

# Cloudy IPv6

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# about::myself

Radek Zajíc



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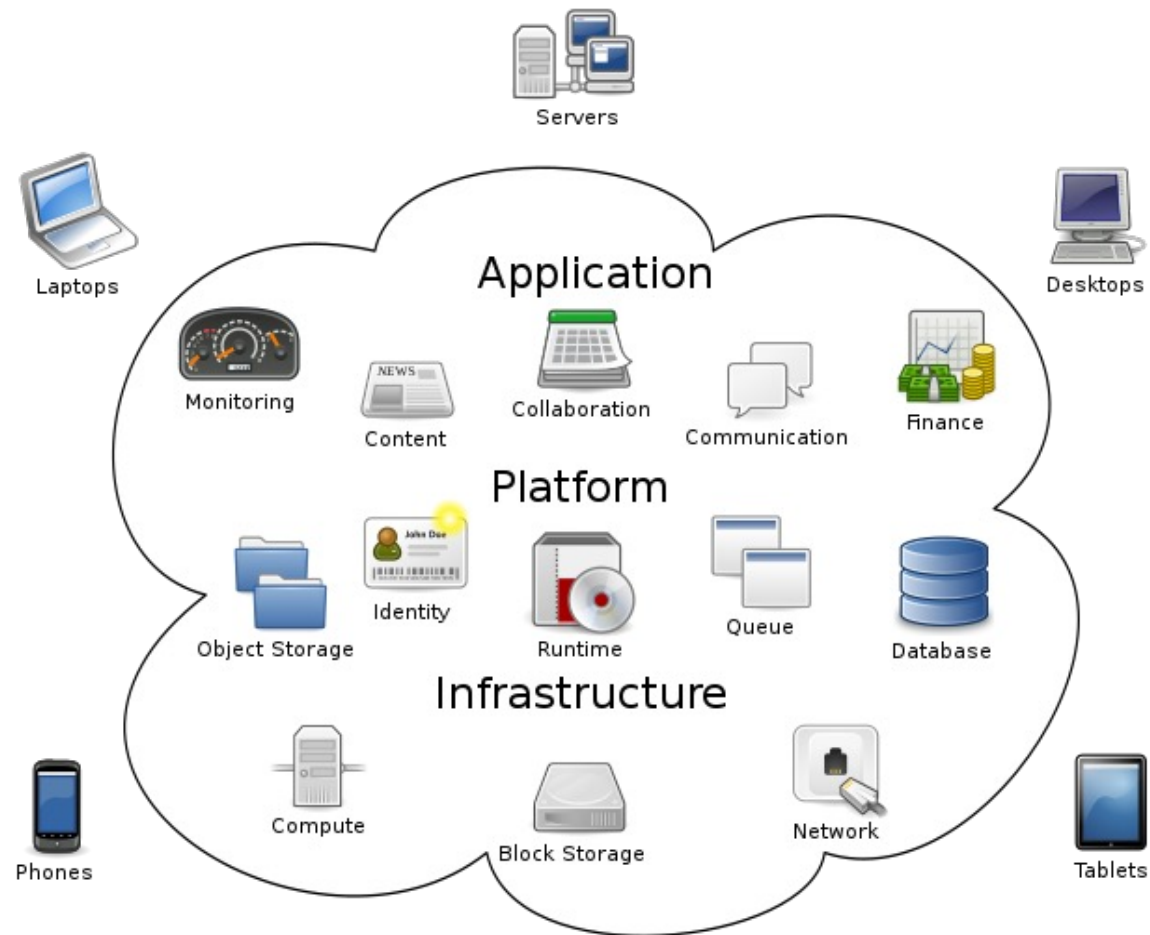
# Všichni se stěhujeme *do cloudu*

Malí i velcí.  
A někteří chtějí  
(nebo potřebují) IPv6.

