Examining Clustering in Ignite

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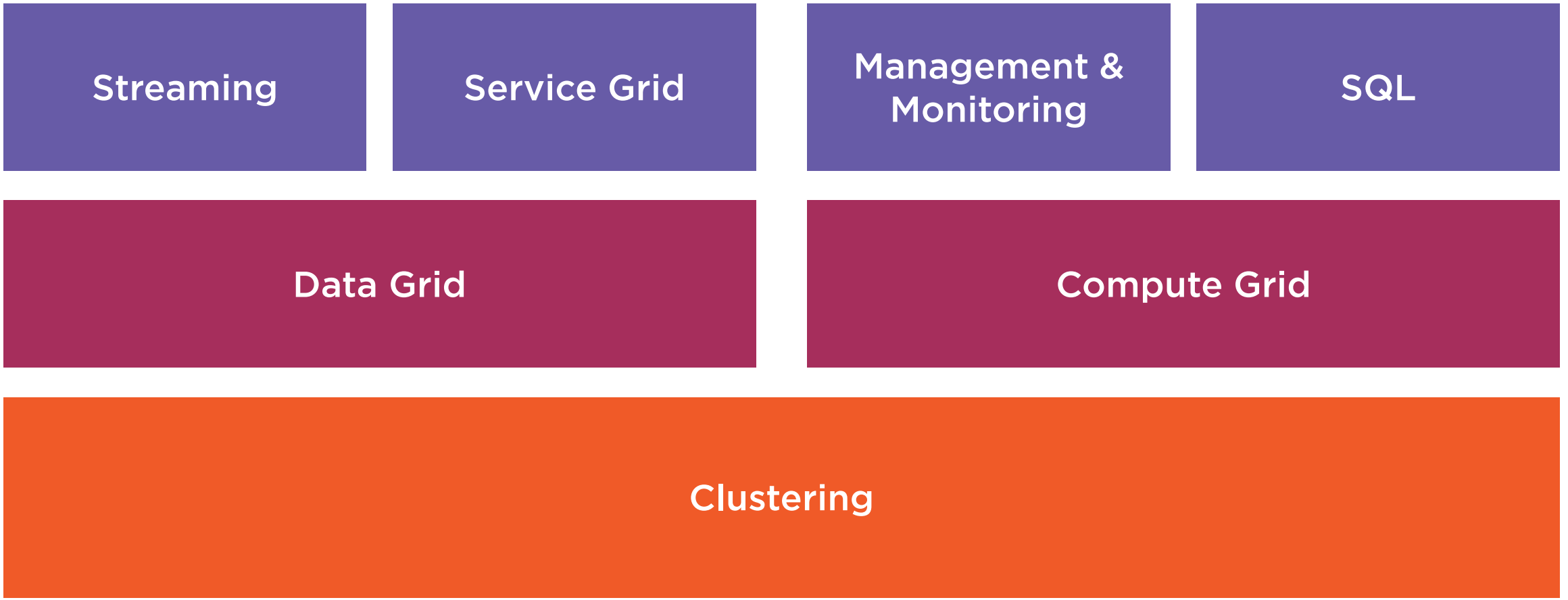
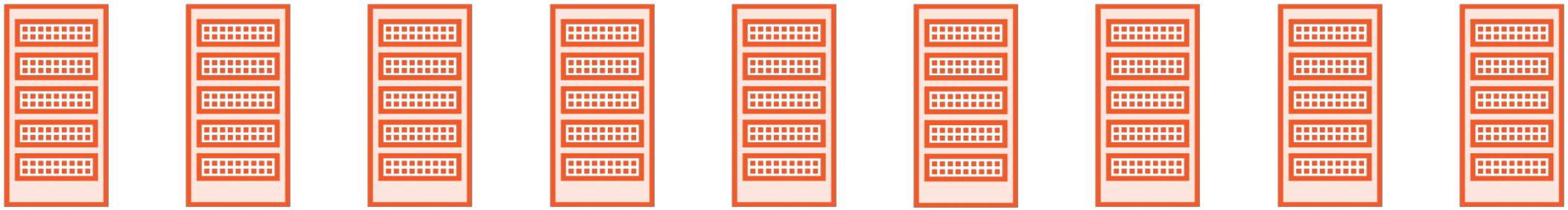
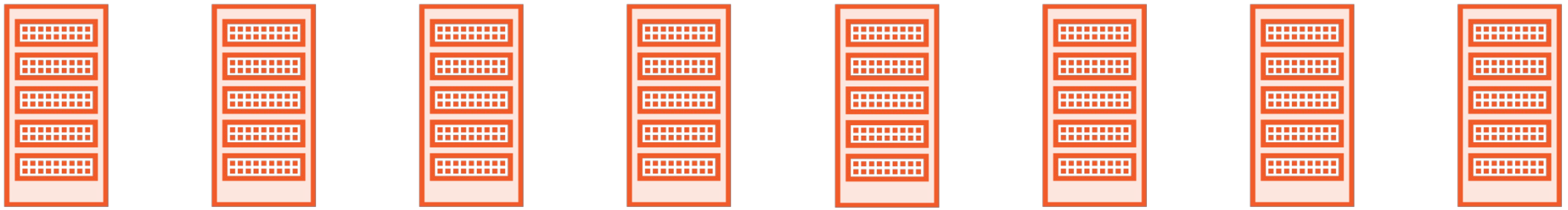
Overview

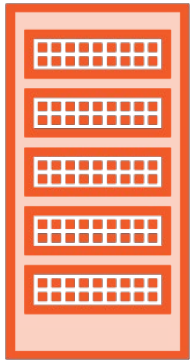
- Nodes
- Groups
- Discovery
- Internode security
- Management and monitoring

