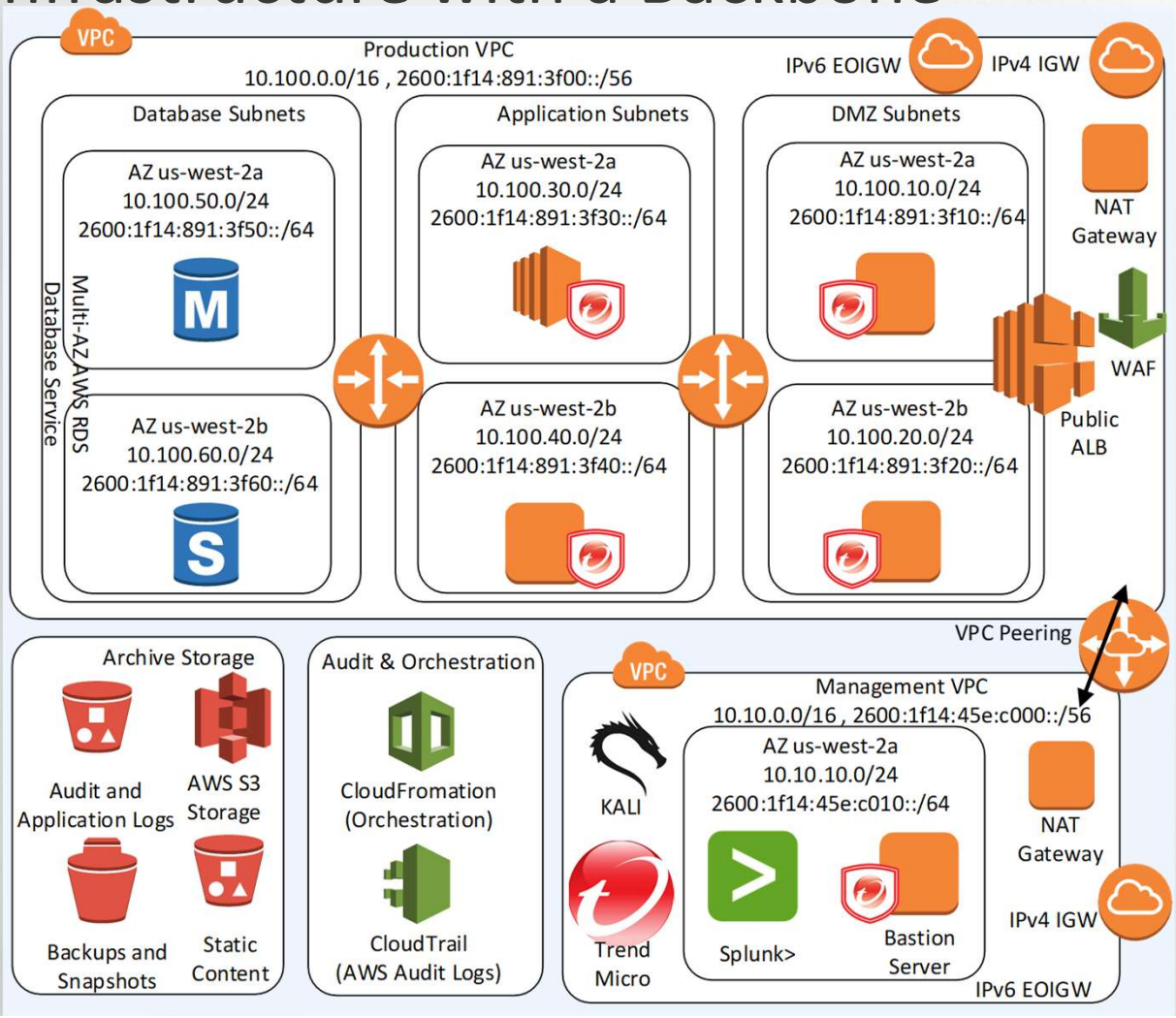
Scriptable Infrastructure – Security as Code