# Ale co je vlastně ten *Cloud?*

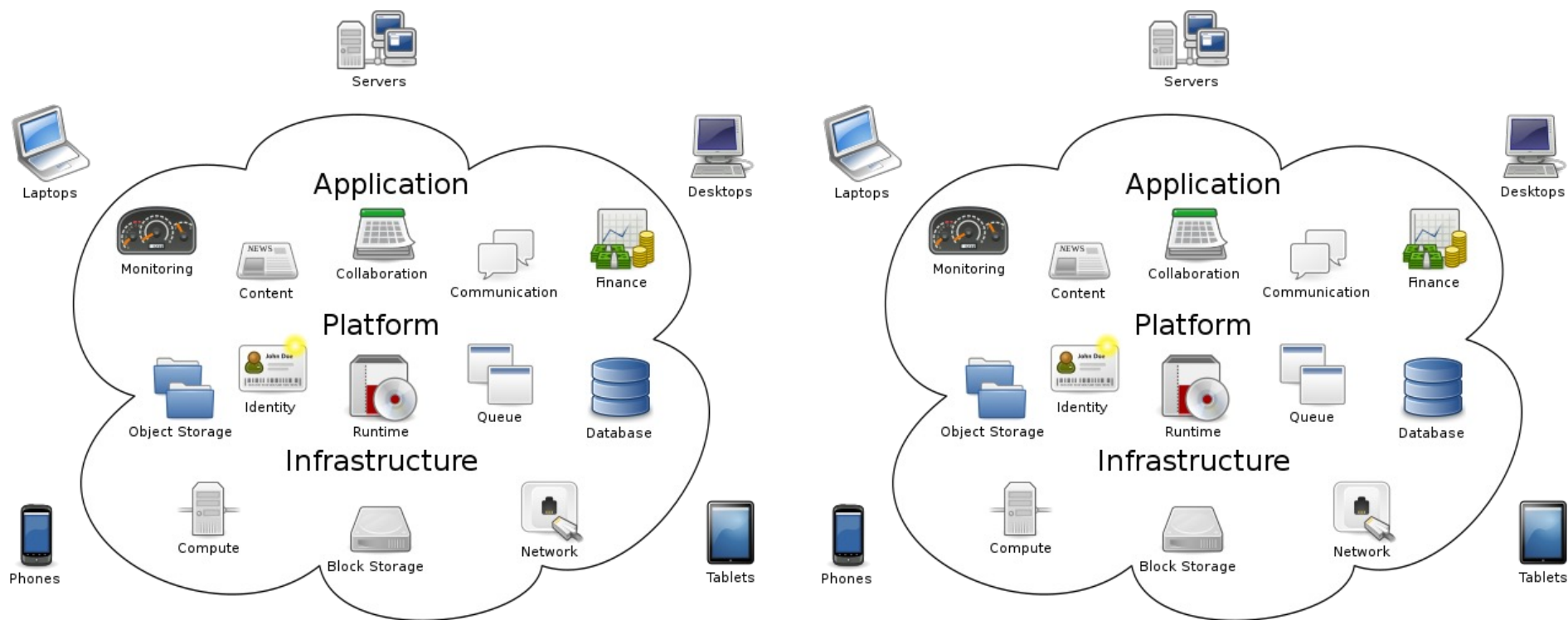
*Rozdíl jako služba*

# Co je to ten *Cloud*?



[https://commons.wikimedia.org/wiki/File:Cloud\\_computing.svg](https://commons.wikimedia.org/wiki/File:Cloud_computing.svg)

