



Reference

Cloud Volumes Service

NetApp
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Reference

AWS security group settings for Windows AD servers

If you use Windows Active Directory (AD) servers with cloud volumes, you should familiarize yourself with the guidance on AWS security group settings. The settings enable cloud volumes to integrate with AD correctly.

By default, the AWS security group applied to an EC2 Windows instance does not contain inbound rules for any protocol except RDP. You must add rules to the security groups that are attached to each Windows AD instance to enable inbound communication from Cloud Volumes Service. The required ports are as follows:

Service	Port	Protocol
AD Web Services	9389	TCP
DNS	53	TCP
DNS	53	UDP
ICMPv4	N/A	Echo Reply
Kerberos	464	TCP
Kerberos	464	UDP
Kerberos	88	TCP
Kerberos	88	UDP
LDAP	389	TCP
LDAP	389	UDP
LDAP	3268	TCP
NetBIOS name	138	UDP
SAM/LSA	445	TCP
SAM/LSA	445	UDP
Secure LDAP	636	TCP
Secure LDAP	3269	TCP
w32time	123	UDP

If you are deploying and managing your AD installation domain controllers and member servers on an AWS EC2 instance, you will require several security group rules to allow traffic for the Cloud Volumes Service. Below is an example of how to implement these rules for AD applications as part of the AWS CloudFormation template.

```
{
  "AWSTemplateFormatVersion" : "2010-09-09",
  "Description" : "Security Group for AD",
  "Parameters" :
```

```

{
  "VPC" :
  {
    "Type" : "AWS::EC2::VPC::Id",
    "Description" : "VPC where the Security Group will belong:"
  },
  "Name" :
  {
    "Type" : "String",
    "Description" : "Name Tag of the Security Group:"
  },
  "Description" :
  {
    "Type" : "String",
    "Description" : "Description Tag of the Security Group:",
    "Default" : "Security Group for Active Directory for CVS "
  },
  "CIDRrangeforTCPandUDP" :
  {
    "Type" : "String",
    "Description" : "CIDR Range for the UDP ports
445,138,464,389,53,123 and for the TCP ports
464,339,3389,3268,88,636,9389,445 and 0-65535: *CIDR range format:
10.0.0.0/24"
  },
  "Resources" :
  {
    "ADSGWest" :
    {
      "Type" : "AWS::EC2::SecurityGroup",
      "Properties" :
      {
        "GroupDescription" : {"Ref" : "Description"},
        "VpcId" : { "Ref" : "VPC" },
        "SecurityGroupIngress" : [
          {
            "IpProtocol" : "udp",
            "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
            "FromPort" : "445",
            "ToPort" : "445"
          },
          {
            "IpProtocol" : "udp",
            "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
            "FromPort" : "138",

```

```

        "ToPort" : "138"
    },
    {
        "IpProtocol" : "udp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "464",
        "ToPort" : "464"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "464",
        "ToPort" : "464"
    },
    {
        "IpProtocol" : "udp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "389",
        "ToPort" : "389"
    },
    {
        "IpProtocol" : "udp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "53",
        "ToPort" : "53"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "339",
        "ToPort" : "339"
    },
    {
        "IpProtocol" : "udp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "123",
        "ToPort" : "123"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "3389",
        "ToPort" : "3389"
    },
    {
        "IpProtocol" : "tcp",

```

```

        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "3268",
        "ToPort" : "3268"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "88",
        "ToPort" : "88"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "636",
        "ToPort" : "636"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "3269",
        "ToPort" : "3269"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "53",
        "ToPort" : "53"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "0",
        "ToPort" : "65535"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "9389",
        "ToPort" : "9389"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "445",
        "ToPort" : "445"
    }
}

```

```

    ]
  }
}
},
"Outputs" :
{
  "SecurityGroupID" :
  {
    "Description" : "Security Group ID",
    "Value" : { "Ref" : "ADSGWest" }
  }
}
}

```

Selecting the appropriate service level and allocated capacity

The cost for Cloud Volumes Service for AWS is based on the *service level* and the *allocated capacity* that you select. Selecting the appropriate service level and capacity helps you meet your storage needs at the lowest cost.