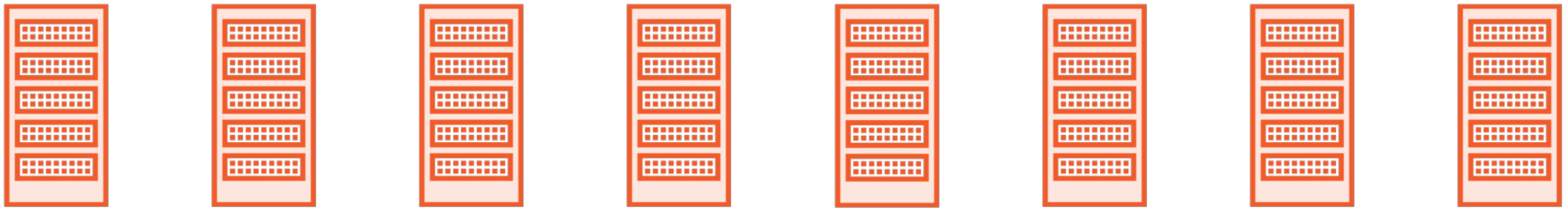
Apache Ignite Stack

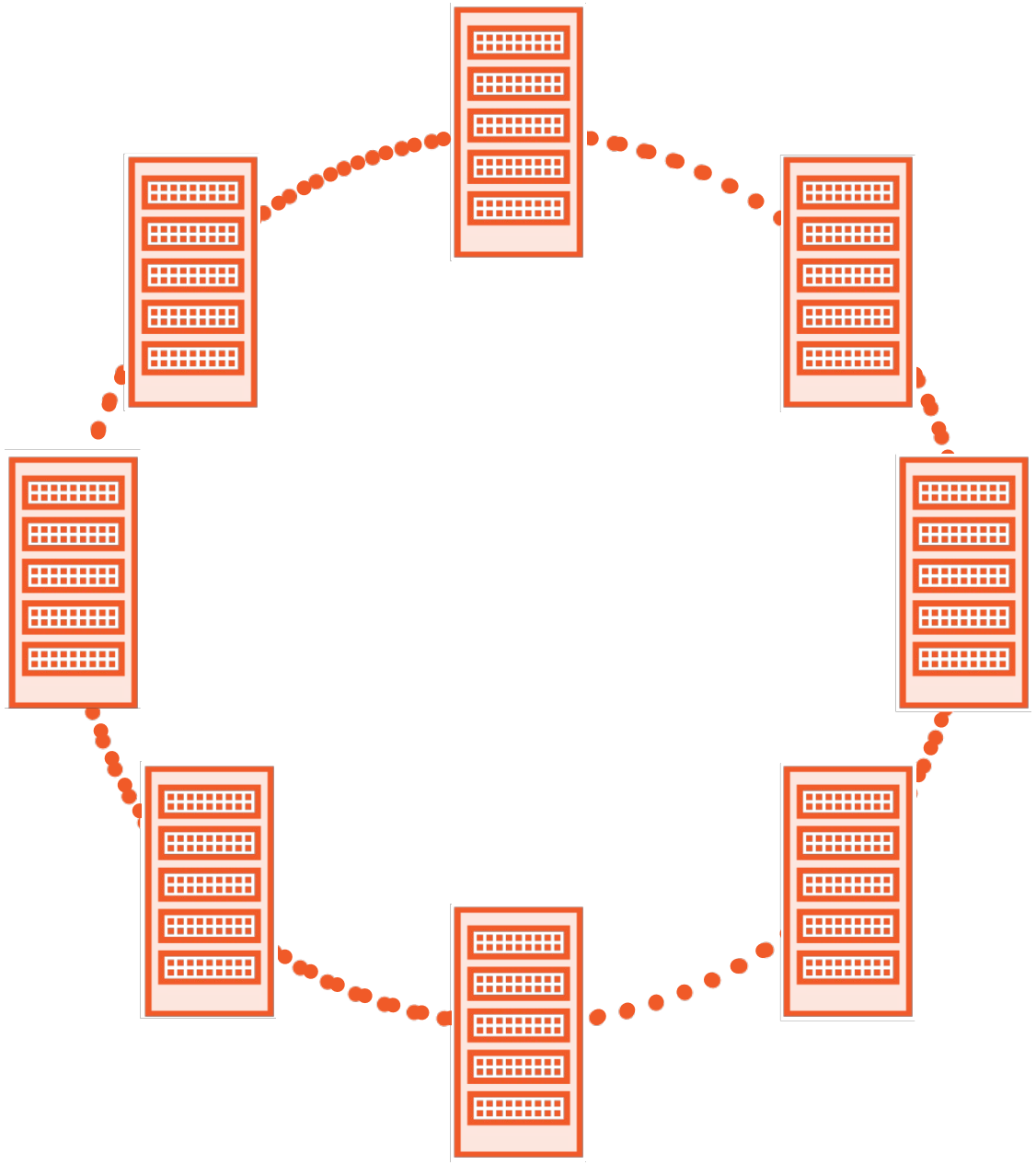


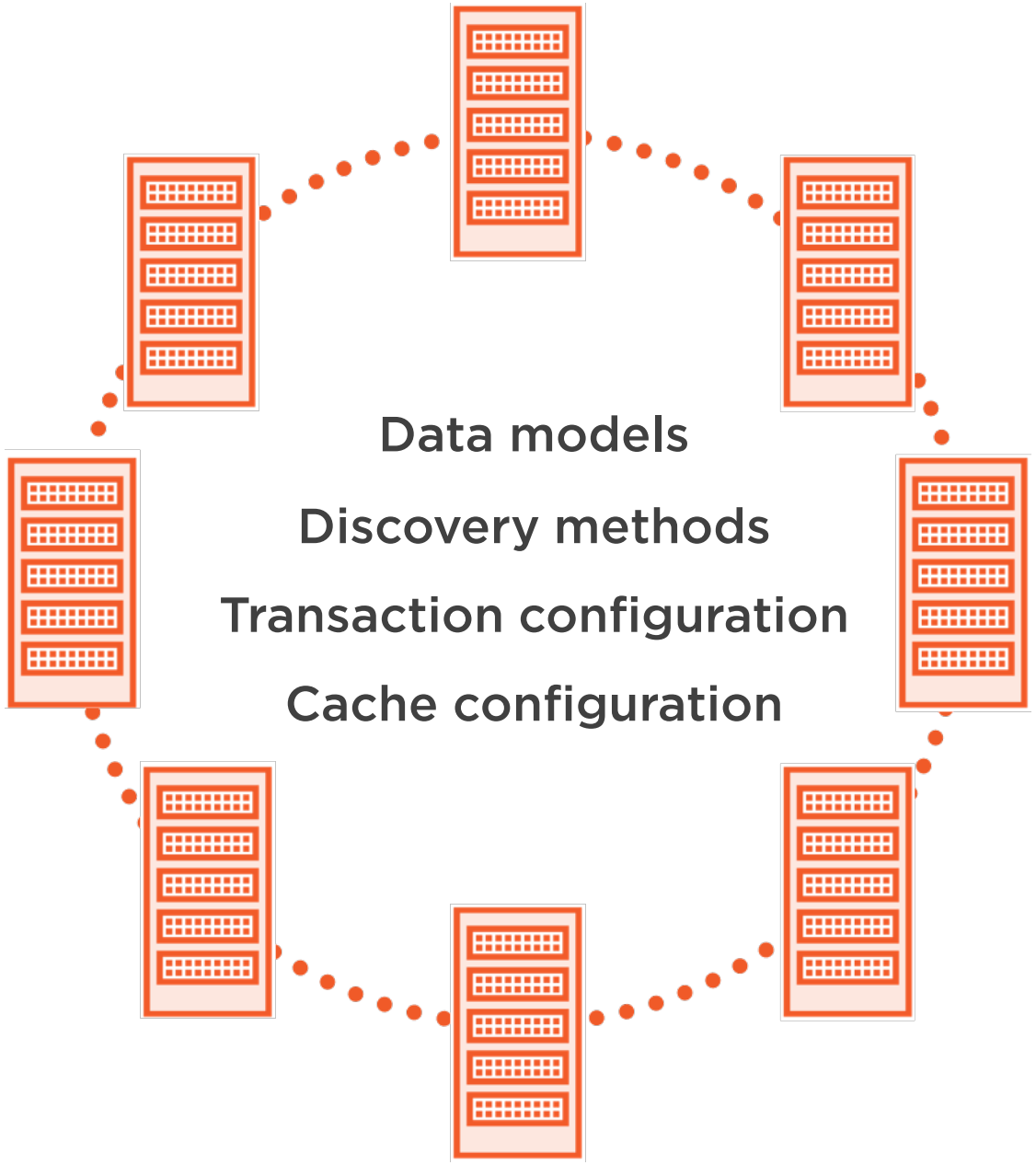


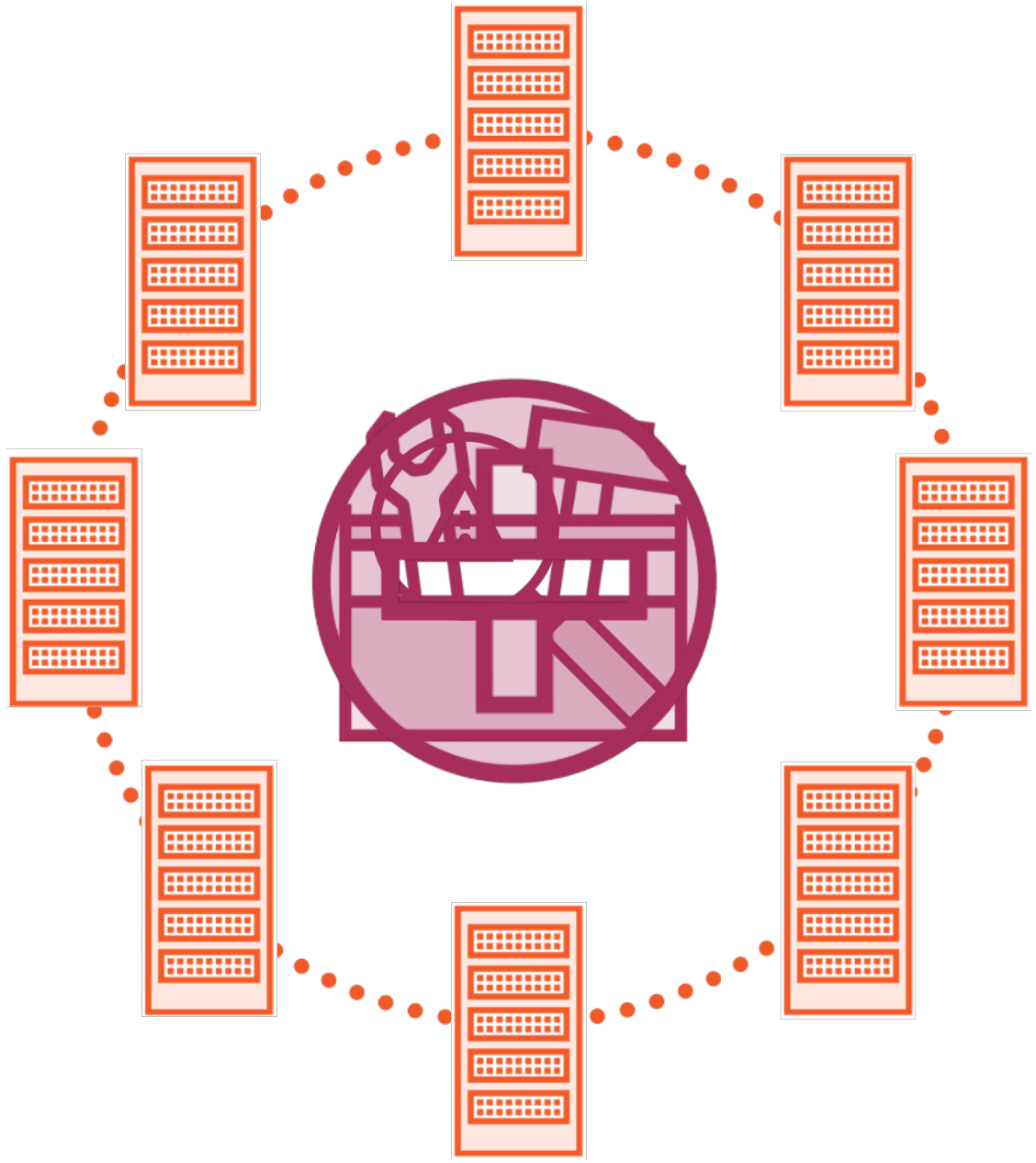


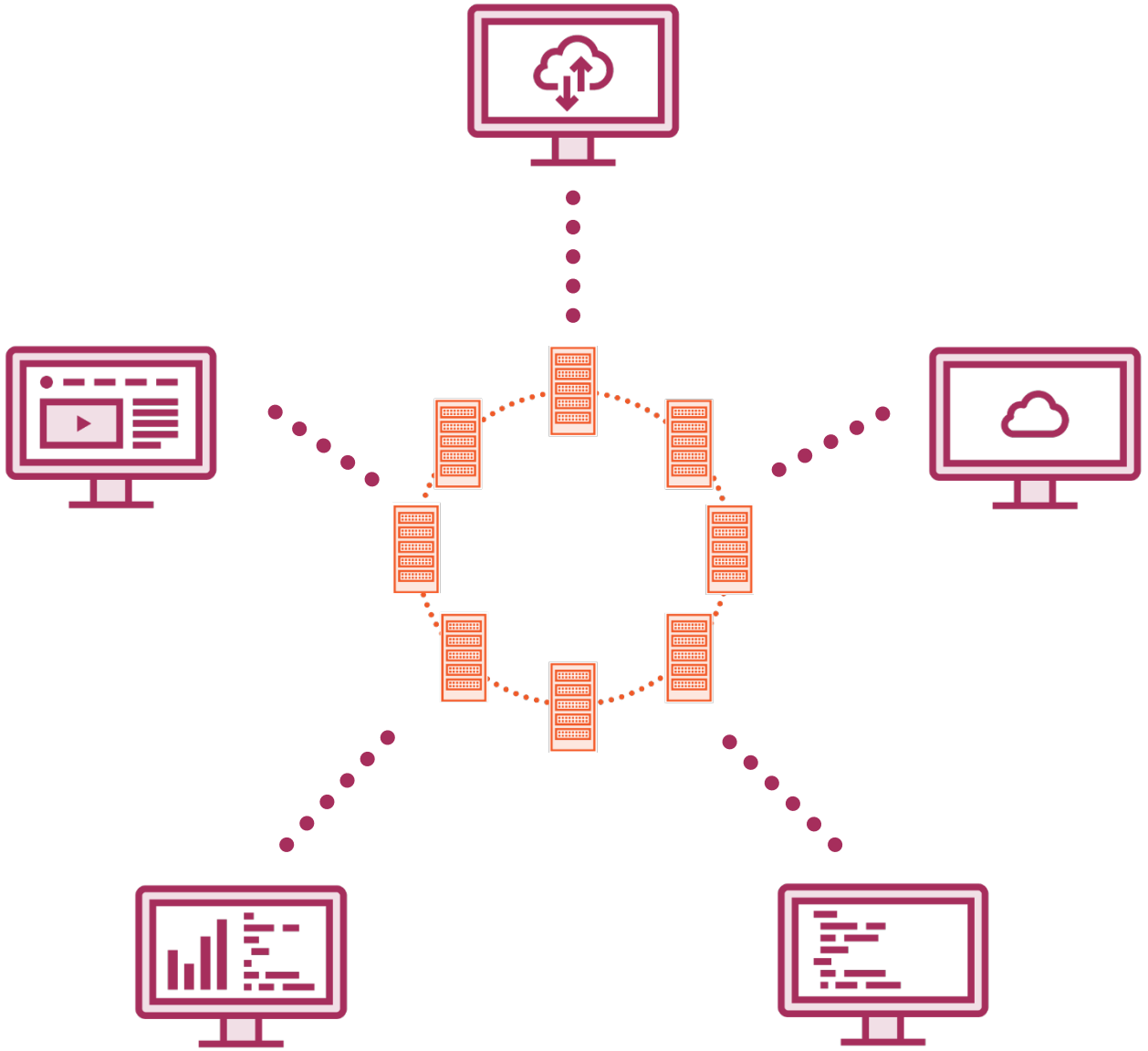


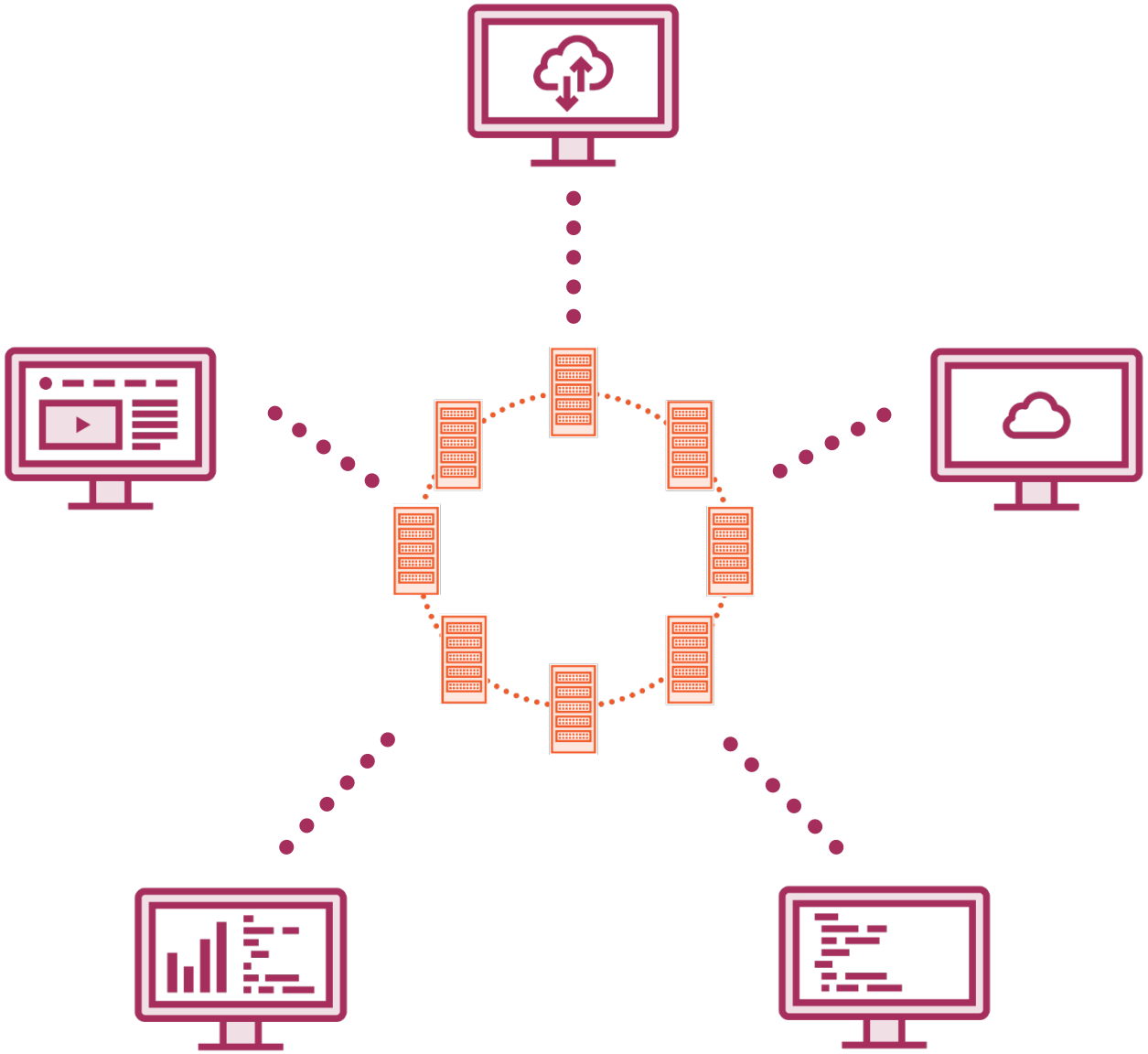





Data models