# Co je *hybridní Cloud*?

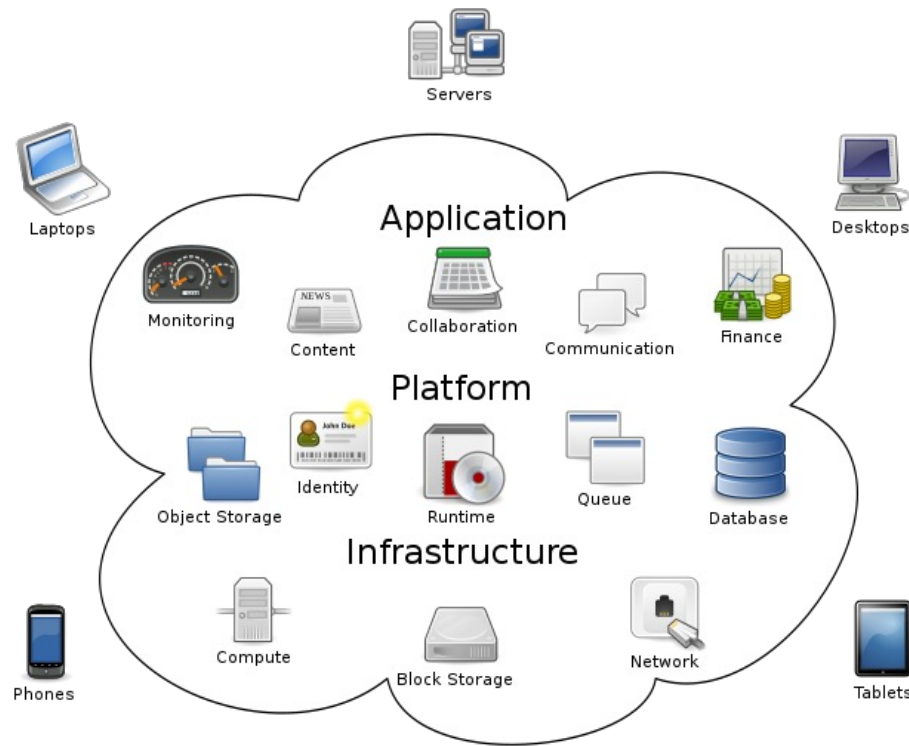


Cloud #1

Cloud #2

[https://commons.wikimedia.org/wiki/File:Cloud\\_computing.svg](https://commons.wikimedia.org/wiki/File:Cloud_computing.svg)

# Co dalšího je *hybridní Cloud*?



Cloud



On-prem infra

[https://commons.wikimedia.org/wiki/File:ZFS\\_server\\_front\\_26.jpg](https://commons.wikimedia.org/wiki/File:ZFS_server_front_26.jpg)



# Cloud & IPv6: Na hraně

## CDN

### Announcing IPv6 support for Amazon CloudFront

Posted On: Oct 6, 2016

Internet Protocol Version 6 (IPv6) is a new version of the Internet Protocol (...) **IPv6 will be enabled by default for all newly created Amazon CloudFront web distributions starting today.**

## Load Balancery

### Network Load Balancer now supports IPv6

Posted On: Nov 13, 2020



# Cloud & IPv6: Síť

Síť jakou svět neviděl

# Cloud & IPv6: Sít'



# Cloud & IPv6: Infrastruktura

## Virtuální sítě

IPv6 for Azure Virtual Network is now generally available

Published date: April 01, 2020

## Compute

### New VPC IPv6 Support

**Now in 2022** – GCP has added some remarkably interesting capabilities that I will outline below. The capabilities are split into (2) types of support: internal and external IPv6. I have some issues with both however, they are still great first steps in enabling the capability.

<https://www.tachyondynamics.com/2022/06/06/google-cloud-platform-gcp-and-new-ipv6-support/>

# Cloud & IPv6: Infrastruktura



# Cloud & IPv6: Úložiště & DB

Objektová úložiště\*

Databáze\*

~~Souborová úložiště~~

# Cloud & IPv6: Kontejnery

## Dual-stack a Kubernetes

# Cloud & IPv6: Kontejnery

## Use dual-stack kubenet networking in Azure Kubernetes Service (AKS)

### Limitations

- Azure Route Tables have a hard limit of 400 routes per table. Because each node in a dual-stack cluster requires two routes, one for each IP address family, dual-stack clusters are limited to 200 nodes.
- Dual-stack networking is required for the Azure Virtual Network and the pod CIDR - single stack IPv6-only isn't supported for node or pod IP addresses. Services can be provisioned on IPv4 or IPv6.
- Features **not supported on dual-stack kubenet** include:
  - [Azure network policies](#)
  - [Calico network policies](#)
  - [NAT Gateway](#)
  - [Virtual nodes add-on](#)
  - [Windows node pools](#)



# Cloud & IPv6: Kontejnery

## Google Kubernetes Engine (GKE)

### IPv4/IPv6 dual-stack networking

With IPv4/IPv6 dual-stack networking, you can define how GKE allocates IP addresses ( `ipFamilies` ) to the following objects:

- For Pods and nodes, GKE allocates **both IPv4 and IPv6 addresses**.
- For Services, GKE allocates either single-stack (IPv4 only or IPv6 only), or dual-stack addresses.