All pricing information in this article is based on the list prices as of September 12, 2018. The information is provided for example purposes only and is subject to change.

Considerations

Storage needs include two fundamental aspects:

- The storage *capacity* for holding data
- The storage *bandwidth* for interacting with data

If you consume more storage space than the capacity you selected for the volume, the following considerations apply:

- You will be billed for the additional storage capacity that you consume at the price defined by your service level.
- The amount of storage bandwidth available to the volume does not increase until you increase the allocated capacity size or change the service level.

Service levels

Cloud Volumes Service for AWS supports three service levels. You specify your service level when you create or modify the volume.

[Creating cloud volumes](#)
[Modifying cloud volumes](#)

The service levels are catered to different storage capacity and storage bandwidth needs:

- **Standard** (capacity)

If you want capacity at the lowest cost, and your bandwidth needs are limited, then the Standard service level might be most appropriate for you. An example is using the volume as a backup target.

- List Price: \$0.10 per GB per month (as of September 12, 2018)
- Bandwidth: 16 KB of bandwidth per GB provisioned capacity

- **Premium** (a balance of capacity and performance)

If your application has a balanced need for storage capacity and bandwidth, then the Premium service level might be most appropriate for you. This level is less expensive per MB/s than the Standard service level, and it is also less expensive per GB of storage capacity than the Extreme service level.

- List Price: \$0.20 per GB per month (as of September 12, 2018)
- Bandwidth: 64 KB of bandwidth per GB provisioned capacity

- **Extreme** (performance)

The Extreme service level is least expensive in terms of storage bandwidth. If your application demands storage bandwidth without the associated demand for lots of storage capacity, then the Extreme service level might be most appropriate for you.

- List Price: \$0.30 per GB per month (as of September 12, 2018)
- Bandwidth: 128 KB of bandwidth per GB provisioned capacity

Allocated capacity

You specify your allocated capacity for the volume when you create or modify the volume.

[Creating cloud volumes](#)

[Modifying cloud volumes](#)

While you would select your service level based on your general, high-level business needs, you should select your allocated capacity size based on the specific needs of applications, for example:

- How much storage space the applications need
- How much storage bandwidth per second the applications or the users require

Allocated capacity is specified in GBs. A volume's allocated capacity can be set within the range of 100 GB to 100,000 GB (equivalent to 100 TBs).

Number of inodes

Volumes less than or equal to 1 TB can use up to 20 million inodes. The number of inodes increase by 20 million for each TB you allocate, up to a maximum of 100 million inodes.

- <= 1TB = 20 million inodes
- >1 TB to 2 TB = 40 million inodes
- >2 TB to 3 TB = 60 million inodes
- >3 TB to 4 TB = 80 million inodes
- >4 TB to 100 TB = 100 million inodes

Bandwidth

The combination of both the service level and the allocated capacity you select determines the maximum bandwidth for the volume.

If your applications or users need more bandwidth than your selections, you can change the service level or increase the allocated capacity. The changes do not disrupt data access.

Selecting the service level and the allocated capacity

To select the most appropriate service level and allocated capacity for your needs, you need to know how much capacity and bandwidth you require at the peak or the edge.

Cost comparison for service levels and allocated capacity

The table below compares cost for different service levels and allocated capacity sizes. In the table, the leftmost column indicates the capacity, and the other columns define the MB/s available at each capacity point and its cost.



All pricing information is based on the list prices as of September 12, 2018. The information is provided for example purposes only and is subject to change.

