



IPv6 in the Cloud - Back to Square One?

Troopers, March 13th 2018

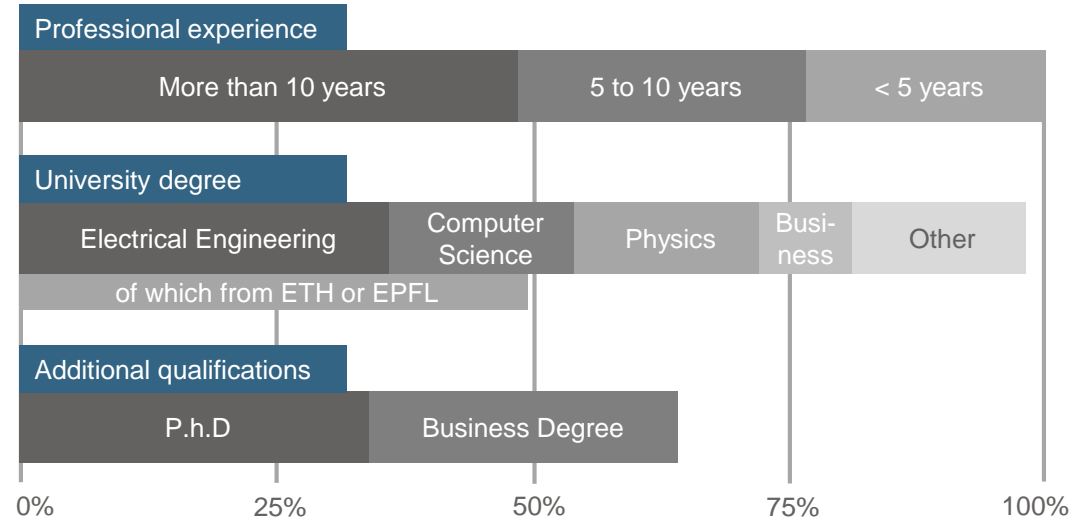
Gabriel Müller, Senior Consultant

Facts and Figures

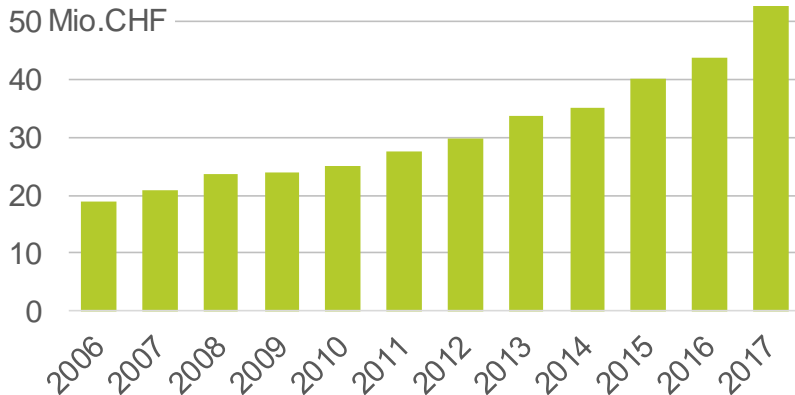


Activity	Consulting, engineering und project management for information technology and digital transformation
Founded in	1986
Employees	Over 250 staff
Clients	Over 400
Projects	Over 4'000
Site Locations	Zurich, Berne, Basle, Lausanne

Qualification of our Consultants



Turnover



Partners of AWK



- From left to right:
- Christian Mauz
- Roger Mosimann
- Adrian Wägli
- Oliver Vaterlaus (CEO)
- Oliver Spiess
- Ueli Sandmeier
- Ralph Tonezzer
- André Arrigoni

Agenda

- ▶ **Introduction**

- ▶ Results

- ▶ Demo

- ▶ Discussion

- ▶ Appendix

Cloud Definition

*“Cloud computing is a model for enabling ubiquitous, convenient, on-demand **network access** to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of **five essential characteristics**, **three service models**, and **four deployment models.**”*

(NIST – Special Publication 800-145)

Essential Characteristics

1. On-demand self-service

- Provision computing capabilities without requiring human interaction

2. Broad network access

- Access service from anywhere through standard mechanisms

3. Resource pooling

- Resources are pooled to serve multiple consumers, no direct control on hardware

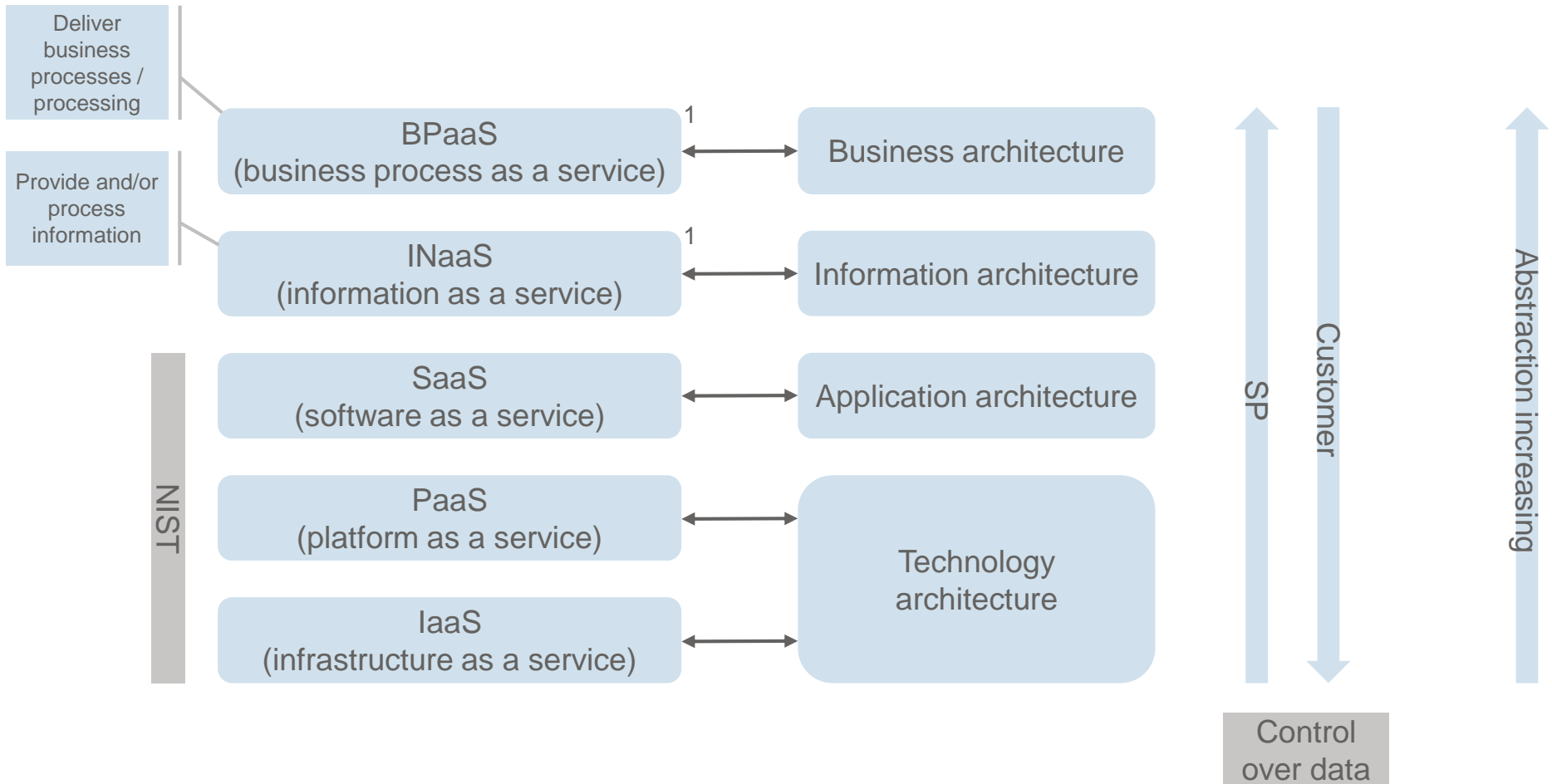
4. Rapid elasticity

- Pooled resources can be elastically provisioned, automation might be used for this

5. Measured service

- Resource usage can be monitored, controlled and reported

Service Models



¹ As defined in MIT book (see appendix)

Deployment Models

Private cloud

- Usually within one organization, or even in part of an organization, restricted to a closed group of people

Community cloud

- Persons and / or organizations with common interests and / or shared requirements w.r.t. security, privacy, regulations, etc.

Public cloud

- Available for the entire public. That is what we will look at today.

Hybrid cloud

- Using two or all three of the models above to form a new cloud with unique characteristics