Discovery methods
Transaction configuration
Cache configuration





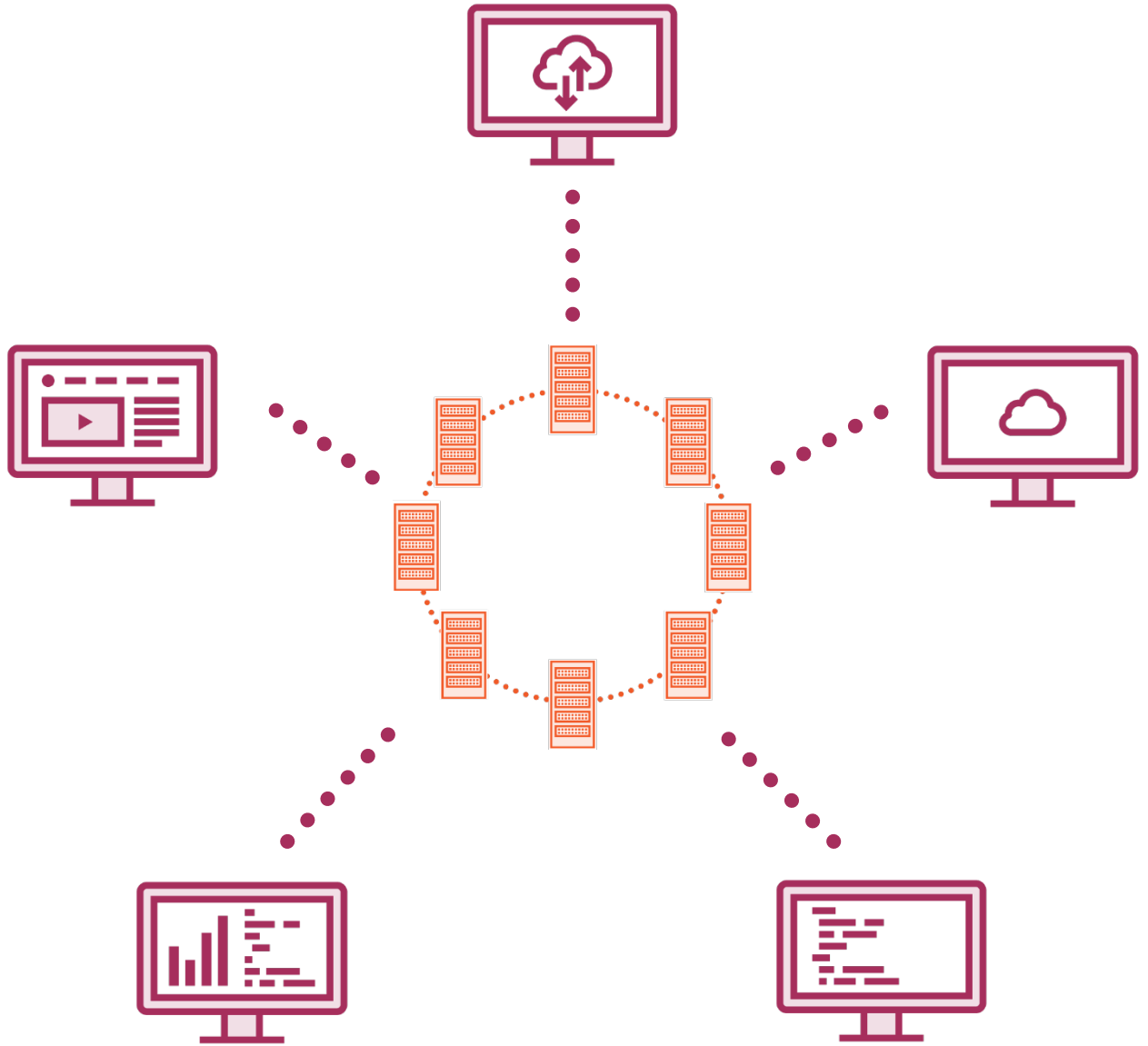


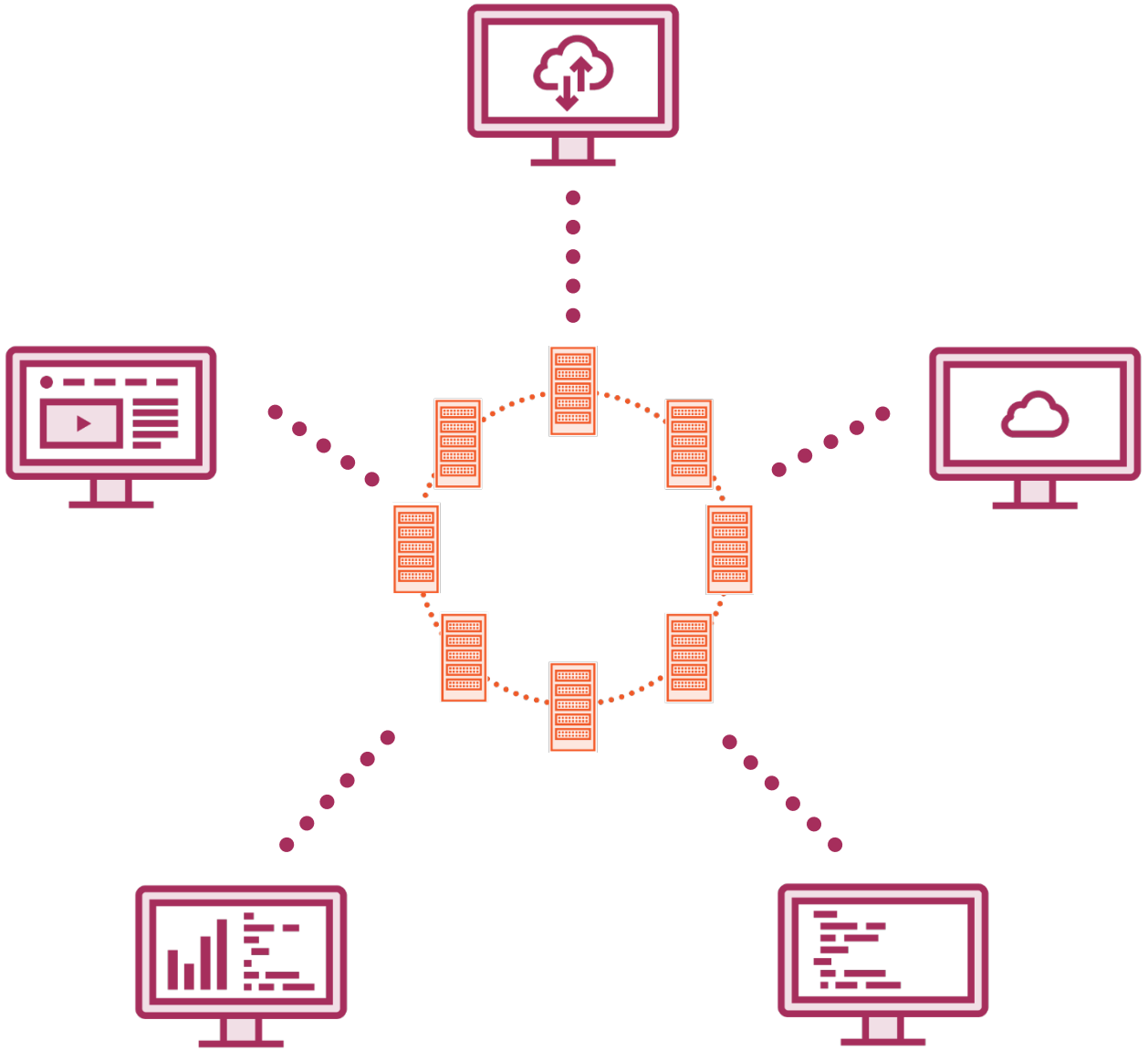
Caching

Executing compute tasks

Handling stream processing

Interface with the Ignite API

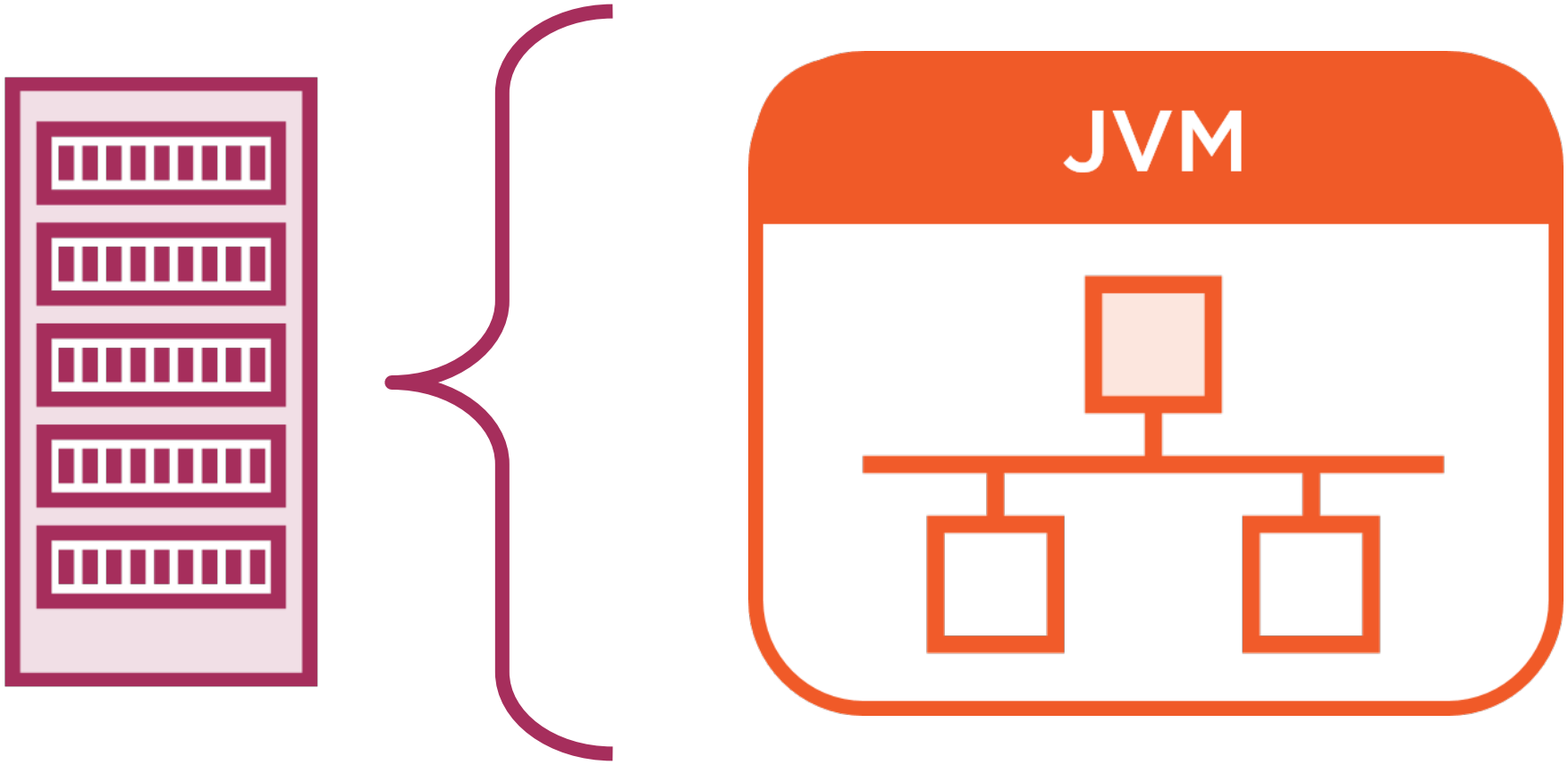