### Availability

Dual-stack networking with GKE has the following restrictions:

- Dual-stack networking is only available for [VPC-native clusters](#) clusters with [GKE Dataplane V2](#) enabled.
- Dual-stack networking is only supported on subnets in custom mode VPCs. For more information, see [Google Cloud types of VPC networks](#).
- **Single-stack IPv6 addresses for Pods or nodes are not supported.**
- Dual-stack clusters don't support Private Google Access over IPv6.

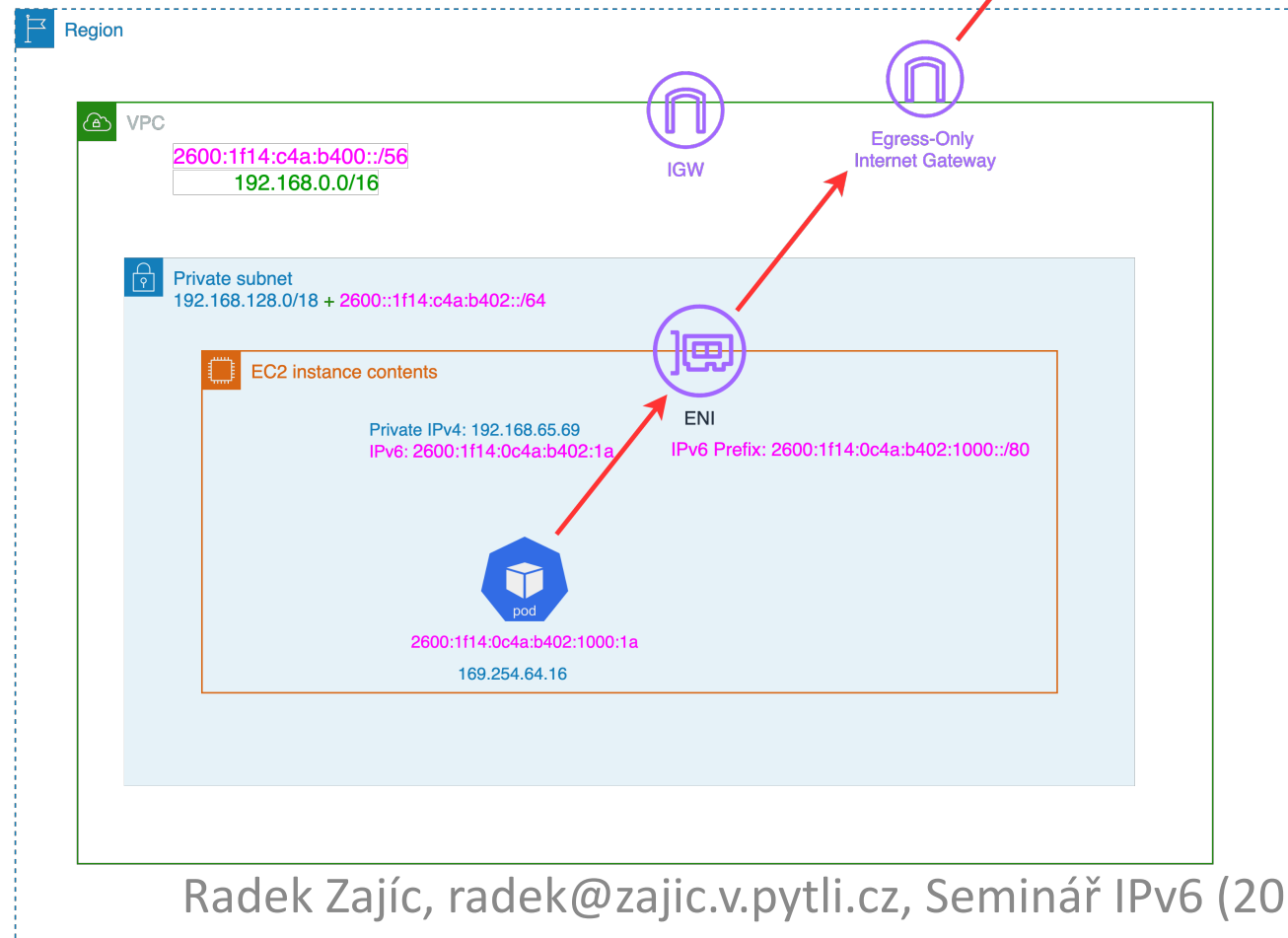