Capacity	Standard		Premium		Extreme	
	MB/s	Cost	MB/s	Cost	MB/s	Cost
TB						
0.1 (100 GB)	1.6	\$10	6.4	\$20	12.8	\$30
1	16	\$100	64	\$200	128	\$300
2	32	\$200	128	\$400	256	\$600
3	48	\$300	192	\$600	384	\$900
4	64	\$400	256	\$800	512	\$1,200
5	80	\$500	320	\$1,000	640	\$1,500
6	96	\$600	384	\$1,200	768	\$1,800
7	112	\$700	448	\$1,400	896	\$2,100
8	128	\$800	512	\$1,600	1,024	\$2,400
9	144	\$900	576	\$1,800	1,152	\$2,700
10	160	\$1,000	640	\$2,000	1,280	\$3,000
11	176	\$1,100	704	\$2,200	1,408	\$3,300
12	192	\$1,200	768	\$2,400	1,536	\$3,600
13	208	\$1,300	832	\$2,600	1,664	\$3,900
14	224	\$1,400	896	\$2,800	1,792	\$4,200
15	240	\$1,500	960	\$3,000	1,920	\$4,500

Capacity	Standard		Premium		Extreme	
16	256	\$1,600	1,024	\$3,200	2,048	\$4,800
17	272	\$1,700	1,088	\$3,400	2,176	\$5,100
18	288	\$1,800	1,152	\$3,600	2,304	\$5,400
19	304	\$1,900	1,216	\$3,800	2,432	\$5,700
20	320	\$2,000	1,280	\$4,000	2,560	\$6,000
21	336	\$2,100	1,344	\$4,200	2,688	\$6,300
22	352	\$2,200	1,408	\$4,400	2,816	\$6,600
23	368	\$2,300	1,472	\$4,600	2,944	\$6,900
24	384	\$2,400	1,536	\$4,800	3,072	\$7,200
25	400	\$2,500	1,600	\$5,000	3,200	\$7,500
26	416	\$2,600	1,664	\$5,200	3,328	\$7,800
27	432	\$2,700	1,728	\$5,400	3,456	\$8,100
28	448	\$2,800	1,792	\$5,600	3,584	\$8,400
29	464	\$2,900	1,856	\$5,800	3,712	\$8,700
30	480	\$3,000	1,920	\$6,000	3,840	\$9,000
31	496	\$3,100	1,984	\$6,200	3,968	\$9,300
32	512	\$3,200	2,048	\$6,400	4,096	\$9,600
33	528	\$3,300	2,112	\$6,600	4,224	\$9,900
34	544	\$3,400	2,176	\$6,800	4,352	\$10,200
35	560	\$3,500	2,240	\$7,000	4,480	\$10,500
36	576	\$3,600	2,304	\$7,200	4,500	\$10,800
37	592	\$3,700	2,368	\$7,400	4,500	\$11,100
38	608	\$3,800	2,432	\$7,600	4,500	\$11,400
39	624	\$3,900	2,496	\$7,800	4,500	\$11,700
40	640	\$4,000	2,560	\$8,000	4,500	\$12,000
41	656	\$4,100	2,624	\$8,200	4,500	\$12,300
42	672	\$4,200	2,688	\$8,400	4,500	\$12,600
43	688	\$4,300	2,752	\$8,600	4,500	\$12,900
44	704	\$4,400	2,816	\$8,800	4,500	\$13,200
45	720	\$4,500	2,880	\$9,000	4,500	\$14,500
46	736	\$4,600	2,944	\$9,200	4,500	\$13,800
47	752	\$4,700	3,008	\$9,400	4,500	\$14,100