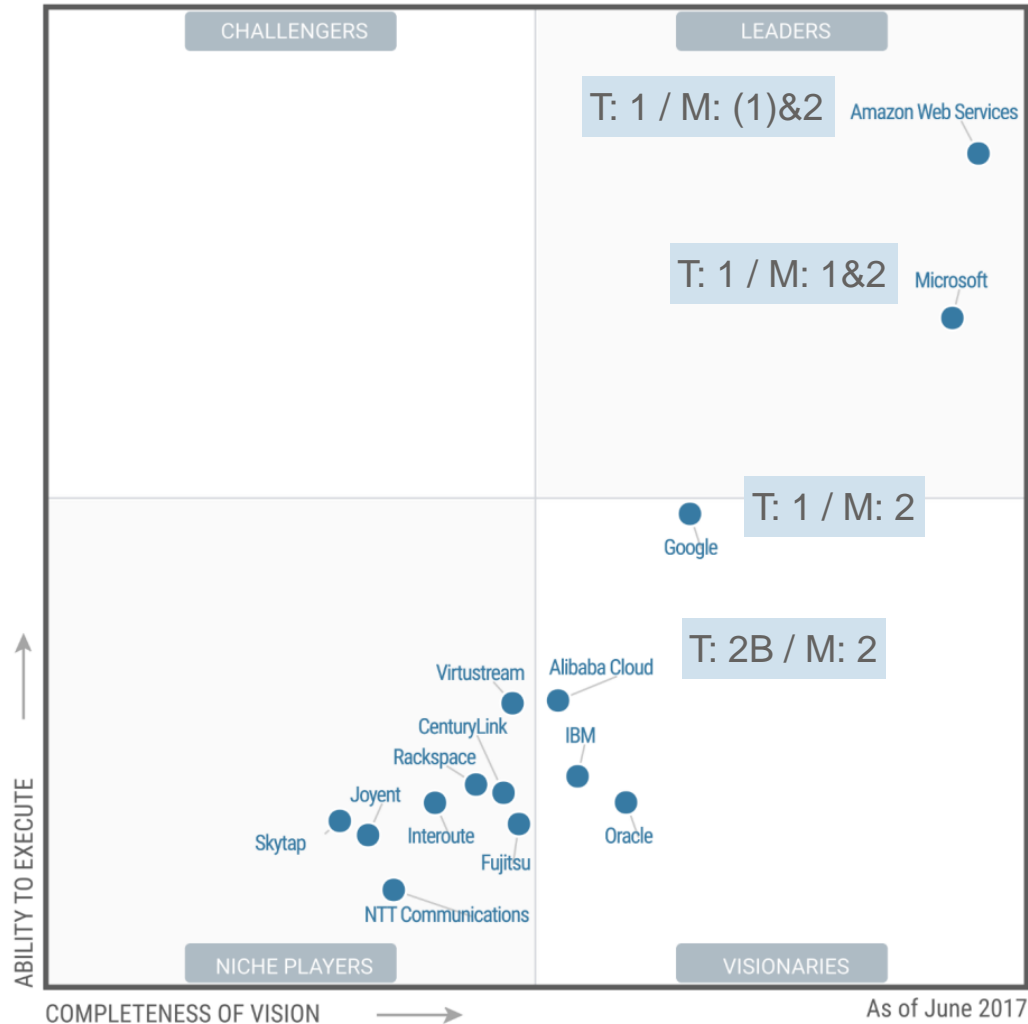
Gartner Perspective

*In the context of this Magic Quadrant, cloud compute IaaS (hereafter referred to simply as "cloud IaaS" or "IaaS") is defined as a **standardized, highly automated** offering, where **compute resources**, complemented by storage and **networking capabilities**, are owned by a service provider and offered to the customer **on demand**. The resources are **scalable and elastic in near real time**, and metered by use. **Self-service interfaces** are exposed directly to the customer, including a web-based UI and an API.*

(Gartner, Magic Quadrant for Cloud Infrastructure as a Service, Worldwide)

Gartner Perspective

Figure 1. Magic Quadrant for Cloud Infrastructure as a Service, Worldwide



Source: Gartner (June 2017)

Provider Maturity

- Tier 1: Global mega vendors
- Tier 2A: Established technology vendors
- Tier 2B: Cloud only / primary vendors
- Tier 3: Emerging vendors

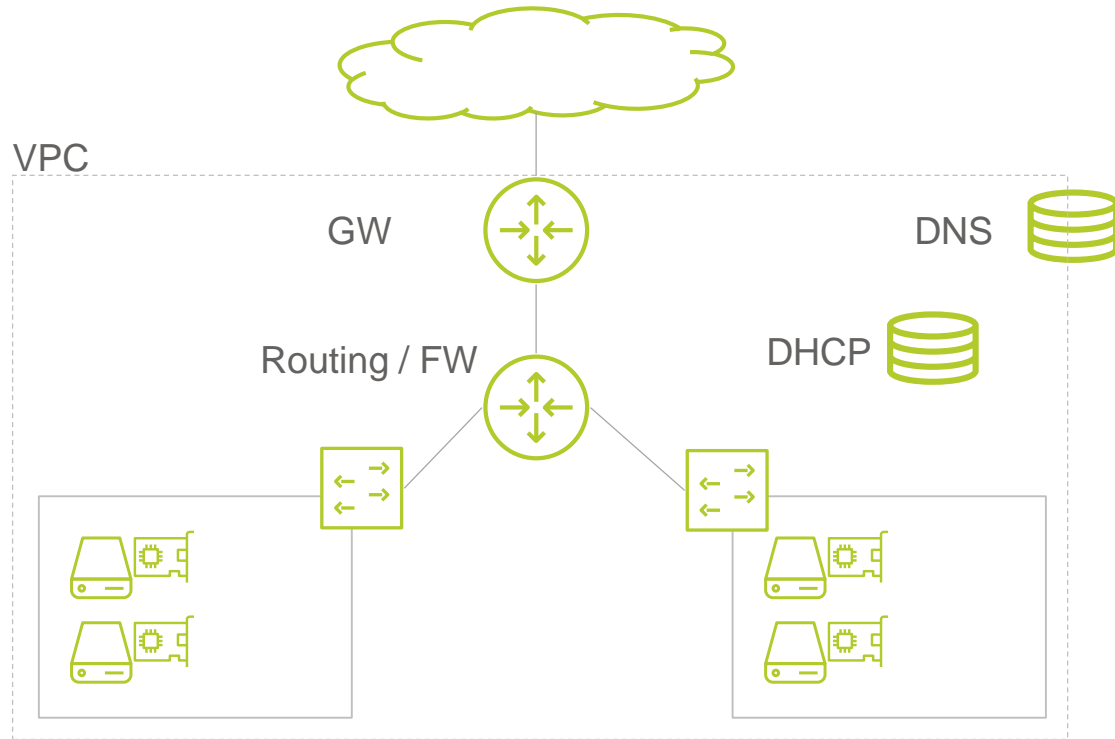
Recommended Mode

- Mode 1: Safety-and-efficiency-oriented IT
- Mode 2: Agility-oriented IT or both

This graphic was published by Gartner, Inc. as part of a larger research document and should be evaluated in the context of the entire document. The Gartner document is available upon request from <https://www.gartner.com/doc/3738058/magic-quadrant-cloud-infrastructure-service>.

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Target Architecture



Agenda

- ▶ Introduction
- ▶ **Results**
- ▶ Demo
- ▶ Discussion
- ▶ Appendix

Alibaba Cloud – Dashboard

Home Products ▾ Billing Management ... English

You have an unpaid balance of \$6,580 USD [Pay Now](#)

Dashboard

Hi, Gabriel Mueller

Tickets

0

[Create Ticket](#)

Alarms

0

[CloudMonitor →](#)

Expiring

0

[Renewal Management →](#)

Monthly Cost Billing Management

Subscription (Current Month)	USD	
\$0.000 USD		
+		
Pay-As-You-Go (Current Month)		
\$9.876 USD		
Coupons		3

Month	Cost (USD)
2017-09	0.000
2017-10	0.000
2017-11	0.000
2017-12	0.000
2018-01	0.000
2018-02	9.876

Indonesia Data Center Pre-sale

30% OFF on ECS and RDS

SSD Cloud Server on ECS

Starting from \$4.50/month

My Resources

<p>Elastic Computing</p> <ul style="list-style-type: none"> <li style="background-color: #e9ecef; padding: 5px; margin-bottom: 5px;"> Elastic Compute Service 2 <li style="background-color: #e9ecef; padding: 5px;"> Server Load Balancer 1 	<p>Storage & CDN</p> <ul style="list-style-type: none"> <li style="background-color: #e9ecef; padding: 5px;"> Alibaba Cloud CDN 	<p>Networking</p> <ul style="list-style-type: none"> <li style="background-color: #e9ecef; padding: 5px; margin-bottom: 5px;"> Virtual Private Cloud 1 <li style="background-color: #e9ecef; padding: 5px;"> Server Load Balancer 1
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[See All ▾](#)

Solutions

Getting Started [Learn More](#)

Set Up a Website and Domain Name

Learn how to build a website with Alibaba Cloud Web Hosting in just a few easy steps

Deploy a WordPress Instance on Alibaba Cloud

How to setup a WordPress instance with an Apache web server on Alibaba Cloud ECS Ubuntu 14.04

Manage Traffic on Multiple Servers with Server Load Balancer

This tutorial describes the process of setting up Server Load Balancer to distribute load across multiple cloud servers.

Latest Activities

Alibaba Cloud – VPC (Virtual Private Cloud)

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- VPC
- Overview
- VPC
- NAT Gateway
- Global Acceleration
- VPN
- VPN Gateway
- Customer Gateway
- VPN Connection
- Quick Links
- Express Connect
- Elastic IP Address
- ECS Security Groups
- Documentation

China North 1 (Qingdao)
China North 2 (Beijing)
China North 3 (Zhangjiakou)
China North 5 (Huhehaote)

Refresh Create VPC

China East 1 (Hangzhou)
China East 2 (Shanghai)
China South 1 (Shenzhen)
Hong Kong(China)

Asia Pacific NE 1 (Japan)
Singapore
Asia Pacific SE 2 (Sydney)
Asia Pacific SE 3 (Kuala Lumpur)

Asia Pacific SE 5 (Jakarta)
Asia Pacific SOU 1 (Mumbai)
US East 1 (Virginia)
US West 1 (Silicon Valley)

Middle East 1 (Dubai)
Germany 1 (Frankfurt)

VPC ID/Name	CIDR	Status	Description	Created At	Default VPC	Actions
vpc-gw88r05o261cn5bghd8cl Test_VPC_01	10.0.0.0/8	Available	For Troopers confere...	2018-01-10 20:26:38	No	Manage Edit Delete

Total: 1 item(s), Per Page: 10 item(s)

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VPC Details

Enable ClassicLink Edit VPC Delete

VPC Info

Name: Test_VPC_01	ID: vpc-gw88r05o261cn5bghd8cl	Status: Available
Region: Germany 1 (Frankfurt)	CIDR block: 10.0.0.0/8	Creation At: 2018-01-10 20:26:38
Default VPC: No	Description: For Troopers conference	ClassicLink Disabled

Resource Allocation Information

ECS: 2	Server Load Balancer: -	VSwitch: 2
Security Group: 2		

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VPC Details VRouters VSwitches

VRouter Information

You can create up to **48** custom route entries in a route table. Refresh Add Route Entry

VRouter Basic Information

Name: -	ID: vrt-gw8mvpwohhnauq9vx537q	Created At: 2018-01-10 20:26:38
Description: -		

Route Entry List

Route Table ID	Status	Destination CIDR Block	Next Hop	Next Hop Type	Type	Actions
vtb-gw8sucsg3j470hjh8i6br	Available	0.0.0.0/0	Instance ID:ngw-gw8c5w4107uf3fhmnvfb	-	Custom	Delete
vtb-gw8sucsg3j470hjh8i6br	Available	10.10.0.0/16	-	-	System	-
vtb-gw8sucsg3j470hjh8i6br	Available	10.20.0.0/16	-	-	System	-
vtb-gw8sucsg3j470hjh8i6br	Available	100.64.0.0/10	-	-	System	-

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VSwitch List
You can create 24 VSwitches at most for a VPC. Refresh Create VSwitch

VSwitch ID ▾

Enter a VSwitch ID to search the VSwitch.