# Cloud & IPv6: Kontejnery

Dual-stack a Kubernetes

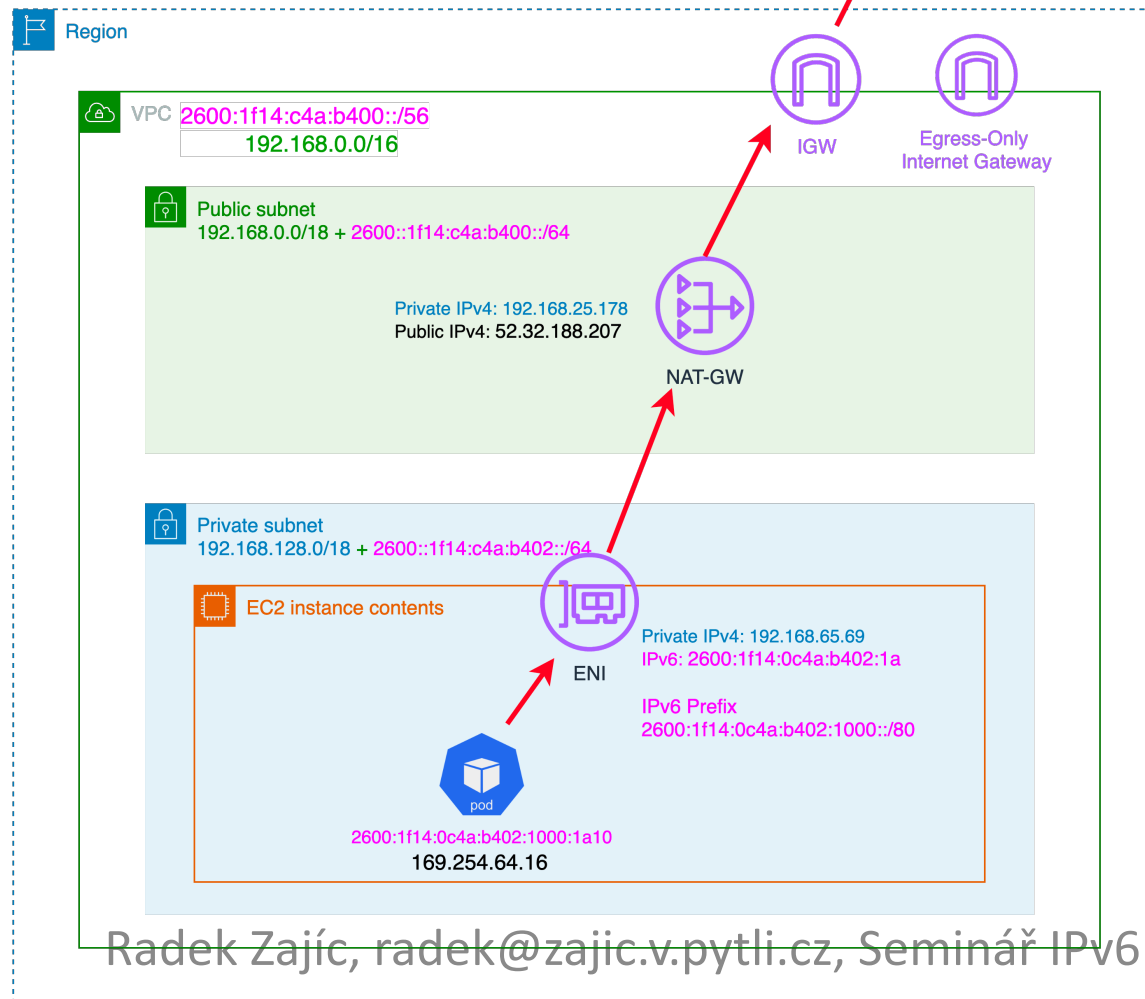
~~IPv6-only Kubernetes~~

Pseudo-IPv6-only Kubernetes

# Cloud & IPv6: Kontejnery



# Cloud & IPv6: Kontejnery



<https://aws.amazon.com/blogs/containers/amazon-eks-launches-ipv6-support/>

# Cloud & IPv6: Serverless

Lambda

Serverless kontejnery

API gateways a další služby

# Cloud & IPv6: IPv6-only

Pouze u AWS

IPv6-only sítě a *compute*

DNS64 a NAT64

# Cloud & IPv6: oblast Enterprise

Propojení on-premises a cloudu

Bring Your Own IP(v6)