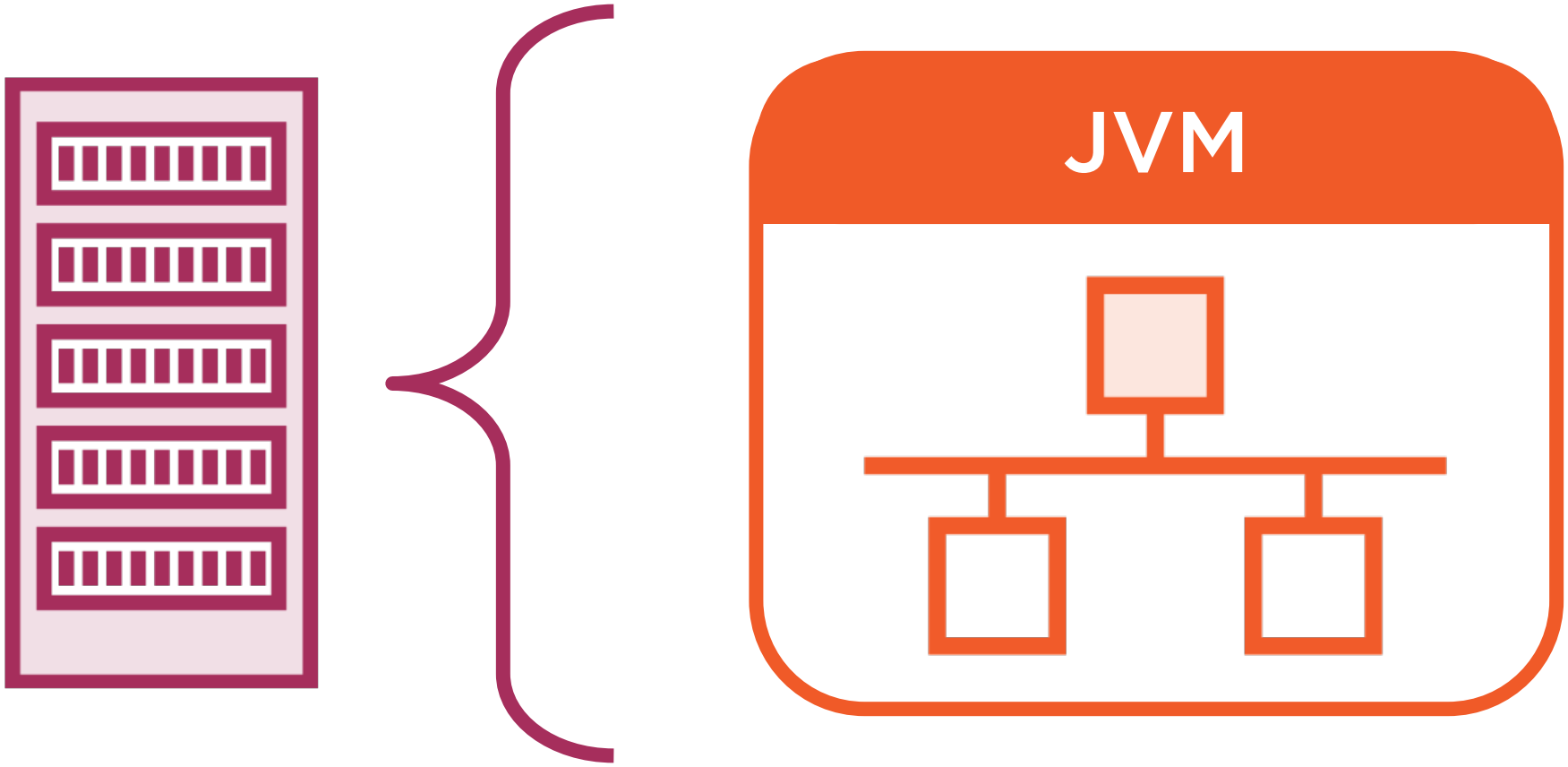


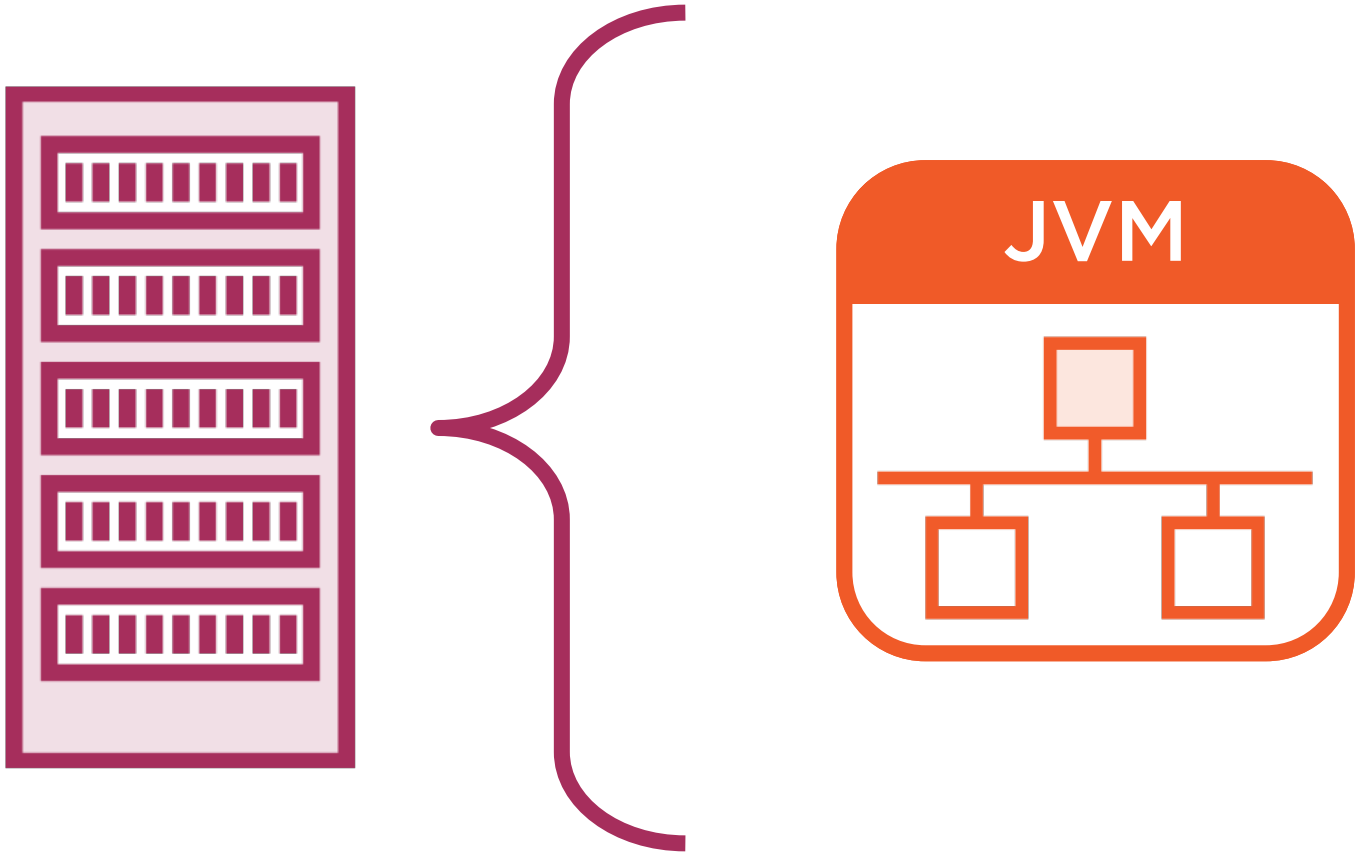
Cluster Nodes

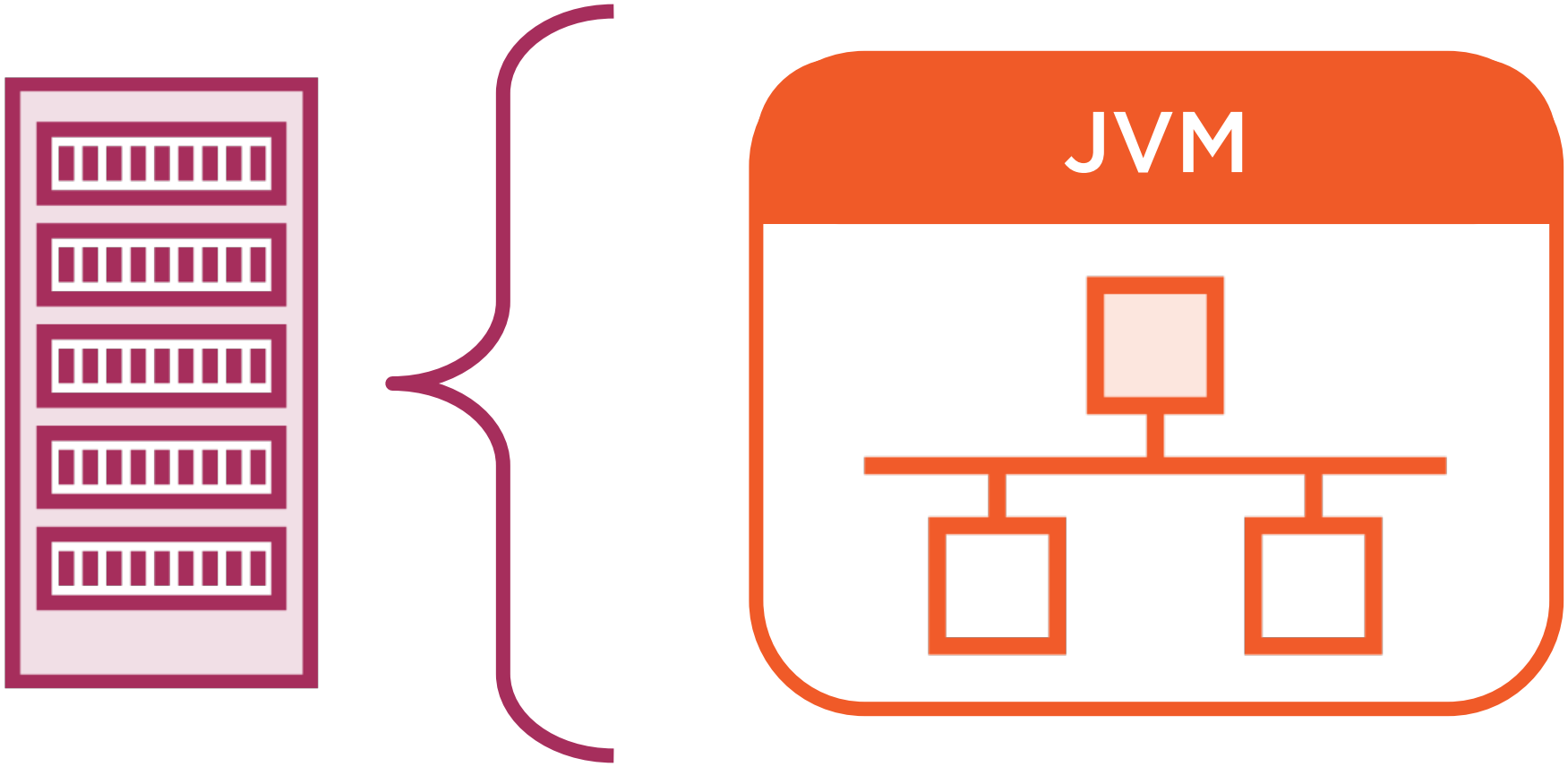
Cluster Support Services

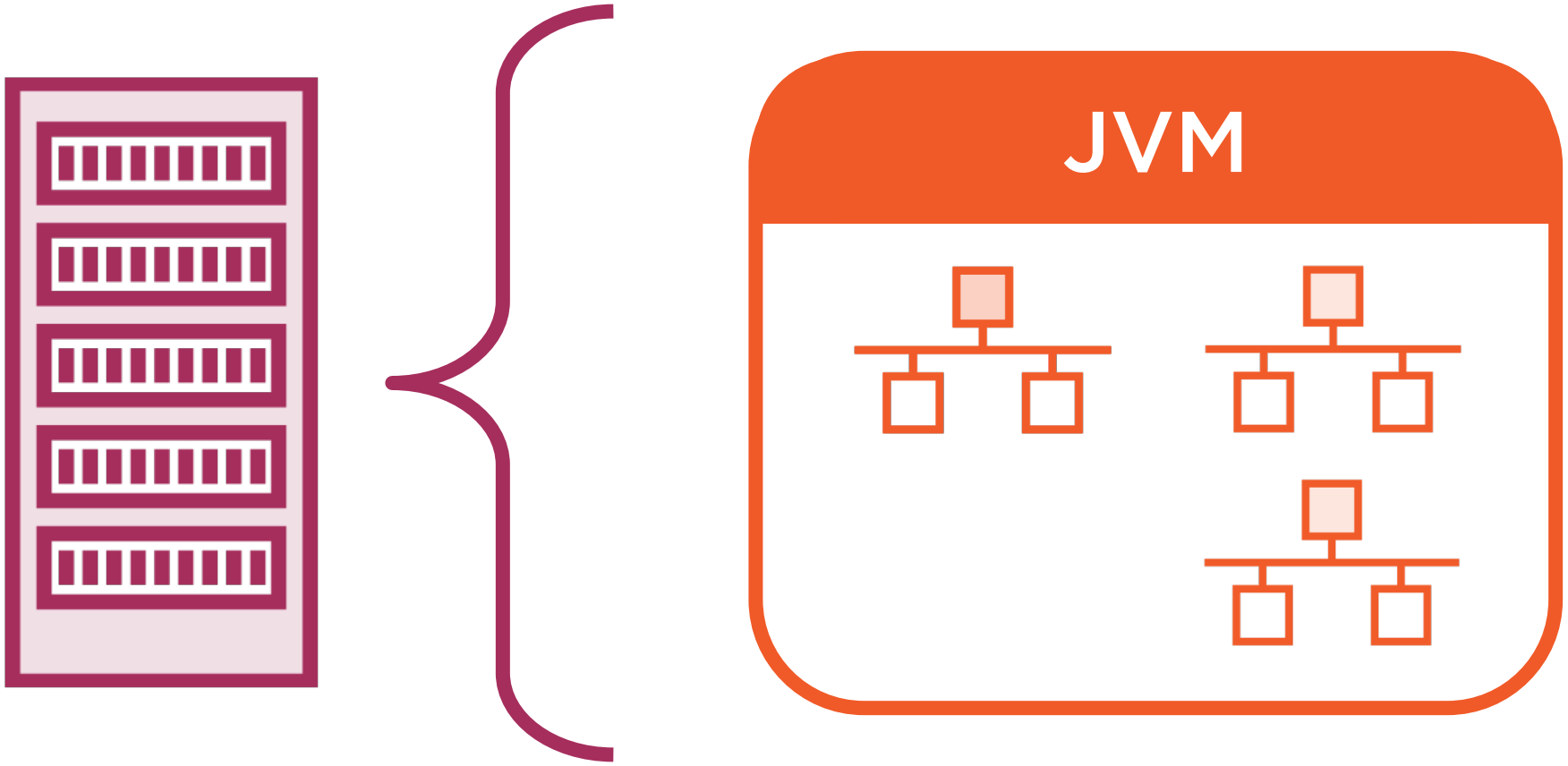
- Load balancing
- Discovery & heartbeat
- Fault tolerance / Failover
- Dynamically adding & removing nodes