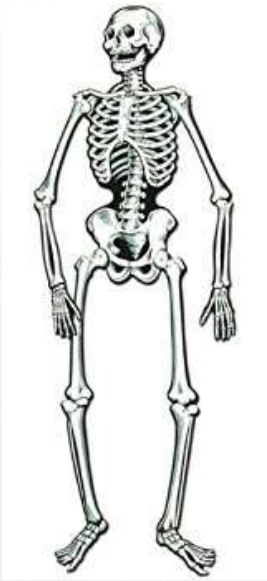
- If you're using the "AWS Management Console", you're doing it wrong!
- Take a page from the DevOps handbook and AUTOMATE!
- NIST AWS CloudFormation Templates (CFTs)
  - https://aws.amazon.com/quickstart/architecture/accelerator-nist/
- Ansible playbooks with Boto3 (1.7.19) and Python
- AWS CLI Commands, Newer (1.15.X) == Better

NIST



Cloud Infrastructure with a Backbone





Configuring IPv6 in AWS

- Step 1: Associate an IPv6 CIDR Block with Your VPC and Subnets
  - /56 for each VPC, /64 for each Subnet
- Step 2: Create and Configure an Egress-Only Internet Gateway (EOIGW)
  - No NAT for IPv6
- Step 3: Update Your Route Tables (and NACLs)
- Step 4: Update Your Security Group Rules
- Step 5: Make Sure Your Instance Type Supports IPv6
  - IPv6 is supported on all current generation instance types & the C3, R3, and I2 previous generation instance types.
- Step 6: Assign IPv6 Addresses to Your Instances
- Step 7: (Optional) Enable DHCPv6 for Ubuntu, RHEL/CentOS

Subnet IPv6 Prefix Assignment Automation

- The /56 IPv6 prefix assigned to a VPC comes from AWS's block and is not known ahead of time and cannot be specified
- If your CloudFormation Templates assigns /64 prefixes to subnets, then you need to know the /56 assigned to the VPC
- Available Options:
  - Handle this in your CFT by parsing the VPC /56 and creating /64s for subnets
  - Use a Lambda function to perform the parsing and subnet assignment
    - https://github.com/mpata/cfnipv6subnetgenerator
  - Use Ansible playbook with Boto3 to enable IPv6
    - http://boto3.readthedocs.io/en/latest/reference/services/ec2.html#vpc
  - Use AWS CLI with IPv6 parameters
    - https://docs.aws.amazon.com/AmazonVPC/latest/UserGuide/vpc-subnets-commands-example-ipv6.html

IPv6 in CloudFormation Templates

- AWS CloudFormation Templates IPv6 Support
  - http://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/ReleaseHistory.html
- Creating the VPC and Assigning its IPv6 Prefix (/56)

```
rVPCApplication:
    Type: AWS::EC2::VPC
        Properties:
            CidrBlock: !Ref pApplicationCIDR
            EnableDnsSupport: true
            EnableDnsHostnames: true
MyVPCv6: #Request an IPv6 block for the VPC
    Type: "AWS::EC2::VPCCidrBlock"
        Properties:
            AmazonProvidedIpv6CidrBlock: true
            VpcId: !Ref rVPCApplication
```

IPv6 in CloudFormation Templates

- Creating a subnet within the VPC and Assigning its IPv6 Prefix (/64)

```
rDMZSubnetA:
       Type: AWS::EC2::Subnet
       DependsOn: MyVPCv6
       Properties:
           CidrBlock: !Ref pDMZSubnetACIDR
           AvailabilityZone: !Ref pRegionAZ1Name
           VpcId: !Ref rVPCApplication
           #MapPublicIpOnLaunch: false
           #Ipv6CidrBlock: "2600:1f14:b39:d101::/64"
           #Ipv6CidrBlock: !Select [1, !Cidr [!Select [0, !GetAtt 'rVPCApplication.Ipv6CidrBlocks'], 256, 64]]
           Ipv6CidrBlock:
               Fn::Sub:
                   - "${VpcPart}${SubnetPart}"
                   - SubnetPart: 01::/64
                     VpcPart: !Select [0, !Split ['00::/56', !Select [0,!GetAtt rVPCApplication.Ipv6CidrBlocks]]]
           AssignIpv6AddressOnCreation: true
```