Search

VSwitch ID/Name	Number of ECS Instances	CIDR	Status	Zone	Number of Available Private IPs	Created At	Default VSwitch	Description	Actions
vsw-gw8lc4gqcp50jawfab3ig vSwitch02	1	10.20.0.0/16	Available	Germany 1 Zone A	65530	2018-01-10 20:28:12	No		Edit Delete Create an Instance ▾
vsw-gw8s1hsf95o1xxzqgvwp1 vSwitch01	1	10.10.0.0/16	Available	Germany 1 Zone A	65531	2018-01-10 20:27:54	No		Edit Delete Create an Instance ▾

Total: 2 item(s), Per Page: 10 item(s)

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Elastic IP Address

Elastic IP Addresses

Elastic IP Address List

China North 1 (Qingdao)
China North 2 (Beijing)
China North 3 (Zhangjiakou)
China North 5 (Huhehaote)
China East 1 (Hangzhou)
China East 2 (Shanghai)

China South 1 (Shenzhen)
Hong Kong(China)
Asia Pacific NE 1 (Japan)
Singapore
Asia Pacific SE 2 (Sydney)
Asia Pacific SE 3 (Kuala Lumpur)
Asia Pacific SE 5 (Jakarta)

Asia Pacific SOU 1 (Mumbai)
US East 1 (Virginia)
US West 1 (Silicon Valley)
Middle East 1 (Dubai)
Germany 1 (Frankfurt)

Refresh Create EIP

Elastic IP Address ▾

Search

Export

Instance ID	IP Address	Monitoring	Bandwidth	Billing Method(All) ▾	Status(All) ▾	Instance Bound	Instance Type	Actions
<input type="checkbox"/> eip-gw8ag7xk1cfztq7cnc2h8	47.254.133.15		Pay by Traffic 50Mbps	Pay-As-You-Go Created at 2018-02-22 12:50:49	Available	-	-	Bind Unbind More ▾
<input type="checkbox"/> eip-gw8jsdjwwj5fa2zc0eaf	47.91.91.93		Pay by Traffic 1Mbps	Pay-As-You-Go Created at 2018-02-22 09:49:06	Available	-	-	Bind Unbind More ▾
<input type="button" value="Unbind"/> <input type="button" value="Release"/>		Total: 2 item(s), Per Page: 10 item(s) « < 1 > » 						

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VPC

- Overview
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- NAT Gateway
- Global Acceleration
- VPN
 - VPN Gateway
 - Customer Gateway
 - VPN Connection
- Quick Links
 - Express Connect
 - Elastic IP Address
 - ECS Security Groups
 - Documentation

China North 1 (Qingdao)
China North 2 (Beijing)
China North 3 (Zhangjiakou)
China North 5 (Huhehaote)

Refresh Create NAT Gateway

China East 1 (Hangzhou)
China East 2 (Shanghai)
China South 1 (Shenzhen)
Hong Kong(China)

Asia Pacific NE 1 (Japan)
Singapore
Asia Pacific SE 2 (Sydney)
Asia Pacific SE 3 (Kuala Lumpur)

Asia Pacific SE 5 (Jakarta)
Asia Pacific SOU 1 (Mumbai)
US East 1 (Virginia)
US West 1 (Silicon Valley)

Middle East 1 (Dubai)
Germany 1 (Frankfurt)

ID/Name	VPC	DNAT Entry	SNAT Entry	SNAT Connections	Shared Bandwidth Package	Specification	Status(All)	Created At	Actions
ngw-gw8c5w4107uf3fhmnmvfb1	vpc-gw88r05o261cn5bghd8cl	Configure DNAT	Configure SNAT		Buy Shared Bandwidth Package	Small	All	2018-02-22 09:40:19	Manage More ▾

Total: 1 item(s), Per Page: 20 item(s)

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Billing Management
...
English

- Server Load Balancer
- Instances
- Certificates
- Tags
- Logs
- Access Log
- Health Check Log
- Documentation

SLB Billing

Starting April 1, 2018, Alibaba Cloud SLB will offer guaranteed-performance instances. These instances will be billed based on the instance type. Shared-performance instances are still available for purchase in the console. You can follow up on Alibaba Cloud announcements and notifications about billing changes made to SLB instances. [Learn more about how to use guaranteed-performance instances, see View Details](#)

Instances

China North 1 (Qingdao)

China North 2 (Beijing)

China North 3 (Zhangjiakou)

China North 5 (Huhehaote)

China East 1 (Hangzhou)

China East 2 (Shanghai)

China South 1 (Shenzhen)

Hong Kong(China)

Asia Pacific NE 1 (Japan)

Singapore

Asia Pacific SE 2 (Sydney)

Asia Pacific SE 3 (Kuala Lumpur)

Asia Pacific SE 5 (Jakarta)

Asia Pacific SOU 1 (Mumbai)

US East 1 (Virginia)

US West 1 (Silicon Valley)

Middle East 1 (Dubai)

Germany 1 (Frankfurt)

Refresh Create Server Load Balancer

Server Load Balancer Name: Search Tag

Server Load Balancer ID/Name	Zone	IP Address(All)	Status	Network(All)	Port/Health Check	Backend Server	Instance Specification	Bandwidth Billing Method(All)	Billing Method(All)	Actions
<input type="checkbox"/> lb-4xok6yisb... (None)	eu-central-1a(Master) eu-central-1b(Slave)	47.91.65.19(Public IP)	Running	Classic Network	No Listener Configure	Not Configured Configure	Shared-Performance Instance	Pay by Traffic	Pay-As-You-Go 2018-02-22 09:42:58 Created	Manage More

Start Stop Release Edit Tags

Total Instances: 1

Total: 1 item(s), Per Page: item(s)

Alibaba Cloud – Summary

Cloud Network Building Blocks (VPC)

- Networks / Subnets
- Switching
- Routing
- VPN
- Public IPs
- NAT
- Load Balancer

Alibaba Cloud – Summary

IPv6

- No IPv6 support
- Roadmap: «*I am sorry but currently we do not have a very specific plan on this. But your voice will be heard, I will transfer your request to product team to let them consider*»
- Recommendation: «*If you are using ECS, you could make some configuration to use some iptunnels to take use of third ipv6 service providers to setup ipv6 service*»
- <https://www.alibabacloud.com/forum/read-751?spm=a3c0i.100421418.0.0.Yrru9M>

4. Click "Create Tunnel" and the tunnel will be ready.

Tunnel Details

IPv6 Tunnel | Example Configurations | Advanced

Tunnel ID: 361513 Delete Tunnel

Creation Date: Sep 5, 2016

Description: mf8.biz 测试用 ipv6

IPv6 Tunnel Endpoints

Server IPv4 Address: ..74

Server IPv6 Address: 2001:1f04:848::1/64

Client IPv4 Address: ..67

Amazon Web Services - Dashboard

The screenshot displays the AWS Management Console dashboard. At the top, the AWS logo is on the left, and navigation links for 'Services', 'Resource Groups', and a star icon are in the center. On the right, there are links for 'AWK Test Account', 'Ohio', and 'Support'. The main content area is titled 'AWS services' and features a search bar with the placeholder text 'Find a service by name or feature (for example, EC2, S3 or VM, storage)'. Below the search bar, there are two sections: 'Recently visited services' and 'All services'. The 'All services' section is organized into several categories:

- Compute:** EC2, Lightsail, Elastic Container Service, Lambda, Batch, Elastic Beanstalk.
- Storage:** S3, EFS, Glacier, Storage Gateway.
- Database:** Relational Database Service, DynamoDB, ElastiCache, Amazon Redshift.
- Management Tools:** CloudWatch, AWS Auto Scaling, CloudFormation, CloudTrail, Config, OpsWorks, Service Catalog, Systems Manager, Trusted Advisor, Managed Services.
- Mobile Services:** Mobile Hub, AWS AppSync, Device Farm, Mobile Analytics.
- AR & VR:** Amazon Sumerian.
- Application Integration:** Step Functions, Amazon MQ, Simple Notification Service, Simple Queue Service, SWF.
- Media Services:** Elastic Transcoder, Kinesis Video Streams, MediaConvert, MediaLive, MediaPackage, MediaStore, MediaTailor.

On the right side of the dashboard, there are 'Helpful tips' and 'Explore AWS' sections. The 'Helpful tips' section includes:

- Manage your costs:** Get real-time billing alerts based on your cost and usage budgets. [Start now](#)
- Create an organization:** Use AWS Organizations for policy-based management of multiple AWS accounts. [Start now](#)

The 'Explore AWS' section features:

- Amazon Relational Database Service (RDS):** RDS manages and scales your database for you. RDS supports Aurora, MySQL, PostgreSQL, MariaDB, Oracle, and SQL Server. [Learn more.](#)
- Real-Time Analytics with Amazon Kinesis:** Stream and analyze real-time data, so you can get timely insights and react quickly. [Learn more.](#)
- Get Started with Containers on AWS:** Amazon ECS helps you build and scale containers for any size application. [Learn more.](#)
- AWS Marketplace**

Amazon Web Services – VPC Wizard

Step 2: VPC with Public and Private Subnets

IPv4 CIDR block: (65531 IP addresses available)

IPv6 CIDR block: No IPv6 CIDR Block Amazon provided IPv6 CIDR block

VPC name:

Public subnet's IPv4 CIDR: (251 IP addresses available)

Public subnet's IPv6 CIDR:
 xxxx:xxxx:xxxx:xx00::/64

Availability Zone:

Public subnet name:

Private subnet's IPv4 CIDR: (251 IP addresses available)

Private subnet's IPv6 CIDR:
 xxxx:xxxx:xxxx:xx01::/64

Availability Zone:

Private subnet name:

You can add more subnets after AWS creates the VPC.