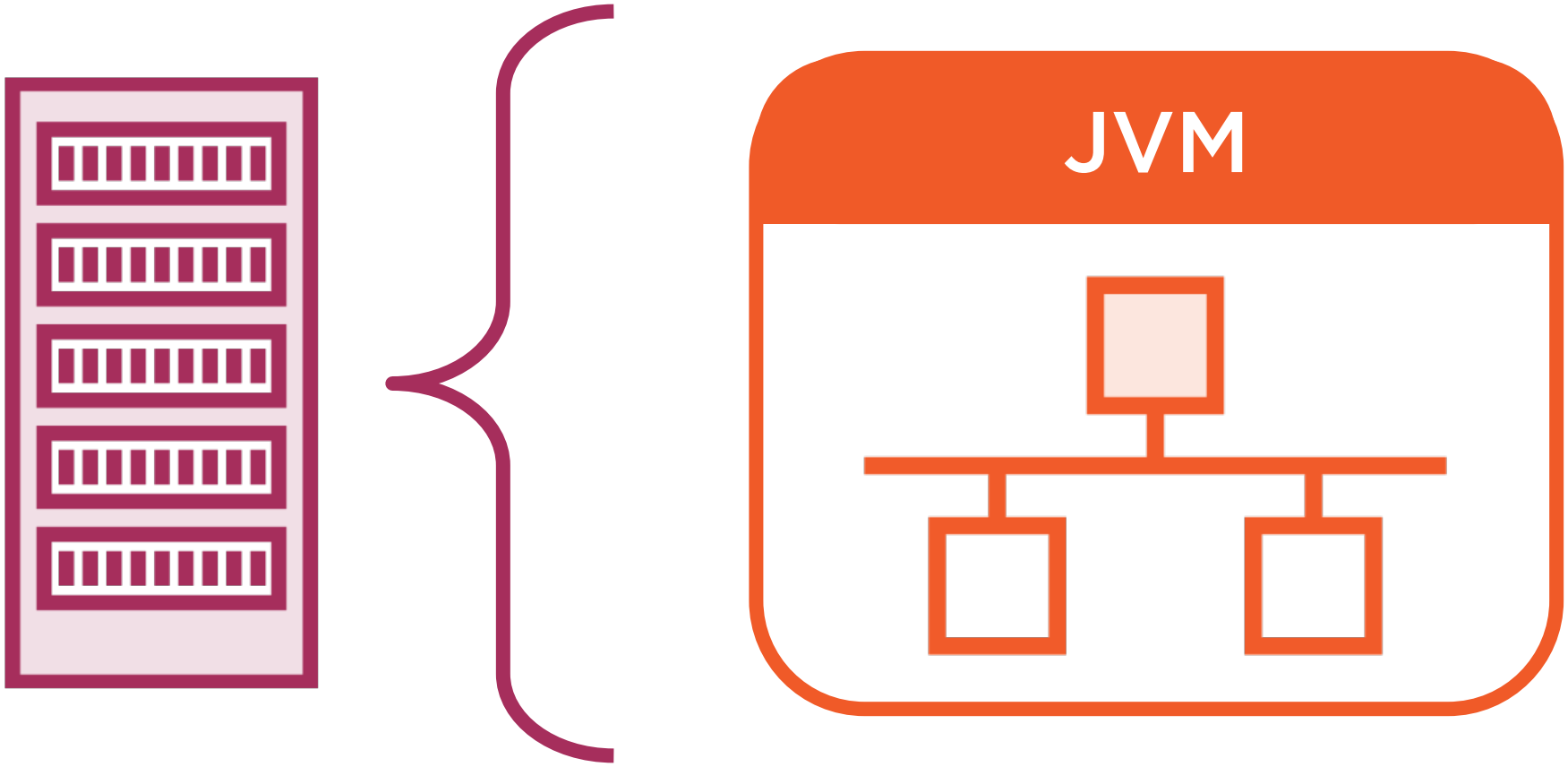

JVM

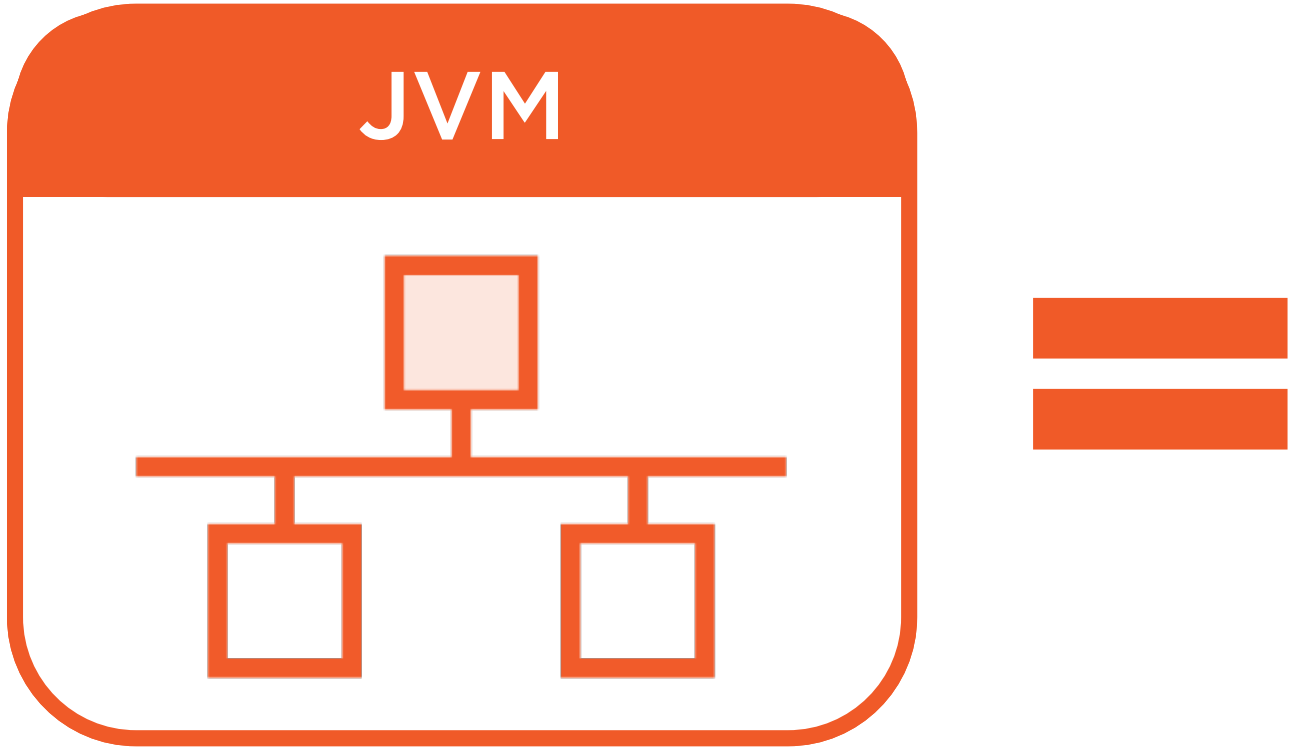

JVM


JVM


JVM


JVM


JVM


JVM

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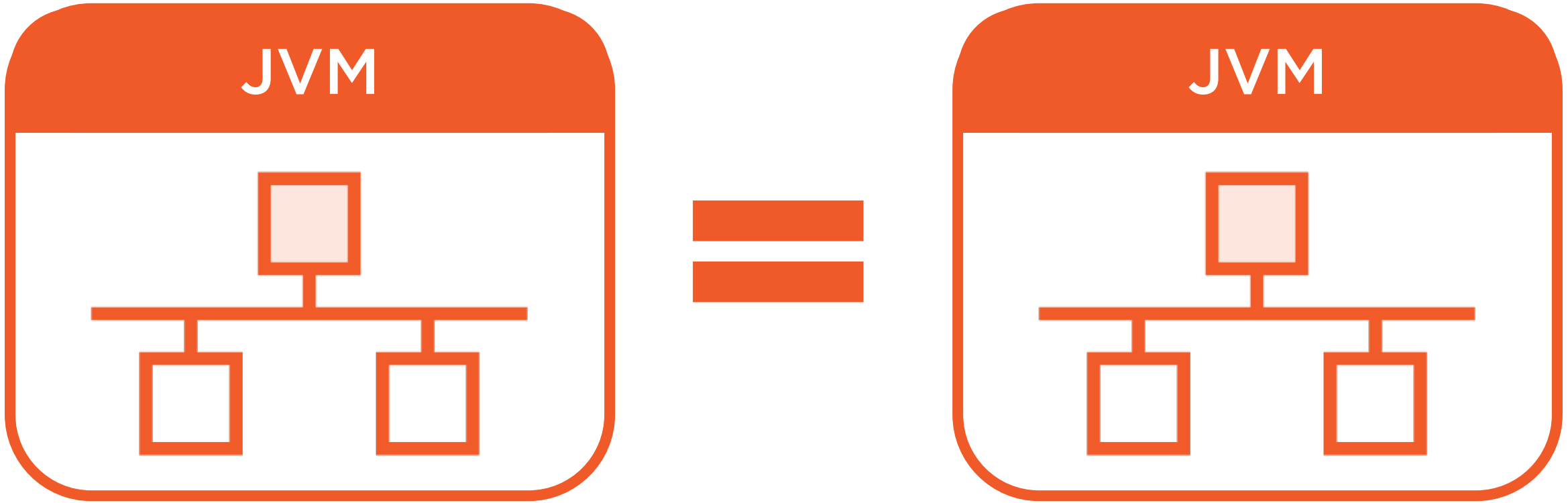
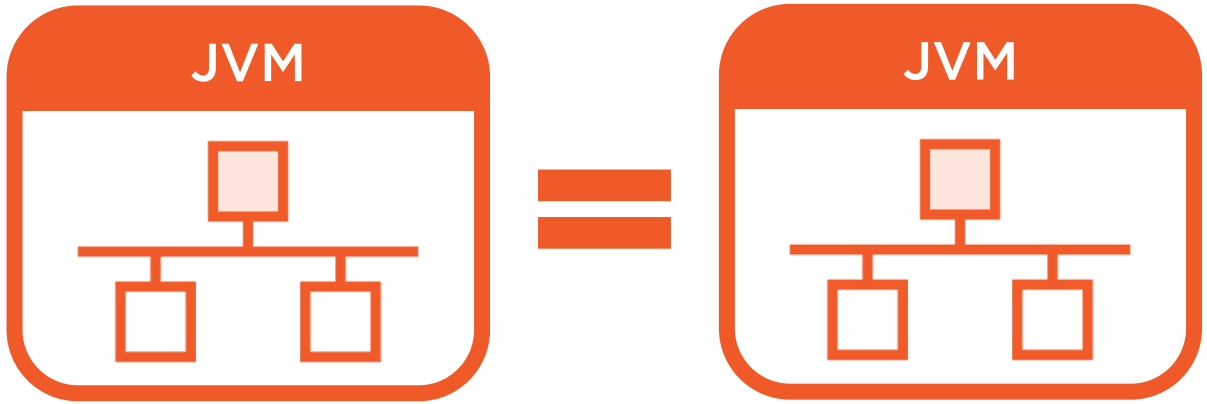