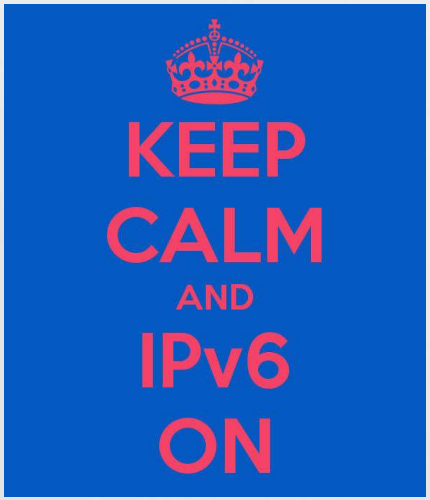
IPv6 in CloudFormation Templates

- Creating IGW, EOIGW and default routes

```
rIGWApp:
    Type: AWS::EC2::InternetGateway
rRouteTableMain:
    Type: AWS::EC2::RouteTable
        Properties:
            VpcId: !Ref rVPCApplication
v6EOIGW:
    Type: "AWS::EC2::EgressOnlyInternetGateway"
        Properties:
            VpcId: !Ref rVPCApplication
rv6RouteAppEOIGW:
    Type: "AWS::EC2::Route"
        Properties:
            DestinationIpv6CidrBlock: "::/0"
            GatewayId: !Ref rIGWApp
            #EgressOnlyInternetGatewayId: !Ref v6EOIGW
            RouteTableId: !Ref rRouteTableMain
```

Summary, Resources, and Q&A

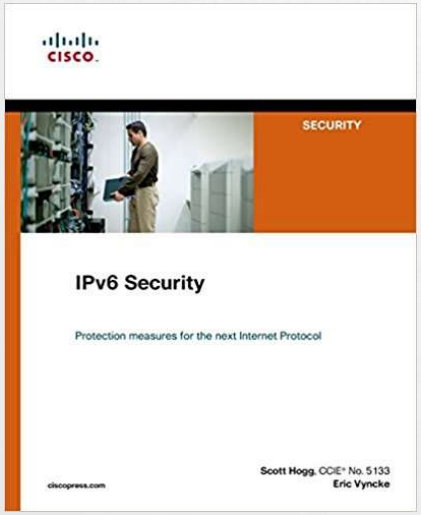
Final Thoughts & Recommendations



Valuable (but FREE) AWS Security Resources

- AWS re:Invent 2017: IPv6 in the Cloud: Protocol and AWS Service Overview (NET202)
  - https://www.youtube.com/watch?v=GE_FqZ-XLR0
- Delivering IPv6 on Amazon Virtual Private Cloud, by Alan Halachmi, Senior manager, solutions architecture, Amazon
  - https://atscaleconference.com/videos/delivering-ipv6-on-amazon-virtual-private-cloud%E2%80%A8/
- Migrating to IPv6
  - http://docs.aws.amazon.com/AmazonVPC/latest/UserGuide/vpc-migrate-ipv6.html
- Amazon Web Services Is Getting into the IPv6 Holiday Spirit

  - https://community.infoblox.com/t5/IPv6-CoE-Blog/Amazon-Web-Services-Is-Getting-into-the-IPv6-Holiday-Spirit/ba-p/8565



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Questions and Answers

- Are there any questions?
- Thank you very much for your time.
- Feel free to contact me if ever I can ever be of service to you.
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