Capacity	Standard		Premium		Extreme	
48	768	\$4,800	3,072	\$9,600	4,500	\$14,400
49	784	\$4,900	3,136	\$9,800	4,500	\$14,700
50	800	\$5,000	3,200	\$10,000	4,500	\$15,000
51	816	\$5,100	3,264	\$10,200	4,500	\$15,300
52	832	\$5,200	3,328	\$10,400	4,500	\$15,600
53	848	\$5,300	3,392	\$10,600	4,500	\$15,900
54	864	\$5,400	3,456	\$10,800	4,500	\$16,200
55	880	\$5,500	3,520	\$11,000	4,500	\$16,500
56	896	\$5,600	3,584	\$11,200	4,500	\$16,800
57	912	\$5,700	3,648	\$11,400	4,500	\$17,100
58	928	\$5,800	3,712	\$11,600	4,500	\$17,400
59	944	\$5,900	3,776	\$11,800	4,500	\$17,700
60	960	\$6,000	3,840	\$12,000	4,500	\$18,000
61	976	\$6,100	3,904	\$12,200	4,500	\$18,300
62	992	\$6,200	3,968	\$12,400	4,500	\$18,600
63	1,008	\$6,300	4,032	\$12,600	4,500	\$18,900
64	1,024	\$6,400	4,096	\$12,800	4,500	\$19,200
65	1,040	\$6,500	4,160	\$13,000	4,500	\$19,500
66	1,056	\$6,600	4,224	\$13,200	4,500	\$19,800
67	1,072	\$6,700	4,288	\$13,400	4,500	\$20,100
68	1,088	\$6,800	4,352	\$13,600	4,500	\$20,400
69	1,104	\$6,900	4,416	\$13,800	4,500	\$20,700
70	1,120	\$7,000	4,480	\$14,000	4,500	\$21,000
71	1,136	\$7,100	4,500	\$14,200	4,500	\$21,300
72	1,152	\$7,200	4,500	\$14,400	4,500	\$21,600
73	1,168	\$7,300	4,500	\$14,600	4,500	\$21,900
74	1,184	\$7,400	4,500	\$14,800	4,500	\$22,200
75	1,200	\$7,500	4,500	\$15,000	4,500	\$22,500
76	1,216	\$7,600	4,500	\$15,200	4,500	\$22,800
77	1,232	\$7,700	4,500	\$15,400	4,500	\$23,100
78	1,248	\$7,800	4,500	\$15,600	4,500	\$23,400
79	1,264	\$7,900	4,500	\$15,800	4,500	\$23,700

Capacity	Standard		Premium		Extreme	
80	1,280	\$8,000	4,500	\$16,000	4,500	\$24,000
81	1,296	\$8,100	4,500	\$16,200	4,500	\$24,300
82	1,312	\$8,200	4,500	\$16,400	4,500	\$24,600
83	1,328	\$8,300	4,500	\$16,600	4,500	\$24,900
84	1,344	\$8,400	4,500	\$16,800	4,500	\$25,200
85	1,360	\$8,500	4,500	\$17,000	4,500	\$25,500
86	1,376	\$8,600	4,500	\$17,200	4,500	\$25,800
87	1,392	\$8,700	4,500	\$17,400	4,500	\$26,100
88	1,408	\$8,800	4,500	\$17,600	4,500	\$26,400
89	1,424	\$8,900	4,500	\$17,800	4,500	\$26,700
90	1,440	\$9,000	4,500	\$18,000	4,500	\$27,000
91	1,456	\$9,100	4,500	\$18,200	4,500	\$27,300
92	1,472	\$9,200	4,500	\$18,400	4,500	\$27,600
93	1,488	\$9,300	4,500	\$18,600	4,500	\$27,900
94	1,504	\$9,400	4,500	\$18,800	4,500	\$28,200
95	1,520	\$9,500	4,500	\$19,000	4,500	\$28,500
96	1,536	\$9,600	4,500	\$19,200	4,500	\$28,800
97	1,552	\$9,700	4,500	\$19,400	4,500	\$29,100
98	1,568	\$9,800	4,500	\$19,600	4,500	\$29,400
99	1,584	\$9,900	4,500	\$19,800	4,500	\$29,700
100	1,600	\$10,000	4,500	\$20,000	4,500	\$30,000

Example 1

For example, your application requires 25 TB of capacity and 100 MB/s of bandwidth. At 25 TB of capacity, the Standard service level would provide 400 MB/s of bandwidth at a cost of \$2,500, making Standard the most suitable service level in this case.

Example 2

For example, your application requires 12 TB of capacity and 800 MB/s of peak bandwidth. Although the Extreme service level can meet the demands of the application at the 12 TB mark, it is more cost-effective to select 13 TB at the Premium service level.

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