Specify the details of your NAT gateway (NAT gateway rates apply). [Use a NAT instance instead](#)

Elastic IP Allocation ID:

Service endpoints

Enable DNS hostnames: Yes No

Hardware tenancy:

Amazon Web Services – VPC

The screenshot shows the AWS VPC console interface. At the top, there's a navigation bar with 'aws', 'Services', 'Resource Groups', and account information. On the left is a sidebar with navigation options like 'VPC Dashboard', 'Virtual Private Cloud', 'Your VPCs', 'Subnets', etc. The main area displays a table of VPCs. One VPC, 'VPC-Ohio-01', is selected, and its 'IPv6 CIDR' field is highlighted with a yellow box. Below the table, the details for 'vpc-a010b7c8 | VPC-Ohio-01' are shown, including a 'Summary' tab and various configuration parameters.

Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR	DHCP options set	Route table	Network ACL	Tenancy
VPC-Ohio-01	vpc-a010b7c8	available	10.1.0.0/16	2600:1f16:294:f000::/56	dopt-a2d10eca	rtb-7509981d	acl-6468d20c	Default

vpc-a010b7c8 | VPC-Ohio-01

Summary | CIDR Blocks | Flow Logs | Tags

- VPC ID:** vpc-a010b7c8 | VPC-Ohio-01
- State:** available
- IPv4 CIDR:** 10.1.0.0/16
- IPv6 CIDR:** 2600:1f16:294:f000::/56
- DHCP options set:** dopt-a2d10eca
- Route table:** rtb-7509981d
- Network ACL:** acl-6468d20c
- Tenancy:** Default
- DNS resolution:** yes
- DNS hostnames:** yes

Amazon Web Services – VPC Subnets

The screenshot shows the AWS Management Console interface for VPC Subnets. The left sidebar contains navigation options like 'VPC Dashboard', 'Virtual Private Cloud', 'Subnets', 'Route Tables', etc. The main area displays a table of subnets with columns for Name, Subnet ID, State, VPC, IPv4 CIDR, Available IPv4, IPv6 CIDR, Availability Zone, Route Table, and Net. Two subnets are listed: 'Private Subnet 20' and 'Public Subnet 10'. The 'Private Subnet 20' is selected, and its configuration details are shown in the 'Summary' tab below the table.

Name	Subnet ID	State	VPC	IPv4 CIDR	Available IPv4	IPv6 CIDR	Availability Zone	Route Table	Net
Private Subnet 20	subnet-722fc808	available	vpc-a010b7c8 VPC-Ohio-01	10.1.20.0/24	251	2600:1f16:294:f...	us-east-2b	rtb-7509981d	acl-
Public Subnet 10	subnet-212dca5b	available	vpc-a010b7c8 VPC-Ohio-01	10.1.10.0/24	249	2600:1f16:294:f...	us-east-2b	rtb-7609981e	acl-

subnet-722fc808 | Private Subnet 20

Summary | Route Table | Network ACL | Flow Logs | Tags

- Subnet ID:** subnet-722fc808 | Private Subnet 20
- Availability Zone:** us-east-2b
- IPv4 CIDR:** 10.1.20.0/24
- IPv6 CIDR:** 2600:1f16:294:f020::/64
- Route table:** rtb-7509981d
- State:** available
- Network ACL:** acl-6468d20c
- VPC:** vpc-a010b7c8 | VPC-Ohio-01
- Default subnet:** no
- Available IPs:** 251
- Auto-assign Public IP:** no
- Auto-assign IPv6 address:** no

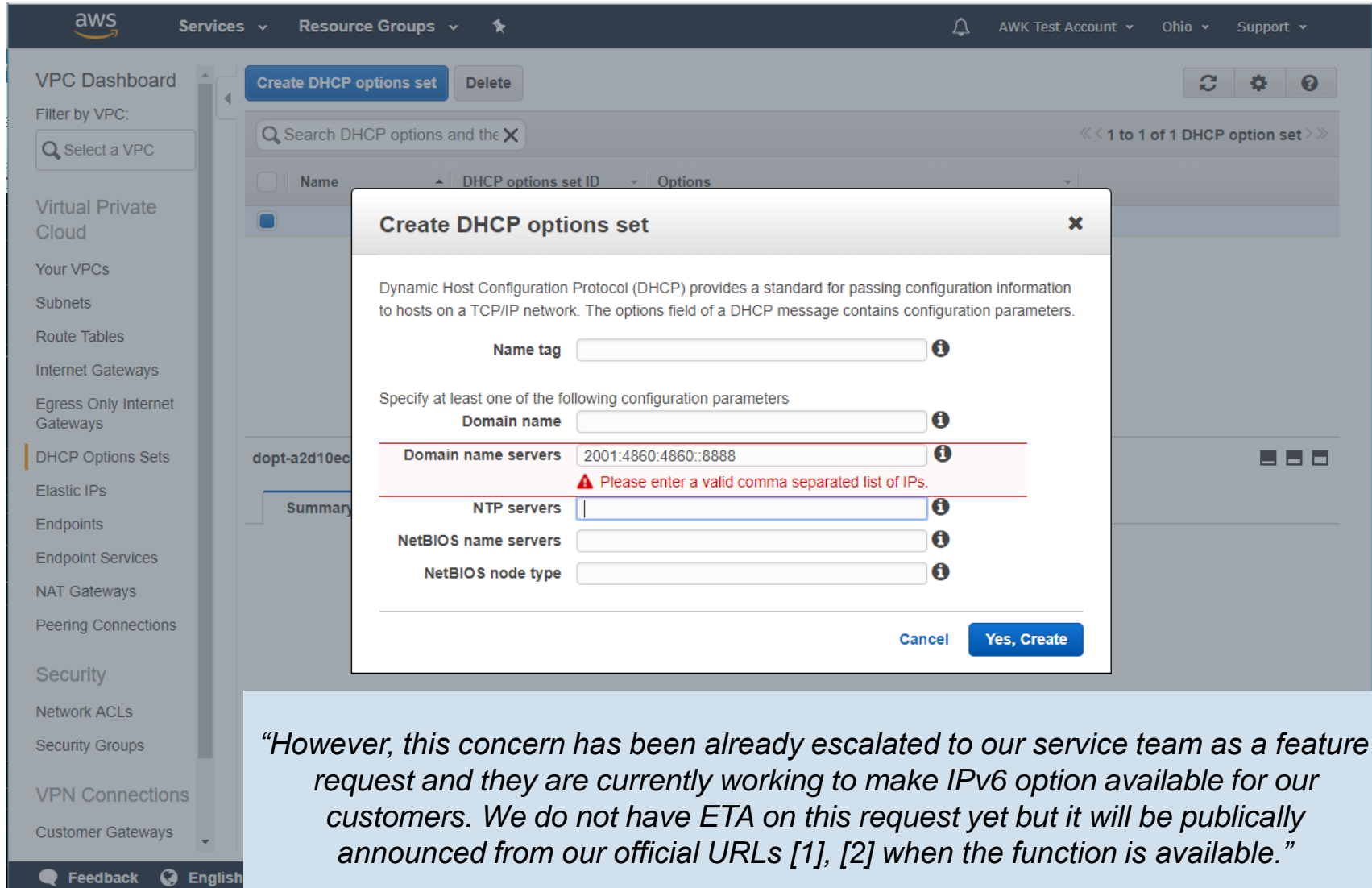
Amazon Web Services – Routing Table

The screenshot shows the AWS Management Console interface for the 'Route Tables' section of a VPC. The top navigation bar includes the AWS logo, 'Services', 'Resource Groups', and account information. The left sidebar lists various VPC services, with 'Route Tables' highlighted. The main content area shows a list of route tables with columns for Name, Route Table ID, Explicitly Associated, Main, and VPC. Below the list, the details for route table 'rtb-7609981e' are shown, including tabs for Summary, Routes, Subnet Associations, Route Propagation, and Tags. The 'Routes' tab is active, displaying a table of routes with columns for Destination, Target, Status, and Propagated.

Name	Route Table ID	Explicitly Associated	Main	VPC
<input checked="" type="checkbox"/>	rtb-7609981e	1 Subnet	No	vpc-a010b7c8 VPC-Ohio-01
<input type="checkbox"/>	rtb-7509981d	0 Subnets	Yes	vpc-a010b7c8 VPC-Ohio-01

Destination	Target	Status	Propagated
10.1.0.0/16	local	Active	No
2600:1f16:294:f000::/56	local	Active	No
0.0.0.0/0	igw-71eed518	Active	No
::/0	igw-71eed518	Active	No

Amazon Web Services – DHCP Options



Create DHCP options set

Dynamic Host Configuration Protocol (DHCP) provides a standard for passing configuration information to hosts on a TCP/IP network. The options field of a DHCP message contains configuration parameters.

Name tag

Specify at least one of the following configuration parameters

Domain name

Domain name servers **Please enter a valid comma separated list of IPs.**

NTP servers

NetBIOS name servers

NetBIOS node type

Cancel **Yes, Create**

“However, this concern has been already escalated to our service team as a feature request and they are currently working to make IPv6 option available for our customers. We do not have ETA on this request yet but it will be publically announced from our official URLs [1], [2] when the function is available.”

Amazon Web Services – Route 53 (DNS)

The screenshot displays the AWS Route 53 console interface. The top navigation bar includes the AWS logo, 'Services', 'Resource Groups', and account information for 'AWK Test Account' in the 'Global' region. The left sidebar lists navigation options: Dashboard, Hosted zones (selected), Health checks, Traffic flow, Traffic policies, Policy records, Domains, Registered domains, and Pending requests. The main content area features three buttons: 'Create Hosted Zone' (highlighted in blue), 'Go to Record Sets', and 'Delete Hosted Zone'. Below these is a search bar and a filter dropdown set to 'All Types'. A table displays three hosted zones:

Domain Name	Type	Record Set Count	Comment	Hosted Zone ID
<input type="radio"/> troopers.muellega.net.	Public	4	for TR18	Z2WNU2JQ9V1FDF
<input type="radio"/> 223.221.18.in-addr.arpa.	Public	3	For Troopers	Z170RX9U3ZGFVW
<input type="radio"/> 0.f.4.9.2.0.6.1.f.1.0.0.6.2.ip6.arpa.	Public	3	For Troopers	ZVSIHYDCZD9

The bottom of the console shows a footer with 'Feedback', 'English (US)', and copyright information for Amazon Web Services, Inc. (2008-2018), along with links to 'Privacy Policy' and 'Terms of Use'.