Virtual Desktop Infrastructure



# Cloud & IPv6: Není všechno zlato...



Service name	Dual stack support	IPv6 only support	Public endpoints support IPv6	Private endpoints support IPv6
AWS App Mesh	✔ Yes	✔ Yes	✔ Yes	✘ No
Amazon Athena	✔ <a href="#">Yes</a>	✘ No	✔ Yes	✘ No
Amazon Aurora	✔ <a href="#">Yes</a>	✘ No	✔ Yes	✘ No
Amazon CloudFront	✔ <a href="#">Yes</a>	✘ No	✘ No	✘ No
AWS Cloud Map	✔ <a href="#">Yes</a>	✔ Yes	✔ Yes	✘ No
AWS Database Migration Service	✔ <a href="#">Yes</a>	✘ No	✘ No	✘ No
AWS Direct Connect	✔ Yes	✔ Yes	✘ No	✘ No
Amazon EC2	✔ <a href="#">Yes</a>	✔ Yes	✔ <a href="#">Yes</a>	✘ No
Amazon ECS	✔ <a href="#">Yes</a>	✘ No	✘ No	✘ No
Amazon EKS	✔ <a href="#">Yes</a>	✔ Yes	✘ No	✘ No
Elastic Load Balancing	✔ <a href="#">Yes</a>	✔ Yes	✘ No	✘ No
Amazon ElastiCache	✔ <a href="#">Yes</a>	✔ Yes	✘ No	✘ No
AWS Fargate	✔ <a href="#">Yes</a>	✘ No	✘ No	✘ No
AWS Global Accelerator	✔ <a href="#">Yes</a>	✘ No	✘ No	✘ No

# Cloud & IPv6: Není všechno zlato...



Service name	Dual stack support	IPv6 only support	Public endpoints support IPv6	Private endpoints support IPv6
AWS IoT	✔ Yes	✔ Yes	✘ No	✘ No
AWS Lambda	✘ No	✘ No	✔ <a href="#">Yes</a>	✘ No
Amazon Lightsail	✔ <a href="#">Yes</a>	✘ No	✘ No	✘ No
AWS Network Firewall	✔ <a href="#">Yes</a>	✔ <a href="#">Yes</a>	✘ No	✘ No
AWS PrivateLink	✔ Yes	✔ Yes	✔ Yes	✘ No
Amazon RDS	✔ <a href="#">Yes</a>	✘ No	✔ Yes	✘ No
Amazon Route 53	✔ Yes	✔ Yes	✘ No	✘ No
Amazon S3	✔ <a href="#">Yes</a>	✘ No	✔ <a href="#">Yes</a>	✘ No
AWS Secrets Manager	✔ Yes	✘ No	✔ Yes	✘ No
AWS Shield	✔ Yes	✔ Yes	✘ No	✘ No
AWS Site-to-Site VPN	✔ <a href="#">Yes</a>	✘ No	✔ <a href="#">Yes</a>	✘ No
AWS Transit Gateway	✔ Yes	✘ No	✔ Yes	✘ No
Amazon VPC	✔ <a href="#">Yes</a>	✔ Yes	✔ <a href="#">Yes</a>	✘ No
AWS WAF	✔ <a href="#">Yes</a>	✔ Yes	✘ No	✘ No
Amazon WorkSpaces	✔ <a href="#">Yes</a>	✘ No	✘ No	✘ No

# Cloud & IPv6: SaaS, PaaS, DaaS



## Categories

Infrastructure Software (8615)

DevOps (6225)

Professional Services (4253)

Data Products (4027)

Business Applications (3067)

Machine Learning (2134)

Industries (1719)

IoT (653)



## ▼ Delivery methods

- Amazon Machine Image (7935)
- Professional Services (4252)
- Data Exchange (4030)
- SaaS (2748)
- SageMaker Model (799)
- Container Image (518)
- CloudFormation Template (511)
- SageMaker Algorithm (134)
- Helm Chart (36)