JVM
=
JVM

No “master” node

Communicate via messages

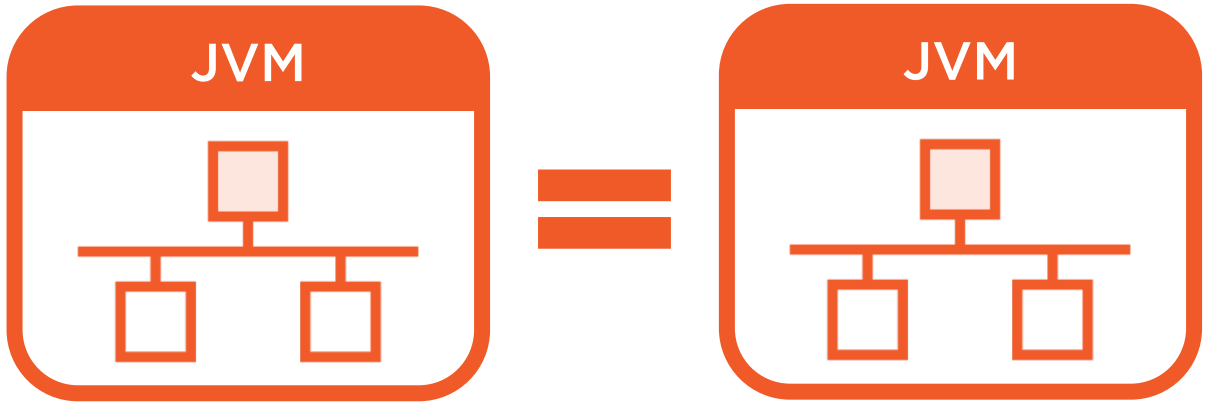
Same configuration

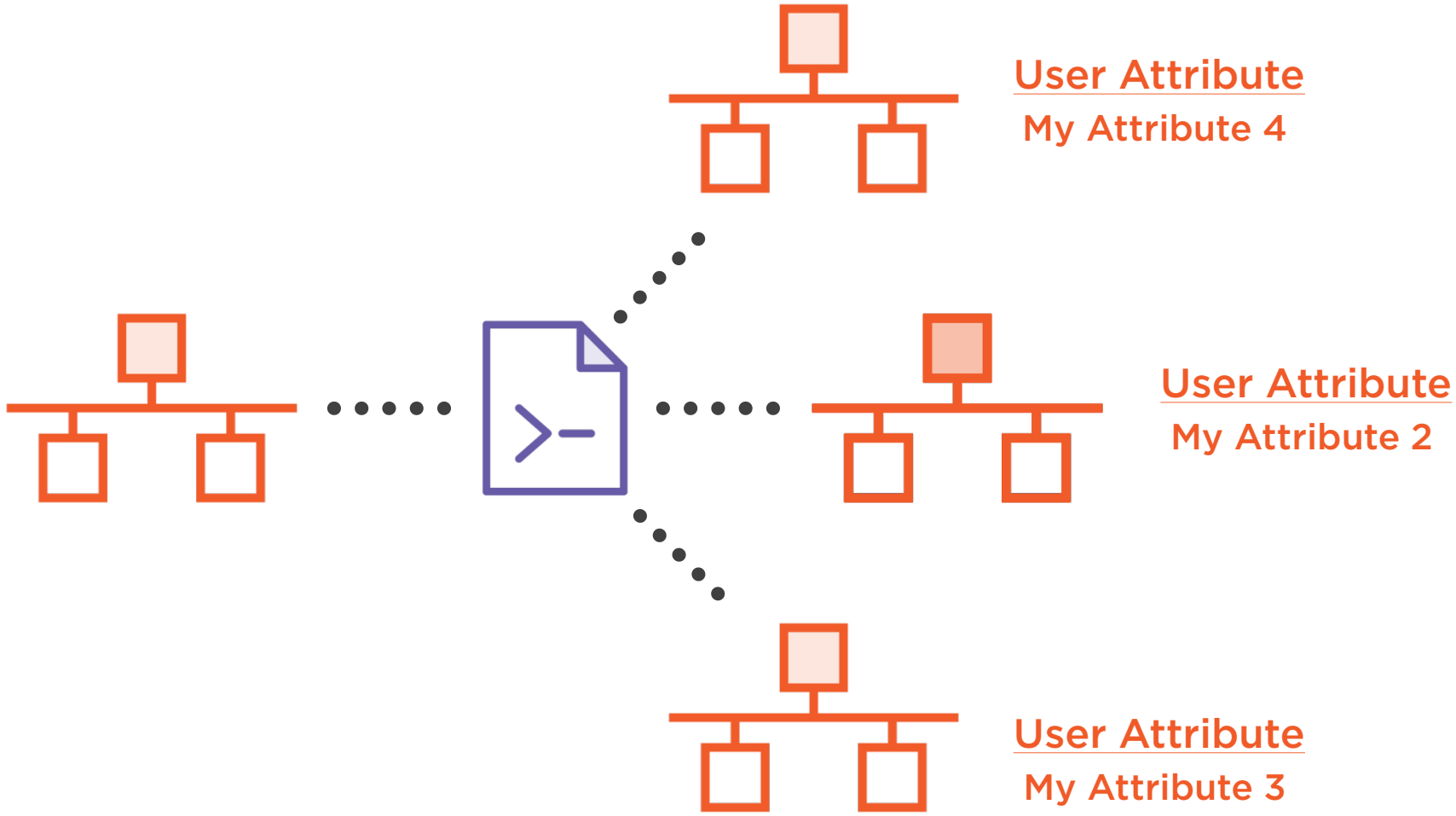


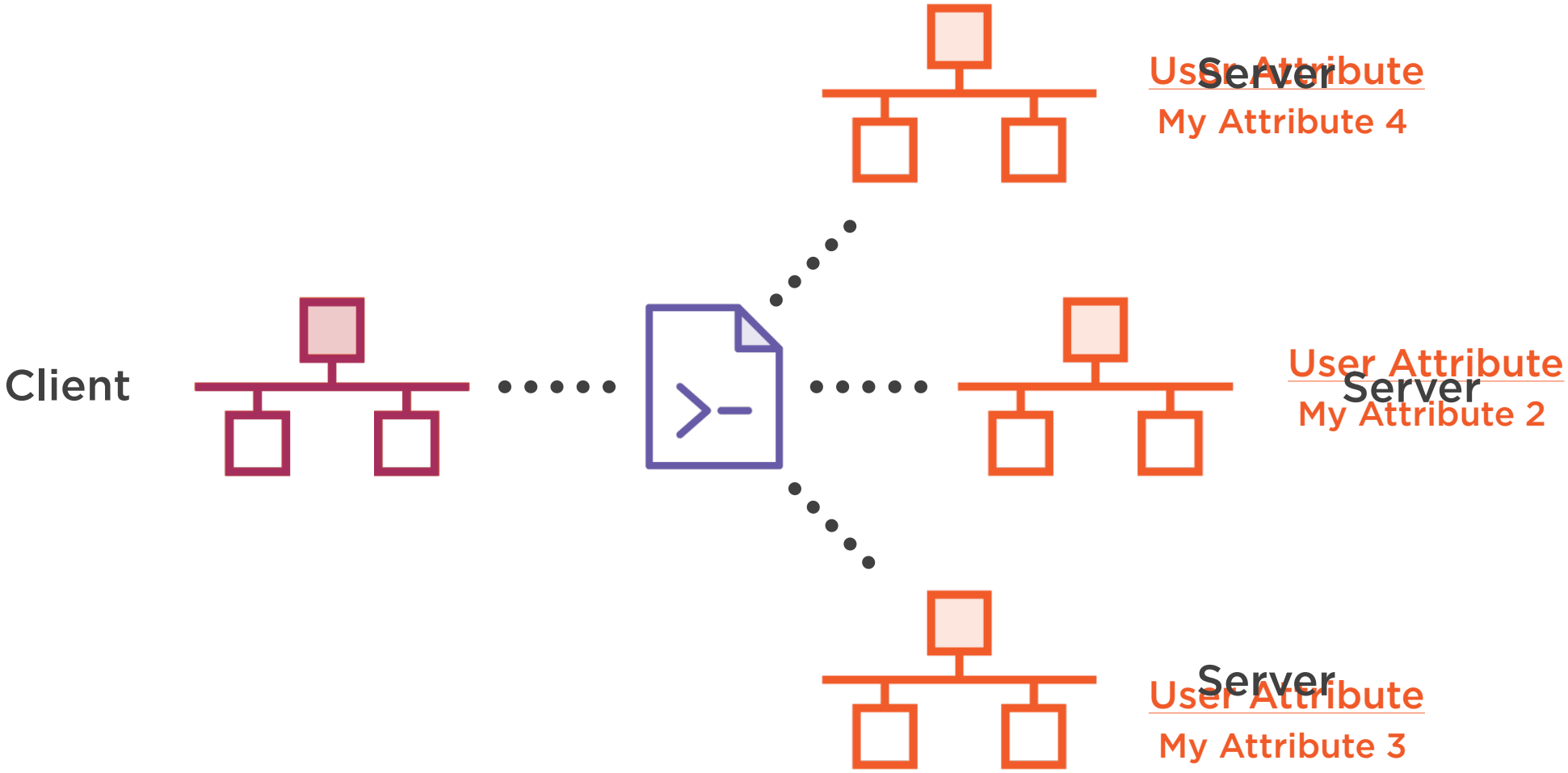
No “master” node

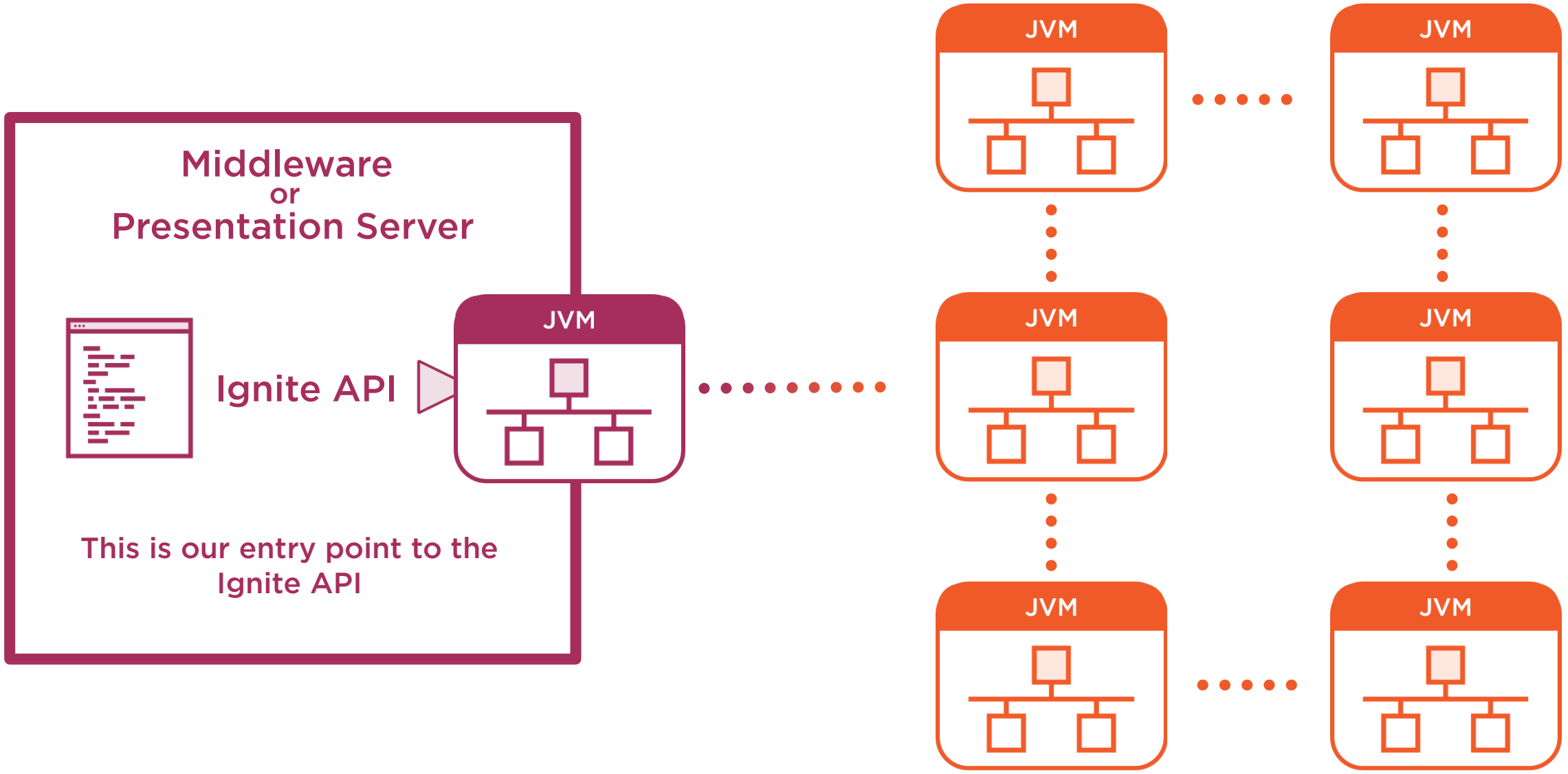
Communicate via messages

Same configuration




User Attribute
My Attribute 4
User Attribute
My Attribute 2
User Attribute
My Attribute 3

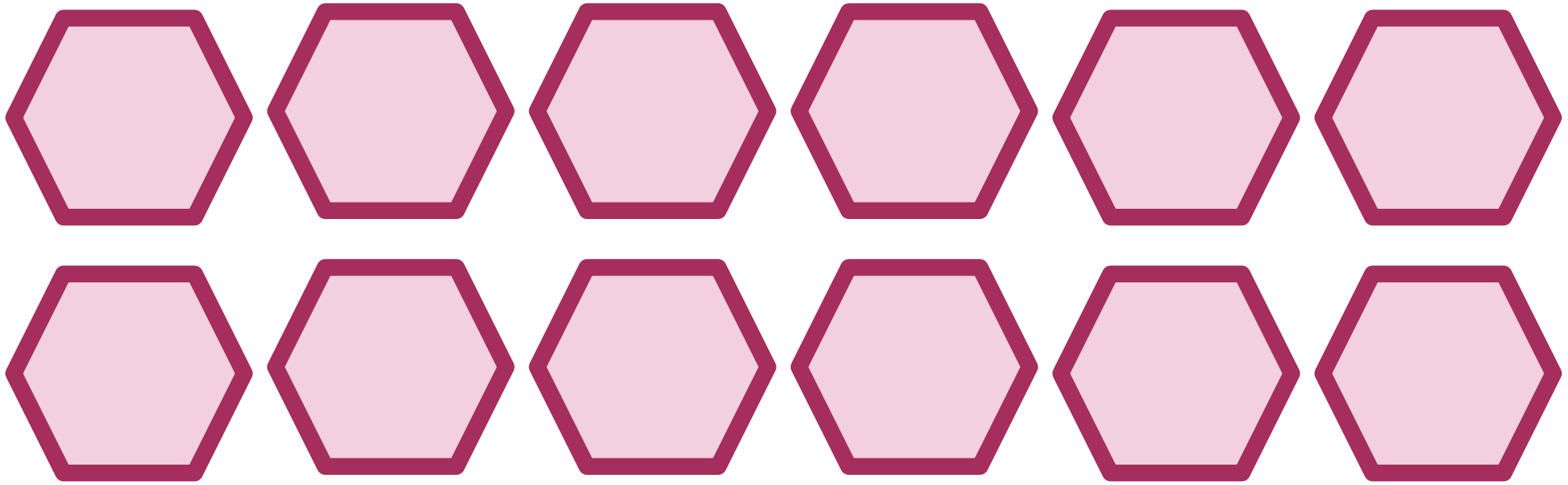

Client
Server
User Attribute
My Attribute 4
Server
User Attribute
My Attribute 2
Server
User Attribute
My Attribute 3