Amazon Web Services – Route 53 (DNS)

The screenshot displays the AWS Route 53 console interface. At the top, there are navigation buttons: "Back to Hosted Zones", "Create Record Set", "Import Zone File", "Delete Record Set", and "Test Record Set". Below these is a search bar for "Record Set Name" and filters for "Any Type", "Aliases Only", and "Weighted Only". A table lists the record sets for the domain "troopers.muellega.net".

Name	Type	Value	Evaluate Target Health	Health
troopers.muellega.net.	NS	ns-215.awsdns-26.com. ns-1606.awsdns-08.co.uk. ns-1323.awsdns-37.org. ns-655.awsdns-17.net.	-	-
troopers.muellega.net.	SOA	ns-215.awsdns-26.com. awsdns-hostmaster.amazon	-	-
server1.troopers.muellega.net.	A	18.221.223.127	-	-
server1.troopers.muellega.net.	AAAA	2600:1f16:294:f010:4e99:5e50:47b:b11	-	-

A dropdown menu on the left side of the console shows the following options:

- A – IPv4 address (selected)
- CNAME – Canonical name
- MX – Mail exchange
- AAAA – IPv6 address
- TXT – Text
- PTR – Pointer
- SRV – Service locator
- SPF – Sender Policy Framework
- NAPTR – Name Authority Pointer
- CAA – Certification Authority Authorization
- NS – Name server
- SOA – Start of authority

Amazon Web Services – IPv6 PTR

```
C:\Users\Mug>nslookup server1.troopers.muellega.net ns-215.awsdns-26.com
```

```
Server: UnKnown
```

```
Address: 2600:9000:5300:d700::1
```

```
Name: server1.troopers.muellega.net
```

```
Addresses: 2600:1f16:294:f010:4e99:5e50:47b:b11  
18.221.223.127
```

```
C:\Users\Mug>nslookup -type=ptr 2600:1f16:294:f010:4e99:5e50:47b:b11 ns-1318.awsdns-  
36.org
```

```
Server: UnKnown
```

```
Address: 2600:9000:5305:2600::1
```

```
1.1.b.0.b.7.4.0.0.5.e.5.9.9.e.4.0.1.0.f.4.9.2.0.6.1.f.1.0.0.6.2.ip6.arpa name
```

```
= server1.troopers.muellega.net
```

```
0.f.4.9.2.0.6.1.f.1.0.0.6.2.ip6.arpa nameserver = ns-1318.awsdns-36.org
```

Amazon Web Services – IPv6 PTR

After request to AWS support PTR record was set and can be resolved by public DNS server

```
C:\Users\Mug>nslookup server1.troopers.muellega.net
Server:  AD10.awkgroup.com
Address:  10.1.71.50

Nicht autorisierende Antwort:
Name:     server1.troopers.muellega.net
Addresses:  2600:1f16:294:f010:4e99:5e50:47b:b11
           18.221.223.127

C:\Users\Mug>nslookup -type=ptr 2600:1f16:294:f010:4e99:5e50:47b:b11
Server:  AD10.awkgroup.com
Address:  10.1.71.50

Nicht autorisierende Antwort:
1.1.b.0.b.7.4.0.0.5.e.5.9.9.e.4.0.1.0.f.4.9.2.0.6.1.f.1.0.0.6.2.ip6.arpa
= server1.troopers.muellega.net

C:\Users\Mug>
```

Amazon Web Services – VPN Connections

Customer Gateways > Create Customer Gateway

Create Customer Gateway

Specify the Internet-routable IP address for your gateway's external interface; the address must be static and may be behind a device performing network address translation (NAT). For dynamic routing, also specify your gateway's Border Gateway Protocol (BGP) Autonomous System Number (ASN); this can be either a public or private ASN (such as those in the 64512-65534 range).

Name

Routing Dynamic Static

IP Address*

Must be a valid public IP address.

[Cancel](#) [Create Customer Gateway](#)

« You are right in saying that, at present AWS VPN service does not support IPv6. However, we already have a feature request to add IPv6 support on VPN connection, as per our customers demand. »

Feedback English (US) © 2008 - 2018, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use

Amazon Web Services – Summary

Within the group of analyzed cloud service providers AWS offers the most advanced IPv6 services and functionalities, and this by far. Limitations observed:

- No IPv6 VPN support yet
- No DHCPv6 support yet
- /56 as maximum VPC size

«And also we've found that there's no feature request raised by other users yet.. so if you like, I can raise feature request on-behalf of you.

*In order to do that I will need to have your use cases and justification why you need /48 CIDR range over /56. As you may know IPv6 /56 offers 256 subnets in VPC and /48 offers 65,536 subnets, so you will need to explain why you are required to have more than 256 subnets.
Detailed information will be great.... »*

Google Cloud Platform – Dashboard

The screenshot displays the Google Cloud Platform dashboard for a project named 'My Project 25225'. The interface is organized into several key sections:

- Navigation:** A left sidebar lists various services and products, including VPC network, Compute Engine, Network services, Cloud Launcher, Billing, APIs & Services, Support, IAM & admin, and Getting started. A 'PRODUCTS' section is also visible.
- Project Info:** A central panel provides details about the project:
 - Project name: My Project 25225
 - Project ID: root-quasar-187714
 - Project number: 1021535128747
- Compute Engine:** A graph shows CPU usage (%) over time, with a notable spike around 8:30 AM. The y-axis ranges from 2e-3 to 10e-3. A legend indicates the data is for 'instance/cpu/utilization'.
- Billing:** A section showing 'Estimated charges' for the billing period Feb 1 – 28, 2018, with a total of -CHF0.04.
- Error Reporting:** A section indicating 'No sign of any errors. Have you set up Error Reporting?' with a link to learn how to set it up.
- Getting Started:** A list of tasks for new users, such as 'Enable APIs and get credentials like keys', 'Deploy a prebuilt solution', and 'Add dynamic logging to a running application'.
- APIs:** A graph showing 'Requests (requests/sec)' over time, with a y-axis ranging from 0.0155 to 0.0175. A legend indicates the data is for 'Requests'.

Google Cloud Platform – VPC

The screenshot displays the Google Cloud Platform interface for VPC network details. The top navigation bar includes the Google Cloud Platform logo, the project name 'My Project 25225', and a search bar. The left sidebar contains navigation options: VPC network, VPC networks (selected), External IP addresses, Firewall rules, Routes, VPC network peering, and Shared VPC. The main content area shows the details for 'vpc-01', including its description 'For Troopers conference', subnet creation mode 'Custom subnets', and dynamic routing mode 'Regional'. Below this, there are tabs for 'Subnets', 'Static internal IP addresses', 'Firewall rules', 'Routes', and 'VPC Network Peering'. The 'Subnets' tab is active, showing a table with columns for Name, Region, IP address ranges, Gateway, and Private Google access. Two subnets are listed: 'subnet10' and 'subnet20', both in the 'europe-west1' region. At the bottom, there is a link for 'Equivalent REST'.

<input type="checkbox"/> Name ^	Region	IP address ranges	Gateway	Private Google access
<input type="checkbox"/> subnet10	europe-west1	10.1.10.0/24	10.1.10.1	Disabled
<input type="checkbox"/> subnet20	europe-west1	10.1.20.0/24	10.1.20.1	Disabled

Google Cloud Platform – Load balancing

Google Cloud Platform My Project 25225

Network services

- Load balancing
- Cloud DNS
- Cloud CDN

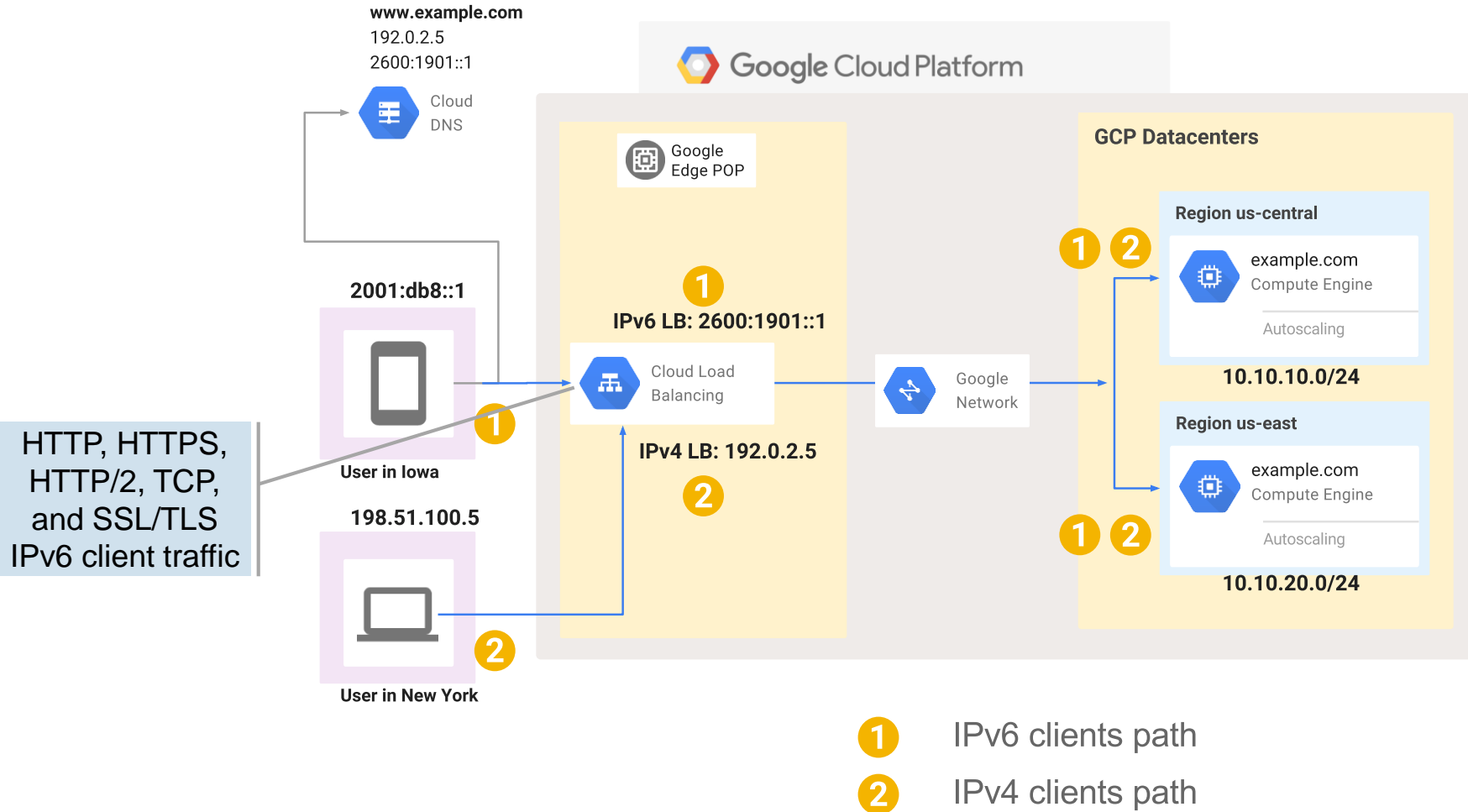
Load balancing + CREATE LOAD BALANCER REFRESH