# Cloud & IPv6: Automatizace



Q is:issue is:open ipv6

✕ Clear current search query, filters, and sorts

🕒 122 Open ✓ 342 Closed

Q is:issue is:open ipv6

✕ Clear current search query, filters, and sorts

🕒 4 Open ✓ 26 Closed

Q is:issue is:open ipv6

✕ Clear current search query, filters, and sorts

🕒 9 Open ✓ 30 Closed

# Cloud není všespásný

Vy tvoříte adresní plány

Vy máte na starost přechod na IPv6

Často musíte IPv6 ručně povolit a nastavit

# Cloud není všespásný

Často chybí IPv4/v6 *feature parity*

Mnohé služby podporu IPv6 postrádají

**Čtěte poznámky pod čarou!**

# Proč nasazovat IPv6 v cloudu?

Když musíte (compliance)

Když si o ni zákazníci (i interní) říkají

Když budete chtít něco ušetřit



# Proč nasazovat IPv6 v cloudu

Když řešíte vyčerpání zdrojů (IPv4)

Když vás trápí kolize IP adres

Nebo si chcete vyzkoušet IPv6-only

# Některá omezení

Azure a jejich 1:1 IPv6 NAT

AWS, databáze a IPv6~~(-only)~~

AWS Client VPN bez podpory IPv6

# Některá omezení: Azure FW

“Azure Firewall is a cloud-native and **intelligent** network firewall security service that provides the **best of breed** threat protection for your cloud workloads running in Azure. It's a fully stateful, firewall as a service with built-in high availability and **unrestricted cloud scalability**. It provides both east-west and north-south traffic inspection.”

(...)

“Azure Firewall **doesn't currently support IPv6**. It can **operate in a dual stack VNet** using only IPv4, but the firewall subnet must be IPv4-only.”

