

# Zones

Xpand allows clusters to be deployed across multiple zones to provide fault tolerance during unplanned zone failure. A zone in Xpand is grouping of nodes, such as AWS Availability Zones within the same Region, different server racks, different network switches, different power sources, or even separate servers in different data centers. Xpand requires that network latency between zones not exceed 2ms.

- [Prerequisites](#)
- [Fault Tolerance and Zones](#)
- [Configuring Zones](#)
  - [Creating a New Cluster in Multiple Zones](#)
  - [Migrating an Existing Cluster to Multiple Zones](#)
  - [Resources](#)

When Xpand is configured for zones, the Rebalancer becomes zone-aware and ensures replicas are placed in different zones. Additionally, Paxos acceptors are distributed across multiple zones. The result is that Xpand is fault tolerant in the face of unexpected zone failure, regardless of how many nodes are in the zone.

## Prerequisites

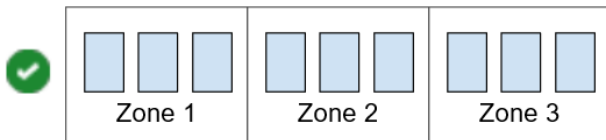
Use of zones with Xpand has the following prerequisites:

- Xpand supports configurations with a minimum of 3 and a maximum of 5 zones.
- There must be a sufficient number of zones to maintain a [quorum](#) of nodes following a failure
- Zones must be in the same geographical region with <2ms network latency between each zone.
- A cluster deployed across zones must have the same number of nodes in each zone.

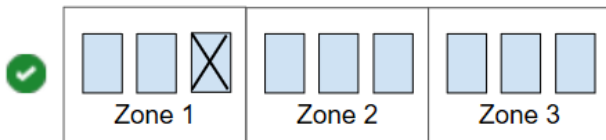
## Fault Tolerance and Zones

The following examples illustrate how zones work with the default MAX\_FAILURES = 1.

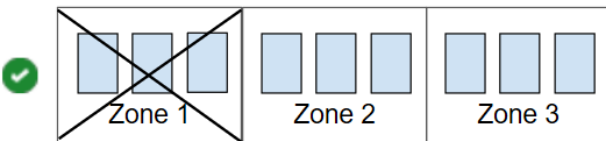
There must be the same number of nodes in each zone. Xpand recommends deploying a 9 node cluster across 3 zones.



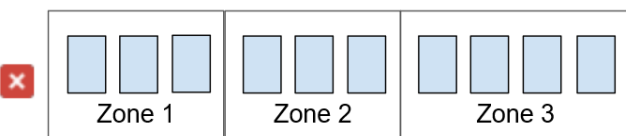
This cluster can tolerate one node failure:



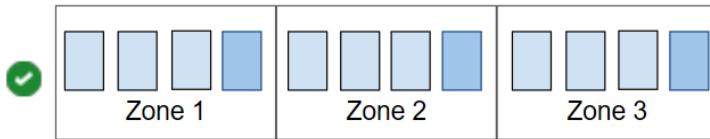
Or one zone failure:



There must be the same number of nodes in each zone. The following configuration is not supported.



If you require a larger cluster, simply add the same number of nodes to each zone.



See [MAX\\_FAILURES](#) for additional information.

## Configuring Zones

To configure zones, use [ALTER CLUSTER ZONE](#) to assign nodes to a zone. Zone ids must be greater than 0 and there must be an equal number of nodes in each zone. For example, a 9 node cluster deployed across 3 zones should have 3 nodes each in zones 1, 2, and 3.

Xpand recommends provisioning enough free disk space to reprotect the data after a zone failure. See [Allocating Disk Space for Fault Tolerance and Availability](#).

Xpand currently supports a minimum of 3 and a maximum of 5 zones.

## Creating a New Cluster in Multiple Zones

To create a new cluster, follow these steps:

1. Provision nodes in different zones, where zones are separate server racks, separate servers in different data centers, separate network switches, independent power sources, or [AWS Availability Zones](#).
2. Use [ALTER CLUSTER ADD](#) to build a cluster.
3. Use [ALTER CLUSTER ZONE](#) to assign nodes to zones.
4. Verify that zones have been configured using [clx stat](#). All nodes should show a zone number of 1 - *nn*. Zone 0 should not appear in the results.

## Migrating an Existing Cluster to Multiple Zones

If you would like to migrate your existing cluster, the high-level steps are:

1. Temporarily disable the Rebalancer.
2. Provision nodes in new zones and install Xpand on each node.
3. Use the [Flex Up](#) procedure to add the new nodes to the cluster.
4. Configure zones using [ALTER CLUSTER ZONE](#).
5. Use the Flex Down procedure to remove surplus nodes from the cluster.
6. Re-enable the Rebalancer.

Once this procedure is complete, you should have the same number of nodes in each zone and all nodes should have a non-zero zone assigned. Because the flex up and flex down operations can be time consuming, it is often simpler to migrate to a new cluster when moving from default to zone configurations.

## Resources

For further information, see [Understanding Fault Tolerance in Xpand](#).