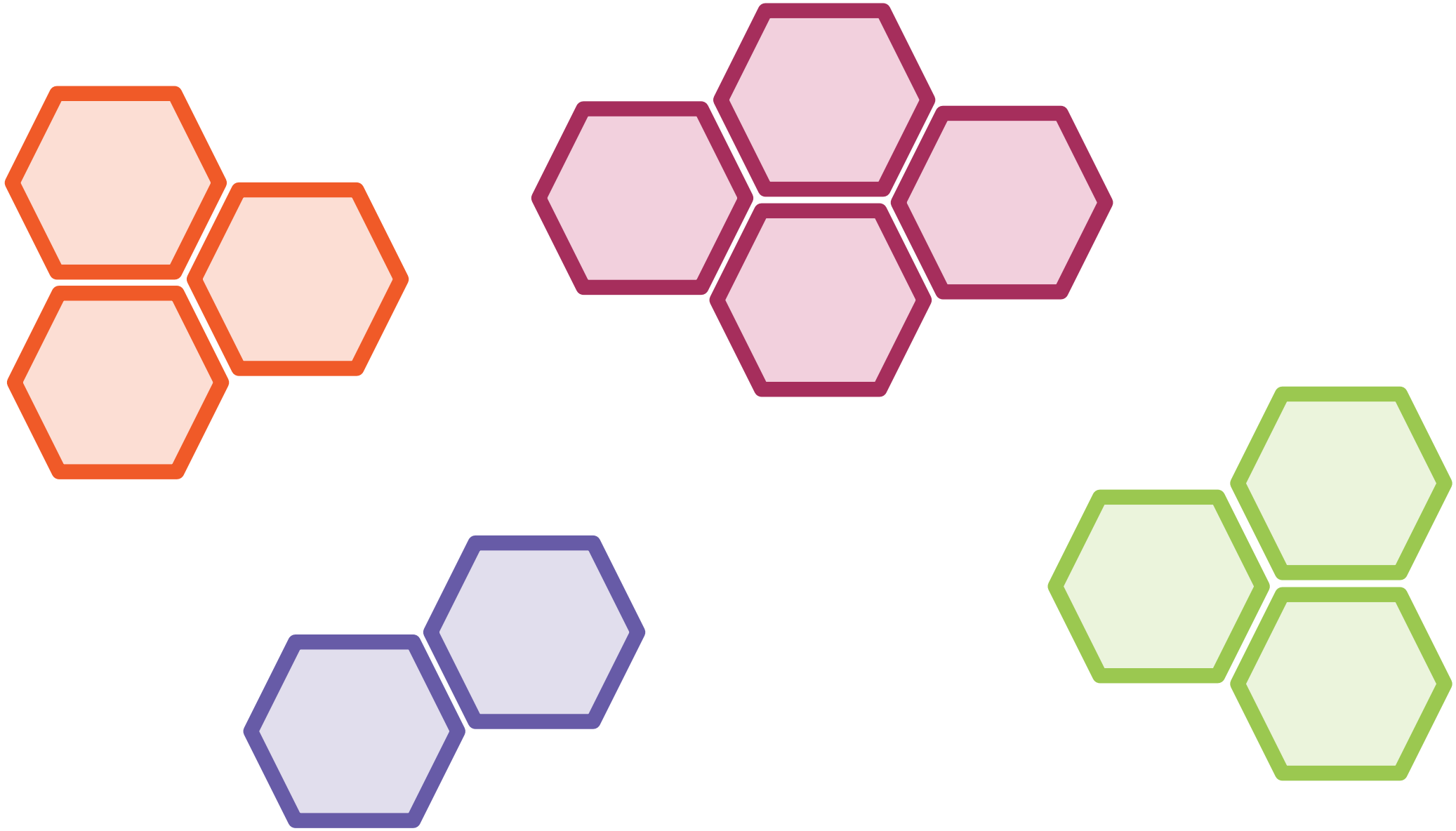

Middleware
or
Presentation Server
Ignite API
JVM
This is our entry point to the
Ignite API
JVM
JVM
JVM
JVM
JVM
JVM
JVM