# Některá omezení: AWS K8s

## Considerations for using the IPv6 family for your cluster:

- You must create a new cluster that's version 1.21 or later and specify that you want to use the IPv6 family for that cluster. You can't enable the IPv6 family for a cluster that you updated from a previous version. For instructions on how to create a new cluster, see [Creating an Amazon EKS cluster](#).
- The version of the Amazon VPC CNI add-on that you deploy to your cluster must be version 1.10.1 or later. This version or later is deployed by default with a new 1.21 or later cluster. After you deploy the add-on, you can't downgrade your Amazon VPC CNI add-on to a version lower than 1.10.1 without first removing all nodes in all node groups in your cluster.
- Windows pods and services aren't supported.
- If you use Amazon EC2 nodes, you must configure the Amazon VPC CNI add-on with IP prefix delegation and IPv6. If you choose the IPv6 family when creating your cluster, the 1.10.1 version of the add-on defaults to this configuration. This is the case for both a self-managed or Amazon EKS add-on. For more information about IP prefix delegation, see [Increase the amount of available IP addresses for your Amazon EC2 nodes](#).
- When you create a cluster, the VPC and subnets that you specify must have an IPv6 CIDR block that's assigned to the VPC and subnets that you specify. They must also have an IPv4 CIDR block assigned to them. This is because, even if you only want to use IPv6, a VPC still requires an IPv4 CIDR block to function. For more information, see [Associate an IPv6 CIDR block with your VPC](#) in the Amazon VPC User Guide.
- When you create your cluster and nodes, you must specify subnets that are configured to auto-assign IPv6 addresses. Otherwise, you can't deploy your cluster and nodes. By default, this configuration is disabled. For more information, see [Modify the IPv6 addressing attribute for your subnet](#) in the Amazon VPC User Guide.
- The route tables that are assigned to your subnets must have routes for IPv6 addresses. For more information, see [Migrate to IPv6](#) in the Amazon VPC User Guide.
- Your security groups must allow IPv6 addresses. For more information, see [Migrate to IPv6](#) in the Amazon VPC User Guide.
- You can only use IPv6 with AWS Nitro-based Amazon EC2 or Fargate nodes.
- You can't use IPv6 with [Tutorial: Security groups for pods](#) with Amazon EC2 nodes. However, you can use it with Fargate nodes. If you need separate security groups for individual pods, continue using the IPv4 family with Amazon EC2 nodes, or use Fargate nodes instead.
- If you previously used [custom networking](#) to help alleviate IP address exhaustion, you can use IPv6 instead. You can't use custom networking with IPv6. If you use custom networking for network isolation, then you might need to continue to use custom networking and the IPv4 family for your clusters.
- You can't use IPv6 with [AWS Outposts](#).
- Pods and services are only assigned an IPv6 address. They aren't assigned an IPv4 address. Because pods are able to communicate to IPv4 endpoints through NAT on the instance itself, [DNS64 and NAT64](#) aren't needed. If the traffic needs a public IP address, the traffic is then source network address translated to a public IP.
- The source IPv6 address of a pod isn't source network address translated to the IPv6 address of the node when communicating outside of the VPC. It is routed using an internet gateway or egress-only internet gateway.
- All nodes are assigned an IPv4 and IPv6 address.
- The [Amazon FSx for Lustre CSI driver](#) is not supported.
- You can use version 2.3.1 or later of the AWS Load Balancer Controller to load balance [application](#) or [network](#) traffic to IPv6 pods in IP mode, but not instance mode. For more information, see [Installing the AWS Load Balancer Controller add-on](#).
- You must attach an IPv6 IAM policy to your node IAM or CNI IAM role. Between the two, we recommend that you attach it to a CNI IAM role. For more information, see [Create IAM policy for clusters that use the IPv6 family](#) and [Step 1: Create the Amazon VPC CNI plugin for Kubernetes IAM role](#).
- Each Fargate pod receives an IPv6 address from the CIDR that's specified for the subnet that it's deployed in. The underlying hardware unit that runs Fargate pods gets a unique IPv4 and IPv6 address from the CIDRs that are assigned to the subnet that the hardware unit is deployed in.
- We recommend that you perform a thorough evaluation of your applications, Amazon EKS add-ons, and AWS services that you integrate with before deploying IPv6 clusters. This is to ensure that everything works as expected with IPv6.
- Use of the Amazon EC2 [Instance Metadata Service](#) IPv6 endpoint is not supported with Amazon EKS.
- You can't use IPv6 with the [Calico network policy engine add-on](#).
- When creating a self-managed node group in a cluster that uses the IPv6 family, user-data must include the following `BootstrapArguments` for the `bootstrap.sh` file that runs at node start up. Replace `your-cidr` with the IPv6 CIDR range of your cluster's VPC.

<https://docs.aws.amazon.com/eks/latest/userguide/cni-ipv6.html>

# Multi-cloud a IPv6

Napadlo vás, že obsadíte víc cloudů...

a nasadíte tam IPv6...

...jako vážně?

# Cloud občas překvapí

## IPv6 support in Azure Active Directory – What's changing?

Our **service endpoint URLs will now resolve to return both IPv4 and IPv6 addresses.** (...)

## When will IPv6 be supported in Azure AD?

We'll begin introducing IPv6 support to Azure AD in **April 2023.**

We know that IPv6 support is a significant change for some organizations. We're publishing this information now so that customers can make plans to ensure readiness.

## What does my organization have to do?

If you have public IPv6 addresses representing your network, **take the actions that are described in the following sections as soon as possible.**

**If customers don't update their named locations with these IPv6 addresses, their users will be blocked.**

<https://learn.microsoft.com/en-us/troubleshoot/azure/active-directory/azure-ad-ipv6-support>

# Vaši vývojáři potřebují zkušenosti

Poskytněte vývojářům IPv6 síť

Ať tvoří aplikace s funkční podporou IPv6

A testují je v IPv6-only prostředí

Vy jste v cloudu zákazníkem  
Kdo je připraven, nebývá překvapen

Začněte včas a postavte si laboratoř

Žádejte od dodavatelů *feature parity*

Žádejte, ať je IPv6 aktivní už v základu

Nezapomeňte na bezpečnost



# IPv6 a velké cloudy

[AWS](#) ([oznámení](#))

[Google Cloud](#) ([oznámení](#))

Azure [VNET](#) ([oznámení](#))

[Eyal Estrin: Is the public cloud ready for IPv6?](#)

Q & A

# Díky



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