Load balancers Backends Frontends

Load balancer	Protocol																											
<div style="display: flex; justify-content: space-between; align-items: center;"> ✔ load-balancer-1 Details Monitoring Caching </div> <p>Frontend</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Protocol ^</th> <th style="width: 40%;">IP:Port</th> <th style="width: 40%;">Certificate</th> </tr> </thead> <tbody> <tr> <td>HTTP</td> <td>35.201.74.146:80</td> <td>—</td> </tr> <tr> <td>HTTP</td> <td>[2600:1901:0:127b::]:80</td> <td>—</td> </tr> </tbody> </table> <p>Host and path rules</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Hosts ^</th> <th style="width: 30%;">Paths</th> <th style="width: 40%;">Backend</th> </tr> </thead> <tbody> <tr> <td>All unmatched (default)</td> <td>All unmatched (default)</td> <td>backend-service-1</td> </tr> </tbody> </table> <p>Backend</p> <p>Backend services</p> <p>1. backend-service-1</p> <p>Endpoint protocol: HTTP Named port: http Timeout: 30 seconds Health check: health-check-1 Session affinity: None Cloud CDN: disabled</p> <p>⌵ Advanced configurations</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Instance group ^</th> <th style="width: 15%;">Zone</th> <th style="width: 15%;">Healthy</th> <th style="width: 15%;">Autoscaling</th> <th style="width: 15%;">Balancing mode</th> <th style="width: 15%;">Capacity</th> </tr> </thead> <tbody> <tr> <td>instance-group-1</td> <td>us-east1-b</td> <td>1 / 1</td> <td>Target CPU usage 60%</td> <td>Max CPU: 80%</td> <td>100%</td> </tr> </tbody> </table>		Protocol ^	IP:Port	Certificate	HTTP	35.201.74.146:80	—	HTTP	[2600:1901:0:127b::]:80	—	Hosts ^	Paths	Backend	All unmatched (default)	All unmatched (default)	backend-service-1	Instance group ^	Zone	Healthy	Autoscaling	Balancing mode	Capacity	instance-group-1	us-east1-b	1 / 1	Target CPU usage 60%	Max CPU: 80%	100%
Protocol ^	IP:Port	Certificate																										
HTTP	35.201.74.146:80	—																										
HTTP	[2600:1901:0:127b::]:80	—																										
Hosts ^	Paths	Backend																										
All unmatched (default)	All unmatched (default)	backend-service-1																										
Instance group ^	Zone	Healthy	Autoscaling	Balancing mode	Capacity																							
instance-group-1	us-east1-b	1 / 1	Target CPU usage 60%	Max CPU: 80%	100%																							

To edit load balancing resources like forwarding rules and target proxies, go to the advanced menu

Google Cloud Platform – Load balancing



Source: <https://cloud.google.com/compute/docs/load-balancing/ipv6>

Google Cloud Platform – External IP addresses

Google Cloud Platform My Project 25225

VPC network

External IP addresses [+ RESERVE STATIC ADDRESS](#) [REFRESH](#) [RELEASE STATIC ADDRESS](#)

<input type="checkbox"/>	Name	External Address	Region	Type ▾	Version	In use by	Labels
<input type="checkbox"/>	–	2600:1901:0:127b::		Ephemeral ▾	IPv6	Forwarding rule load-balancer-1-forwarding-rule-2	
<input type="checkbox"/>	–	35.201.74.146		Ephemeral ▾	IPv4	Forwarding rule load-balancer-1-forwarding-rule	
<input type="checkbox"/>	–	35.229.112.217	us-east1	Ephemeral ▾	IPv4	VM instance instance-group-1-25sd (Zone b)	

<|

Google Cloud Platform – DNS

Google Cloud Platform My Project 25225

Network services

- Load balancing
- Cloud DNS
- Cloud CDN

← Zone details
 EDIT
 ADD RECORD SET
 DELETE ZONE

dns-01 [Registrar Setup](#)

DNS name: `troopersgpc.muellega.net`.

for Troopers conference

Record sets

Add record set
Delete record sets

<input type="checkbox"/> DNS name ^	Type	TTL (seconds)	Data	
troopersgpc.muellega.net.	NS	21600	ns-cloud-c1.googledomains.com. ns-cloud-c2.googledomains.com. ns-cloud-c3.googledomains.com. ns-cloud-c4.googledomains.com.	
troopersgpc.muellega.net.	SOA	21600	ns-cloud-c1.googledomains.com. cloud-dns-hostmaster.google.com. 1 21600 3600 259200 300	
<input type="checkbox"/> lb01.troopersgpc.muellega.net.	A	300	35.201.74.146	
<input type="checkbox"/> lb01.troopersgpc.muellega.net.	AAAA	300	2600:1901:0:127b::	
<input type="checkbox"/> server1.troopersgpc.muellega.net.	A	300	35.229.112.217	

Equivalent REST

Cloud Launcher

Google Cloud Platform – DNS

```
C:\Users\Mug>nslookup lb01.troopersgpc.muellega.net
Server: AD10.awkgroup.com
Address: 10.1.71.50

Nicht autorisierende Antwort:
Name: lb01.troopersgpc.muellega.net
Addresses: 2600:1901:0:127b::
           35.201.74.146

C:\Users\Mug>
```

«I understand that you want to use IPv6 on Google Compute Engine instances for PTR entry, however GCE is not supporting IPv6 on instances only IPv4, currently Google Cloud Platform only supports IPv6 clients with HTTP(S), SSL Proxy and TCP proxy load balancing.

Google Cloud Platform does not have an ETA for this feature but I would like to suggest you to follow this blog...»

Google Cloud Platform – Summary

No IPv6 support in the VPC

- For selected protocols one can terminate IPv6 traffic at a load balancer
- This is achieved by using NAT64, traffic is then forwarded over IPv4 to the GCP compute instances within the VPC
- GCP DNS support for IPv6 is limited (no PTR records)

Microsoft Azure – Dashboard

The screenshot displays the Microsoft Azure dashboard interface. At the top, there is a search bar with the text "Search resources, services and docs". The user's profile "mug@awk.ch" and "AWK GROUP AG" are visible in the top right corner. The left sidebar contains navigation options such as "Create a resource", "All services", and "FAVORITES". The main content area shows a list of services under the heading "All services".

The services are organized into two main categories:

- GENERAL (11)**
 - Dashboard (★)
 - All resources (★)
 - Cost Management + Billing (PREVIEW ★)
 - Marketplace (★)
 - Recent (★)
 - What's new (★)
 - Resource groups (★)
 - Subscriptions (★)
 - Reservations (★)
 - Help + support (★)
 - Tags (★)
- COMPUTE (20)**
 - Virtual machines (★)
 - Virtual machine scale sets (★)
 - Batch accounts (★)
 - Cloud services (classic) (★)
 - Container groups (PREVIEW ★)
 - Disks (★)
 - Images (★)
 - OS images (classic) (★)
 - Citrix XenDesktop Essentials (★)
 - Virtual machines (classic) (★)
 - Container services (★)
 - Service Fabric clusters (★)
 - Container registries (★)
 - Availability sets (★)
 - Snapshots (★)
 - Disks (classic) (★)
 - VM images (classic) (★)
 - Citrix XenApp Essentials (★)

Microsoft Azure – Virtual Network

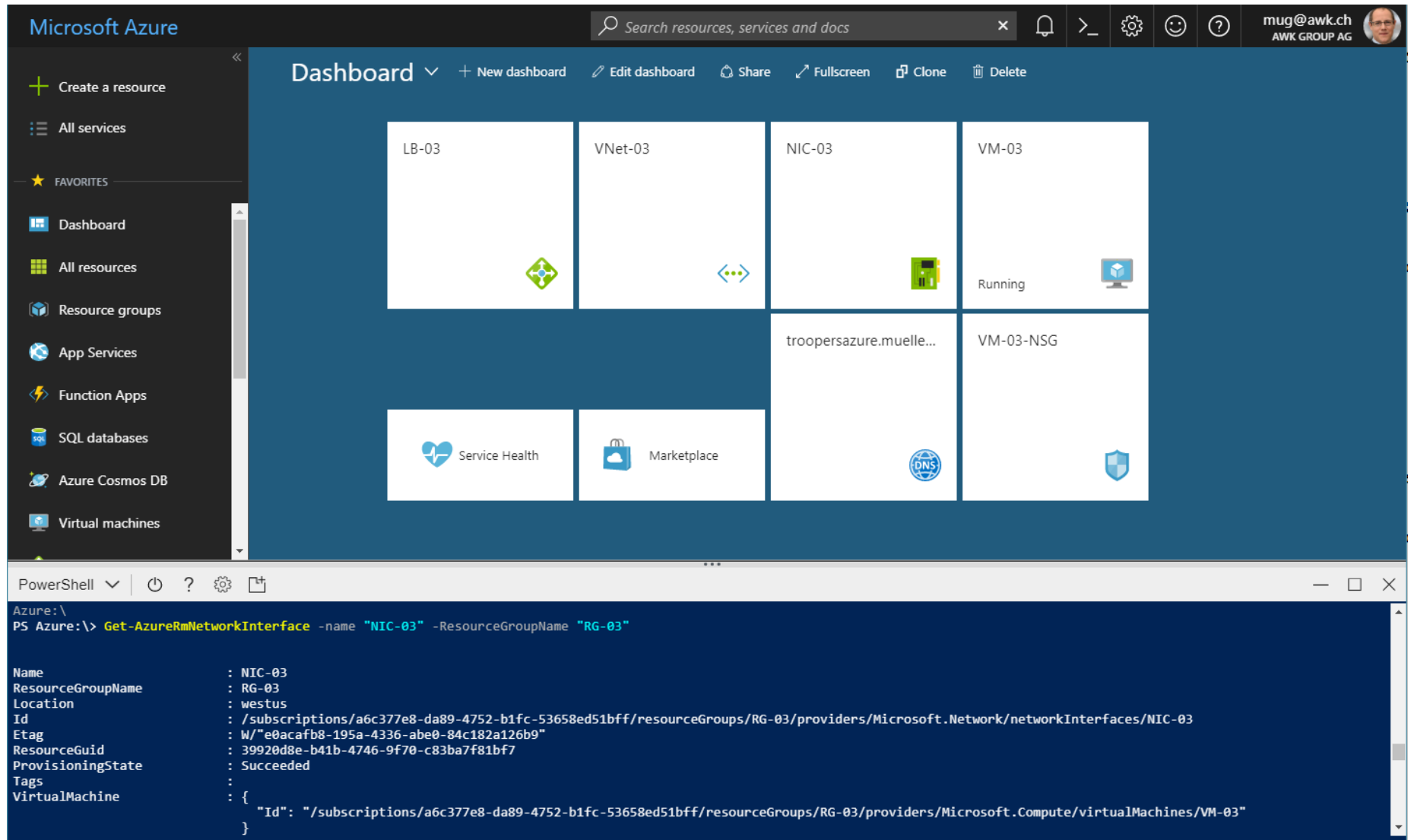
The screenshot displays the Microsoft Azure portal interface for creating a virtual network. The left sidebar shows navigation options like 'Create a resource', 'All services', and 'FAVORITES'. The main content area is titled 'Create virtual network' and contains the following form fields:

- Name:** An empty text input field.
- Address space:** A text input field containing '10.0.0.0/16', with a tooltip showing '10.0.0.0 - 10.0.255.255 (65536 addresses)'.
- Subscription:** A dropdown menu set to 'Pay-As-You-Go'.
- Resource group:** Radio buttons for 'Create new' (selected) and 'Use existing', followed by an empty text input field.
- Location:** A dropdown menu set to 'West US'.
- Subnet:**
 - Name:** A text input field containing 'default'.
 - Address range:** A text input field containing '10.0.0.0/24', with a tooltip showing '10.0.0.0 - 10.0.0.255 (255 addresses)'.
- Service endpoints:** Two buttons, 'Disabled' (highlighted in blue) and 'Enabled'.

A callout box on the right side of the form contains the following text:

« We certainly understand that this is a highly requested feature, and we are working diligently to deliver this across the networking platform. Unfortunately, we do not currently have an ETA on when this feature will be available, but it is a high priority. »

Microsoft Azure – Load balancer solution (1/2)

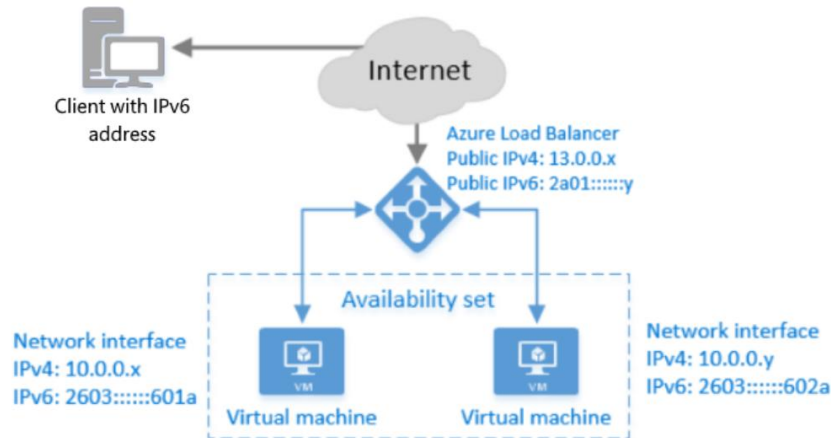


The screenshot displays the Microsoft Azure portal interface. The top navigation bar includes the search bar, user profile (mug@awk.ch), and various utility icons. The left sidebar shows navigation options like 'Create a resource', 'All services', and 'FAVORITES'. The main dashboard area is titled 'Dashboard' and contains several resource tiles: 'LB-03', 'VNet-03', 'NIC-03', 'VM-03' (status: Running), 'troopersazure.muelle...', 'VM-03-NSG', 'Service Health', and 'Marketplace'. At the bottom, a PowerShell terminal window is open, showing the command and its output:

```
PS Azure:\> Get-AzureRmNetworkInterface -name "NIC-03" -ResourceGroupName "RG-03"

Name                : NIC-03
ResourceGroupName   : RG-03
Location            : westus
Id                  : /subscriptions/a6c377e8-da89-4752-b1fc-53658ed51bff/resourceGroups/RG-03/providers/Microsoft.Network/networkInterfaces/NIC-03
Etag                : W/"e0acafb8-195a-4336-abe0-84c182a126b9"
ResourceGuid        : 39920d8e-b41b-4746-9f70-c83ba7f81bf7
ProvisioningState    : Succeeded
Tags                :
VirtualMachine       : {
  "Id": "/subscriptions/a6c377e8-da89-4752-b1fc-53658ed51bff/resourceGroups/RG-03/providers/Microsoft.Compute/virtualMachines/VM-03"
}
```

Microsoft Azure – Load balancer solution (2/2)



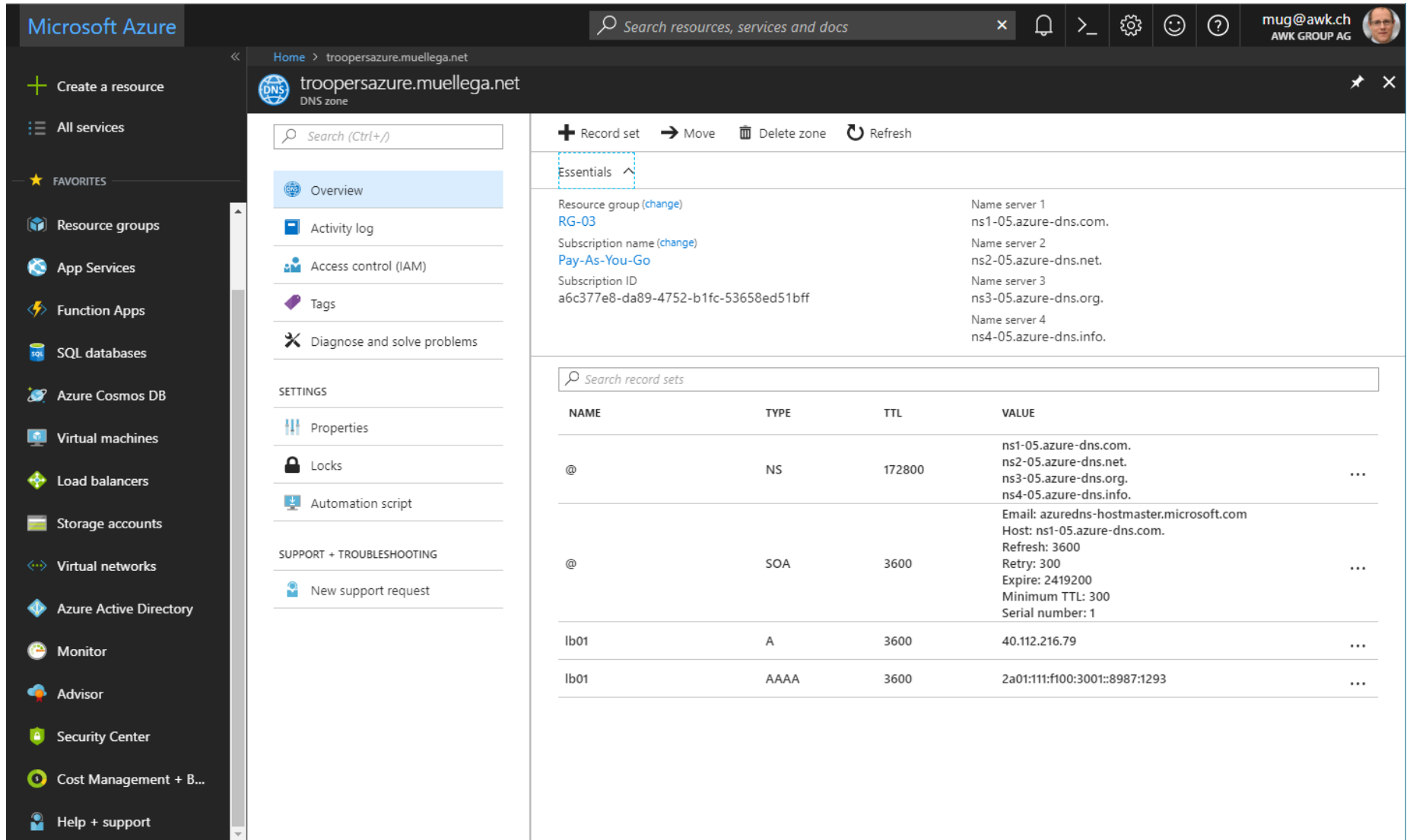
Source: <https://docs.microsoft.com/en-us/azure/load-balancer/load-balancer-ipv6-overview>

Microsoft example uses complex setup with availability set and PS setup of entire setup

IPv6 support can be achieved much easier – only NIC needs to be assigned to VM via PS – for details see appendix

```
// Getting reference for Dualstack NIC (set up in GUI)
$nic = Get-AzureRmNetworkInterface -Name "NIC-03" -ResourceGroupName "RG-03"

// Creating vm with Dualstack NIC (this seems not to be possible with GUI)
...
$vm03 = Add-AzureRmVMNetworkInterface -VM $vm03 -Id $nic.Id
New-AzureRmVM -ResourceGroupName 'RG-03' -Location 'West US' -VM $vm03
```



Microsoft Azure

Search resources, services and docs

mug@awk.ch
AWK GROUP AG

Home > troopersazure.muellega.net

troopersazure.muellega.net
DNS zone

Search (Ctrl+/)

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

SETTINGS

Properties

Locks

Automation script

SUPPORT + TROUBLESHOOTING

New support request

Record set → Move Delete zone Refresh

Essentials

Resource group (change)
RG-03

Subscription name (change)
Pay-As-You-Go

Subscription ID
a6c377e8-da89-4752-b1fc-53658ed51bff

Name server 1
ns1-05.azure-dns.com.

Name server 2
ns2-05.azure-dns.net.

Name server 3
ns3-05.azure-dns.org.

Name server 4
ns4-05.azure-dns.info.

Search record sets

NAME	TYPE	TTL	VALUE
@	NS	172800	ns1-05.azure-dns.com. ns2-05.azure-dns.net. ns3-05.azure-dns.org. ns4-05.azure-dns.info.
@	SOA	3600	Email: azuredns-hostmaster.microsoft.com Host: ns1-05.azure-dns.com. Refresh: 3600 Retry: 300 Expire: 2419200 Minimum TTL: 300 Serial number: 1
lb01	A	3600	40.112.216.79
lb01	AAAA	3600	2a01:111:f100:3001::8987:1293

Microsoft Azure – DNS

```
C:\Users\Mug>nslookup lb01.troopersazure.muellega.net
Server: AD10.awkgroup.com
Address: 10.1.71.50

Nicht autorisierende Antwort:
Name: lb01.troopersazure.muellega.net
Addresses: 2a01:111:f100:3001::8987:1293
           40.112.216.79

C:\Users\Mug>
```

«Azure currently supports reverse DNS only for IPv4 PublicIpAddress resources. It is not supported for IPv6.»

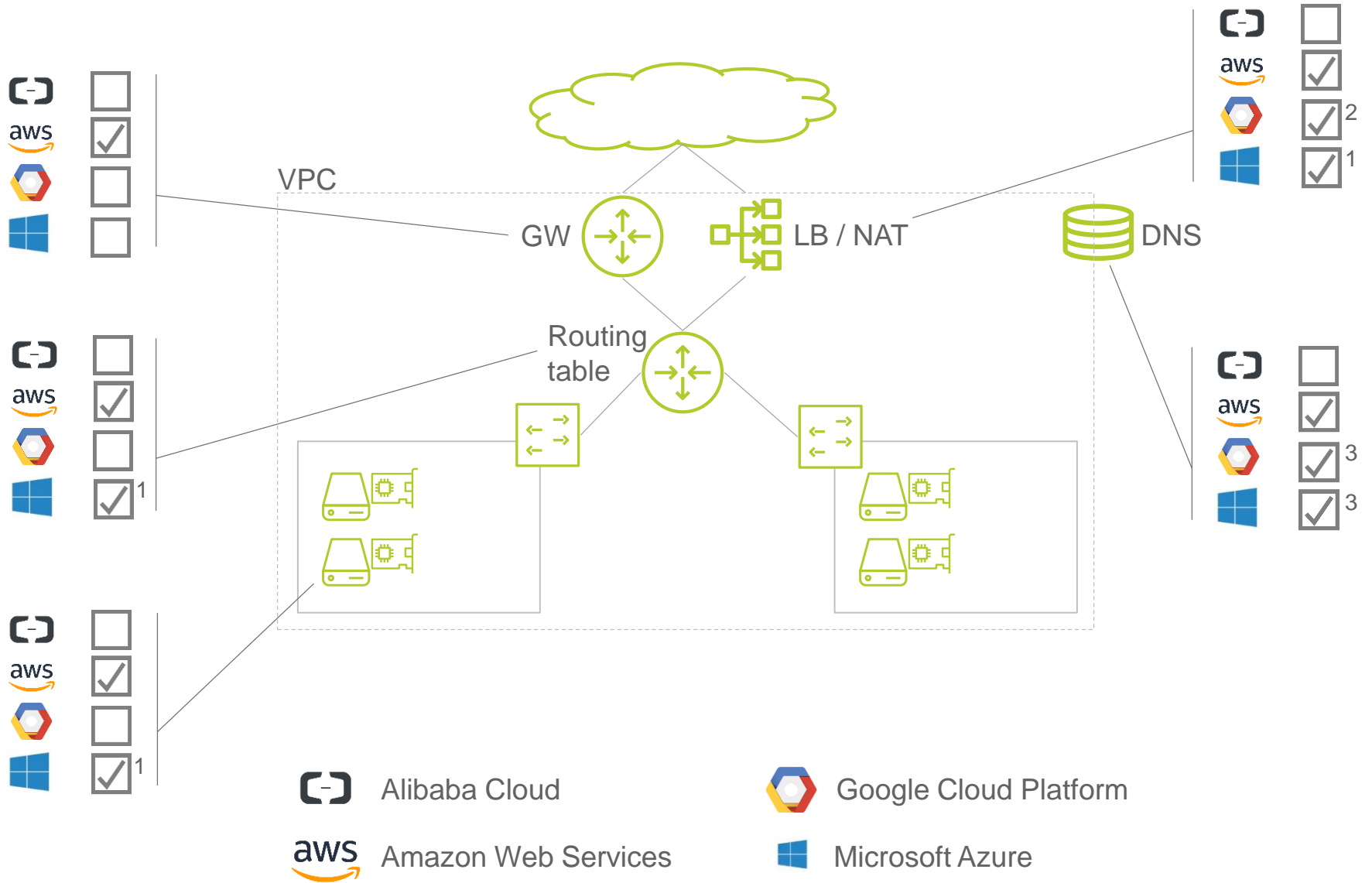
Source: <https://docs.microsoft.com/en-us/azure/dns/dns-reverse-dns-for-azure-services#reverse-dns-for-publicipaddress-resources>

Microsoft Azure - Summary

No IPv6 support in the virtual network (VPC)

- Similar to GCP, IPv6 needs to be terminated on load balancer
- In contrast to GCP, instead of NAT64 NAT66 is implemented
- A dualstack NIC can be attached to a VM, but assigned addresses are not routed into the internet, but terminated (NATed) at the load balancer
- Azure DNS support for IPv6 is limited (no PTR records)

The Big Picture



The Big Picture – Notes

- 1) IPv6 addresses not routed from/to the Internet, NAT66 on load balancer
- 2) NAT64, between load balancer and VM only IPv4 traffic
- 3) No PTR record possible

Agenda

- ▶ Introduction
- ▶ Results
- ▶ **Demo**
- ▶ Discussion
- ▶ Appendix

Demo

Amazon Web Services – vSRX

Agenda

- ▶ Introduction
- ▶ Results
- ▶ Demo
- ▶ **Discussion**
- ▶ Appendix

Challenging IAAS / PAAS

Do we need IAAS / PAAS at all ?

- Only for services not available in SAAS catalogue ?
- Other ways to achieve redundancy for your local DC ?
- ...

Agenda

- ▶ Introduction
- ▶ Results
- ▶ Demo
- ▶ Discussion
- ▶ **Appendix**

Resources

- Referenced book

- Cloud Computing (The MIT Press Essential Knowledge series)
- ISBN-13: 978-0262529099



- Referenced Gartner documents

- Magic Quadrant for Cloud Infrastructure as a Service, Worldwide – ID: G00315215
- Critical Capabilities for a Public Cloud Infrastructure as a Service, Worldwide – ID: G00323120

- NIST cloud definition

- The NIST Definition of Cloud Computing, Special Publication 800-145

Google Cloud Platform – Load balancing – X-forwarding

```
12:36:12.732460 IP (tos 0x60, ttl 64, id 0, offset 0, flags [DF],  
130.211.2.74.55671 > instance-group-1-25sd.c.root-quasar-18771  
win 111, options [nop,nop,TS val 2932475305 ecr 3570049508], len 100  
GET / HTTP/1.1  
User-Agent: Wget/1.15 (linux-gnu)  
Accept: */*  
Host: [2600:1901:0:127b::]  
X-Cloud-Trace-Context: 2b89fa988b1a540472e042c4102d52b9/17  
Via: 1.1 google  
X-Forwarded-For: 2001:470:25:2a::2, 2600:1901:0:127b::  
X-Forwarded-Proto: http  
Connection: Keep-Alive
```

IPv4

IPv6

Microsoft Azure – Load balancer – NAT66

Connecting to load balancer IP: 2a01:111:f100:3001::8987:1293

```
mug@VM-03:~$ who
mug      pts/0      2018-02-28 14:34 (194.230.77.216)
mug      pts/1      2018-02-28 14:36 (2001:1702:6:1311:9068:93c6:f776:6a7a)

mug@VM-03:~$ ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0d:3a:37:4c:78
          inet addr:10.2.0.4  Bcast:10.2.0.255  Mask:255.255.255.0
          inet6 addr: 2603:10b0:b03:1933::644b:9a1a/128 Scope:Global
          inet6 addr: fe80::20d:3aff:fe37:4c78/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1988  errors:0  dropped:0  overruns:0  frame:0
          TX packets:2201  errors:0  dropped:0  overruns:0  carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1226907 (1.2 MB)  TX bytes:413798 (413.7 KB)

mug@VM-03:~$
```

Microsoft Azure – Simplified IPv6 load balancer Setup

```
// in GUI
- create load balancer
- create Subnet
- create NIC

// in PS
// credentials for VM
$mySecureCredentials= Get-Credential -Message "Type the username and password of the local administrator account."

// getting reference for Dualstack NIC (setup in GUI)
$nic = Get-AzureRmNetworkInterface -Name "NIC-03" -ResourceGroupName "RG-03"

// creating vm with Dualstack NIC (seems not to be possible with GUI)
$vm03 = New-AzureRmVMConfig -VMName 'VM-03' -VMSize Standard_D1
$vm03 = Set-AzureRmVMOperatingSystem -VM $vm03 -Linux -ComputerName 'VM-03' -Credential $mySecureCredentials
$vm03 = Set-AzureRmVMSourceImage -VM $vm03 -PublisherName Canonical -Offer UbuntuServer -Skus 16.04-LTS -Version latest
$vm03 = Add-AzureRmVMNetworkInterface -VM $vm03 -Id $nic.Id
New-AzureRmVM -ResourceGroupName 'RG-03' -Location 'West US' -VM $vm03

// in GUI
- add VM to LB
    - BE-Pool_v4
    - BE-Pool_v6
- create NSG
- add NSG to NIC
- create NAT rule, eg for SSH
    - IPv4
    - IPv6
- login to VM and request IPv6 address via DHCPv6
```