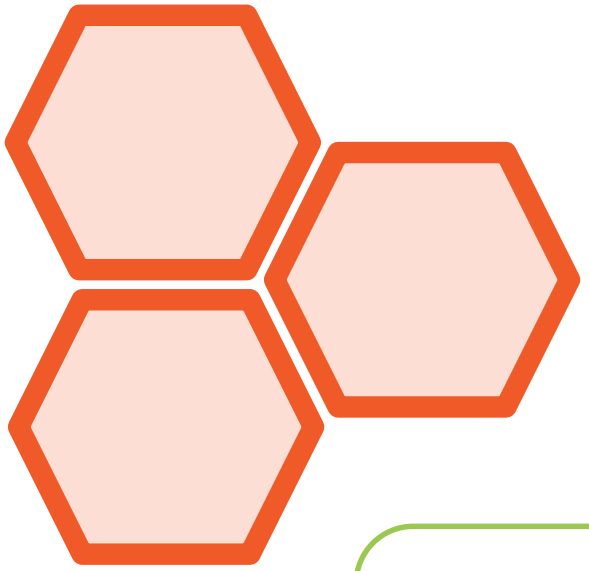
Up Next

Cluster Groups

Cluster Groups

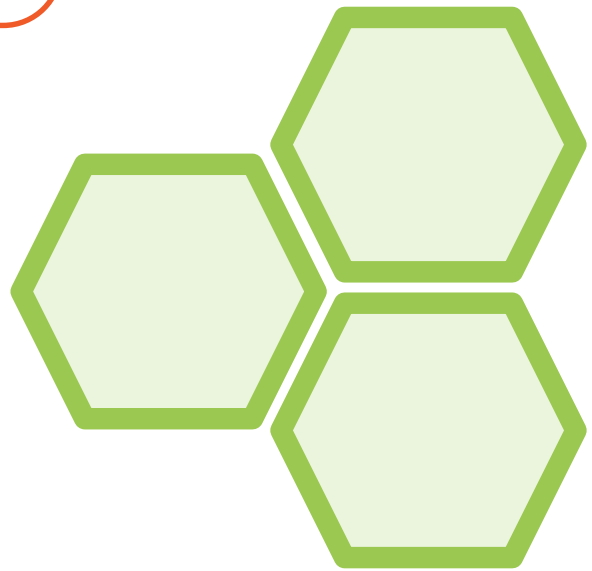


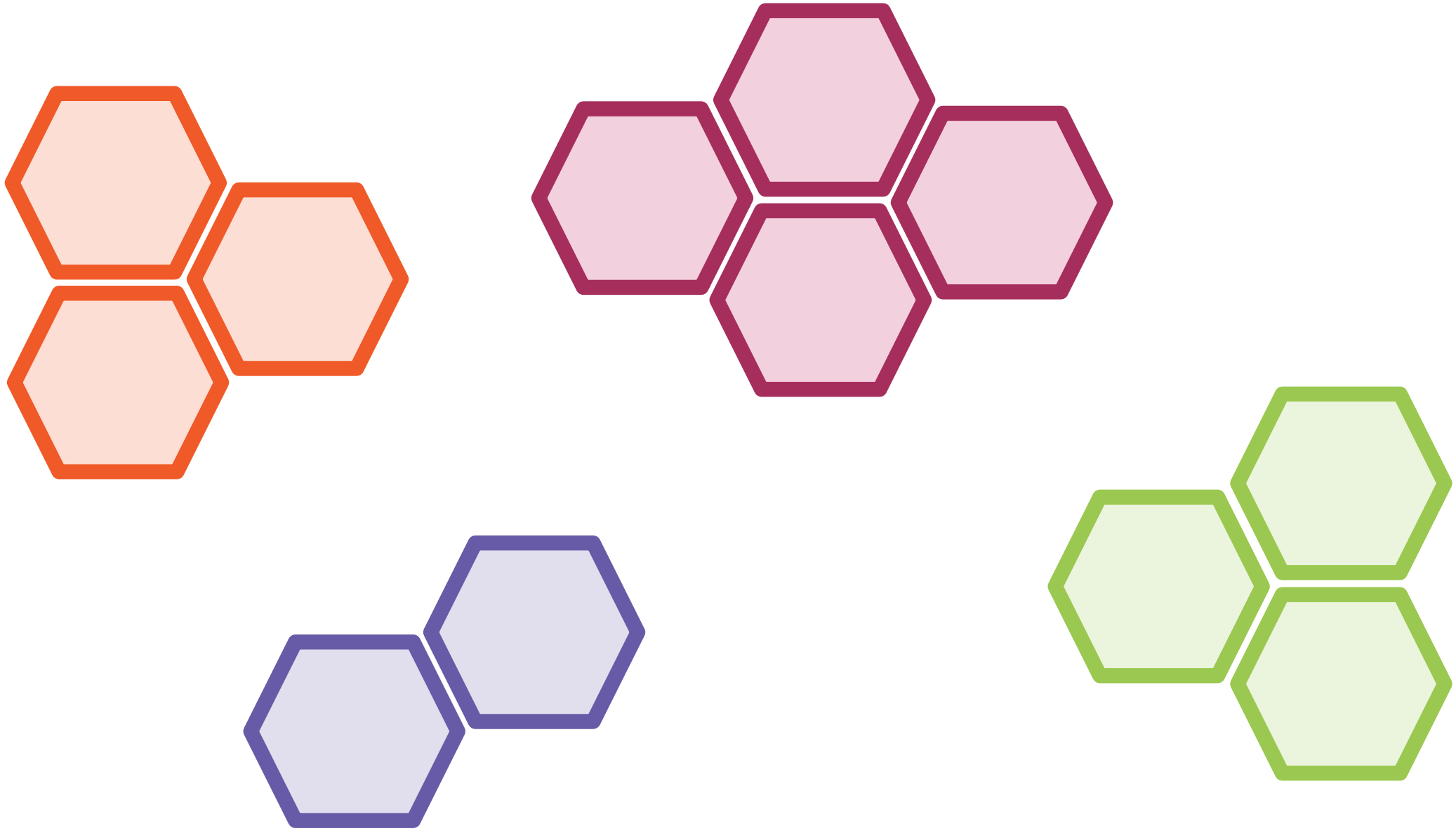


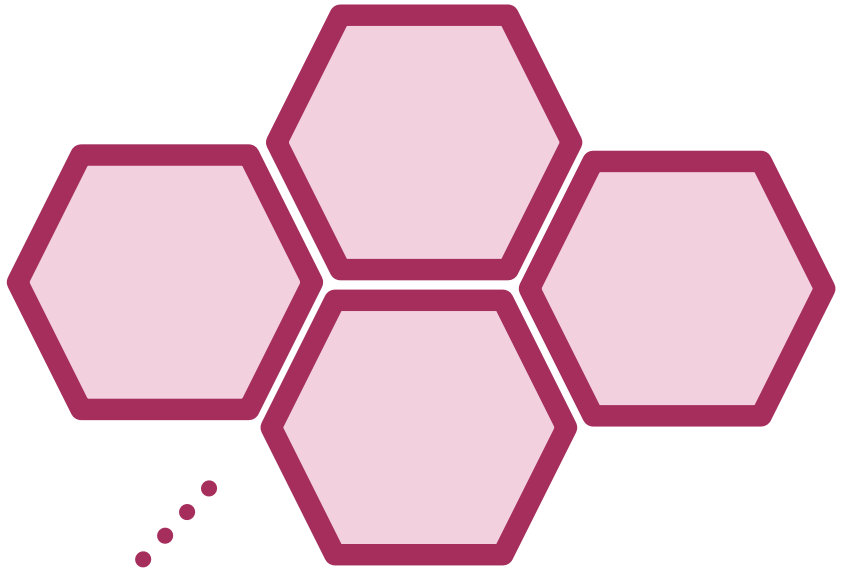


Flight Operations

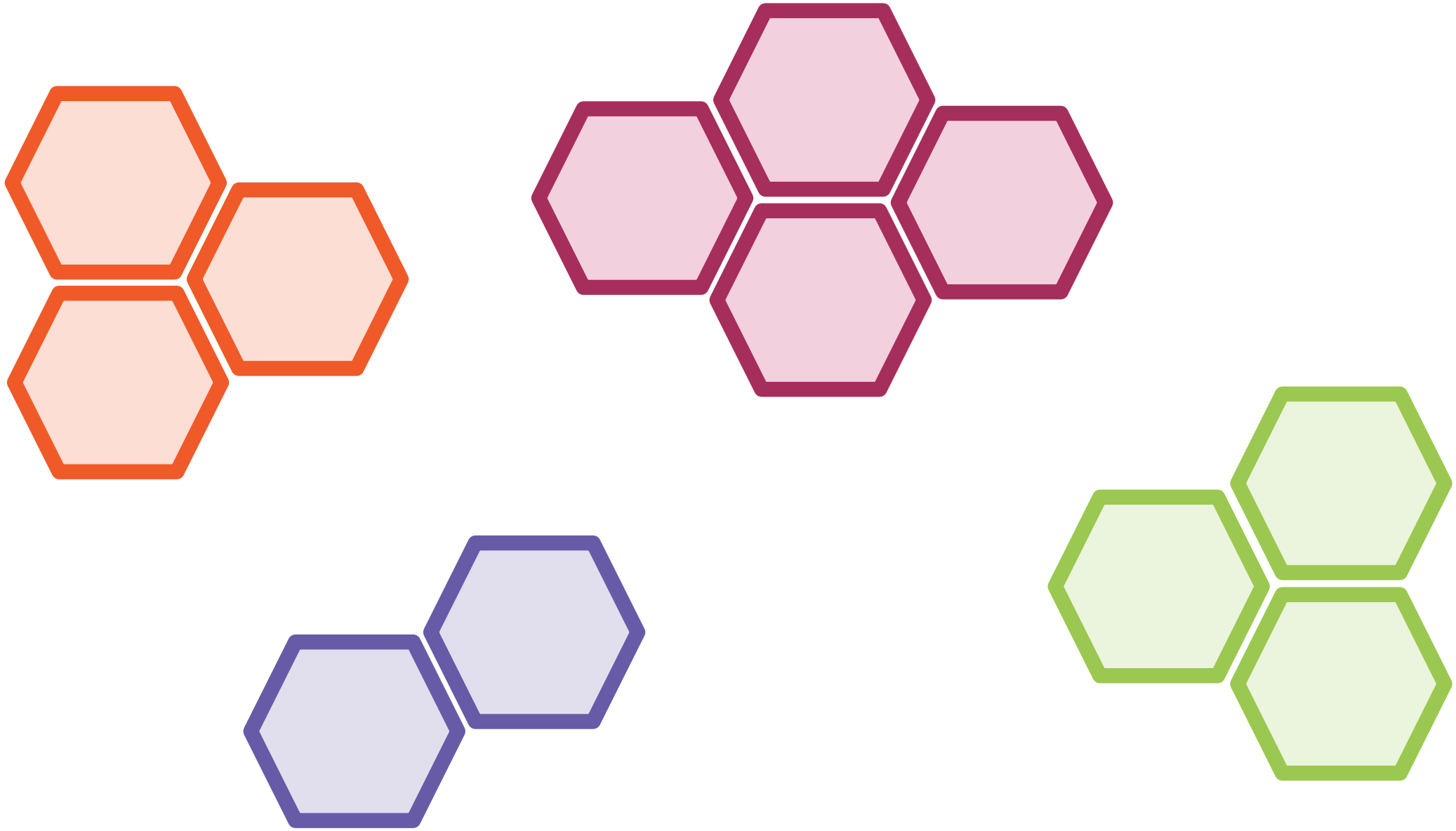
Flight Reservations





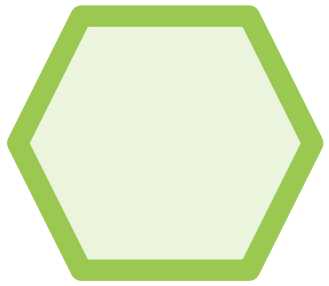


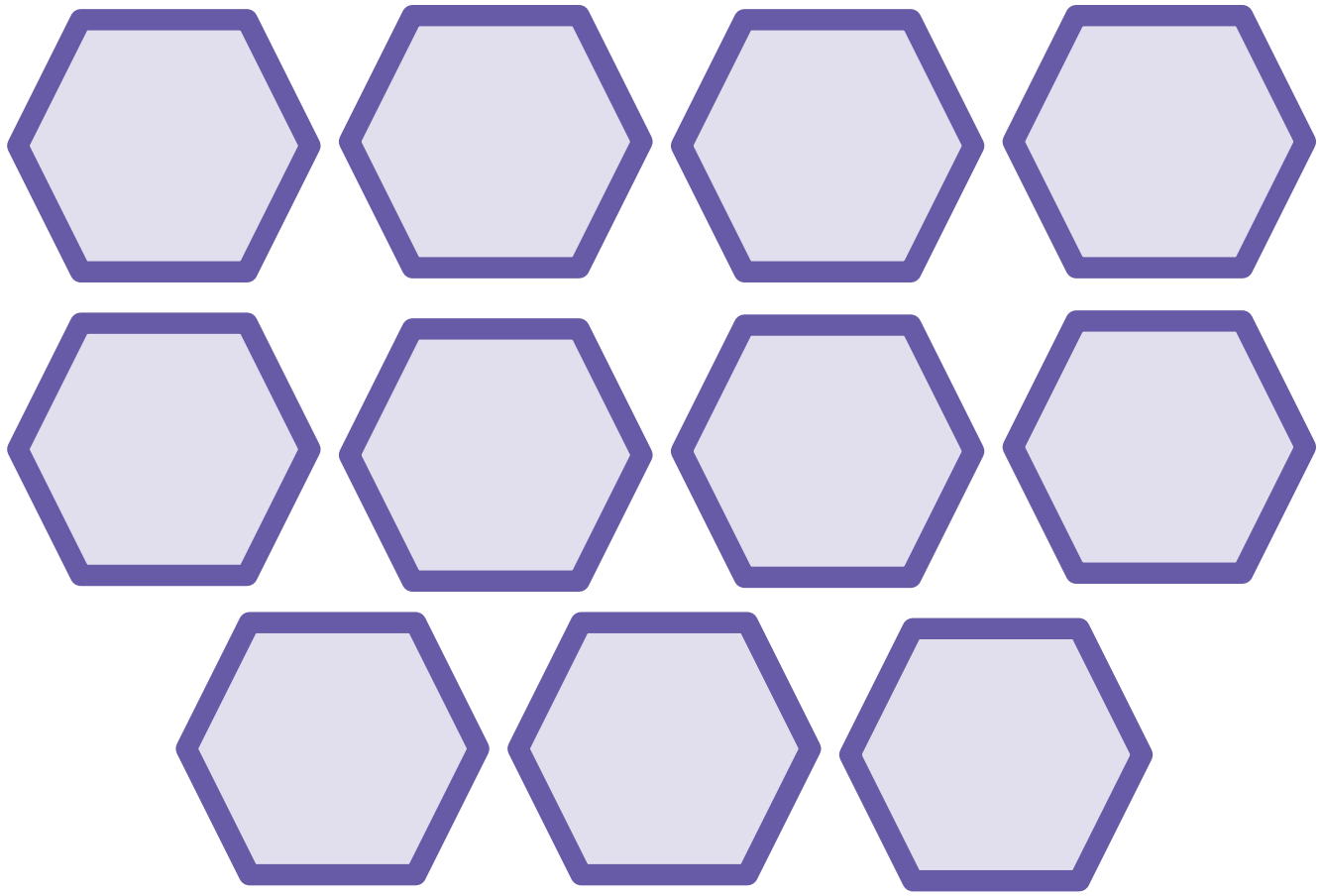
Idle Time < 70%

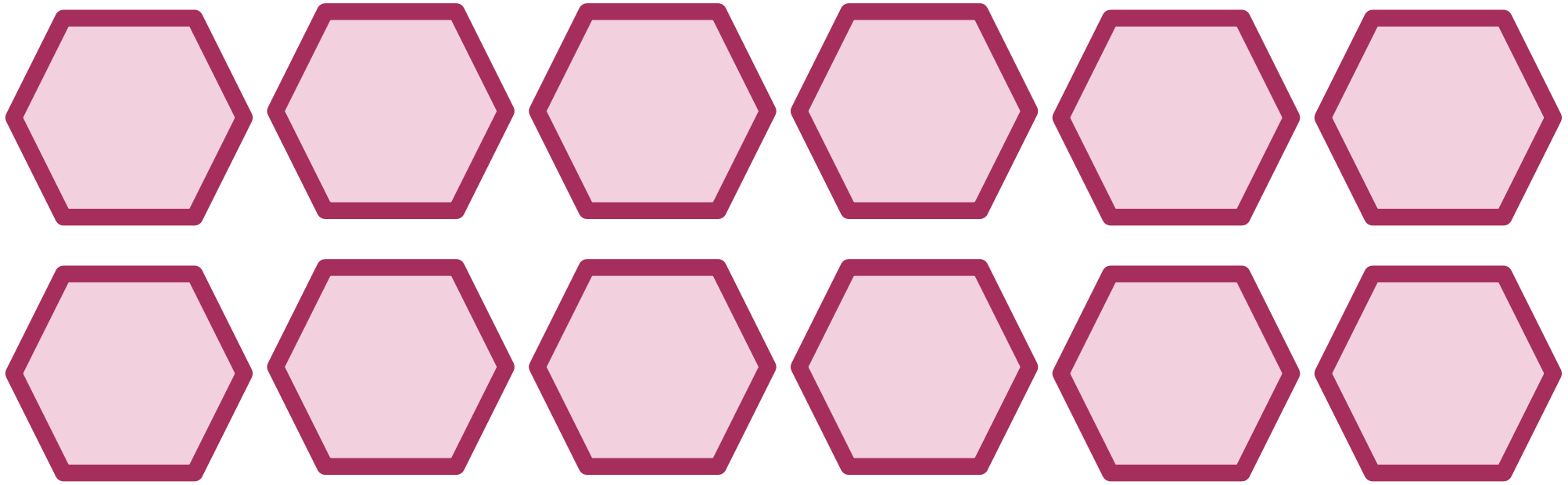


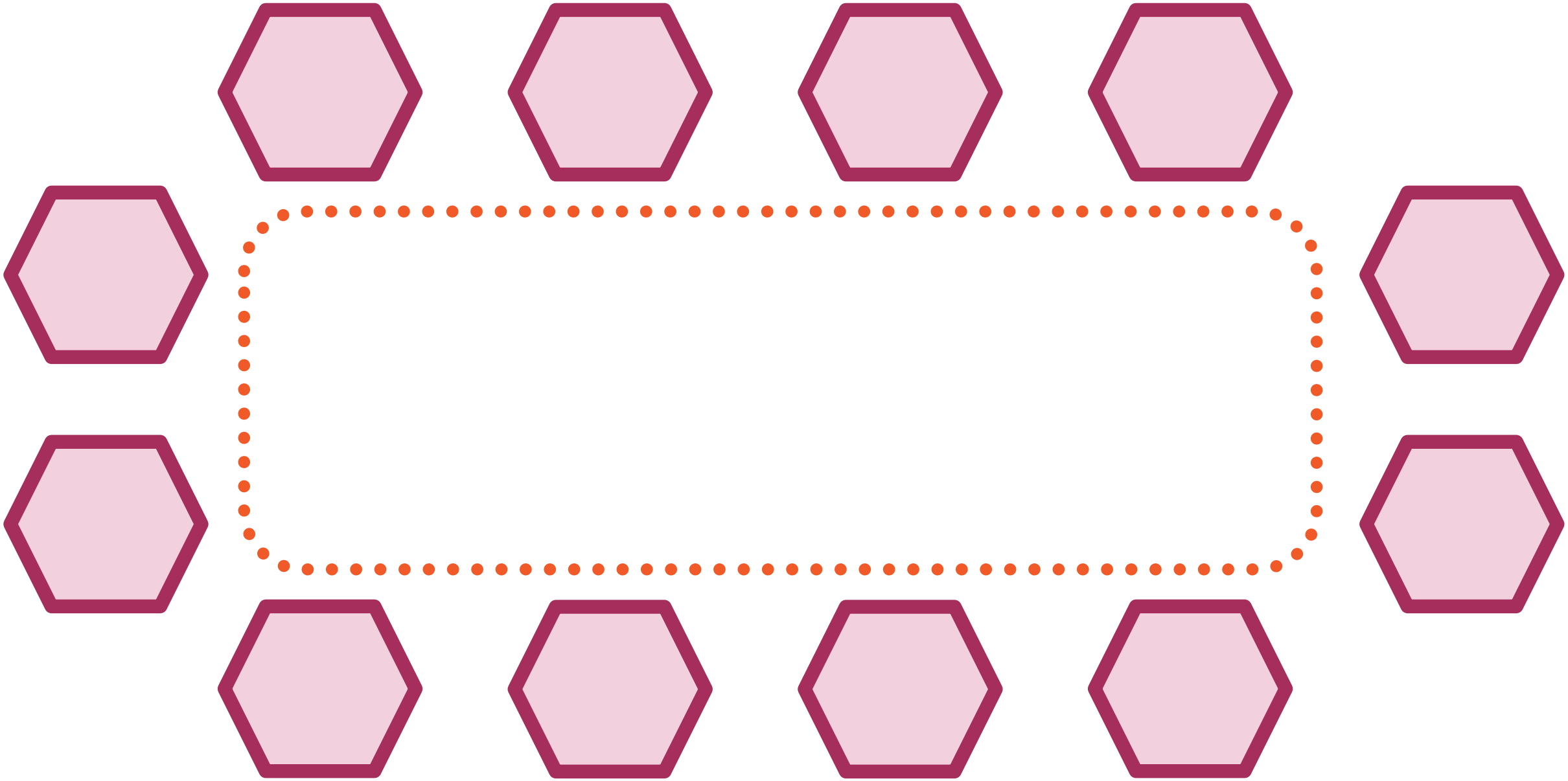
Remote Nodes

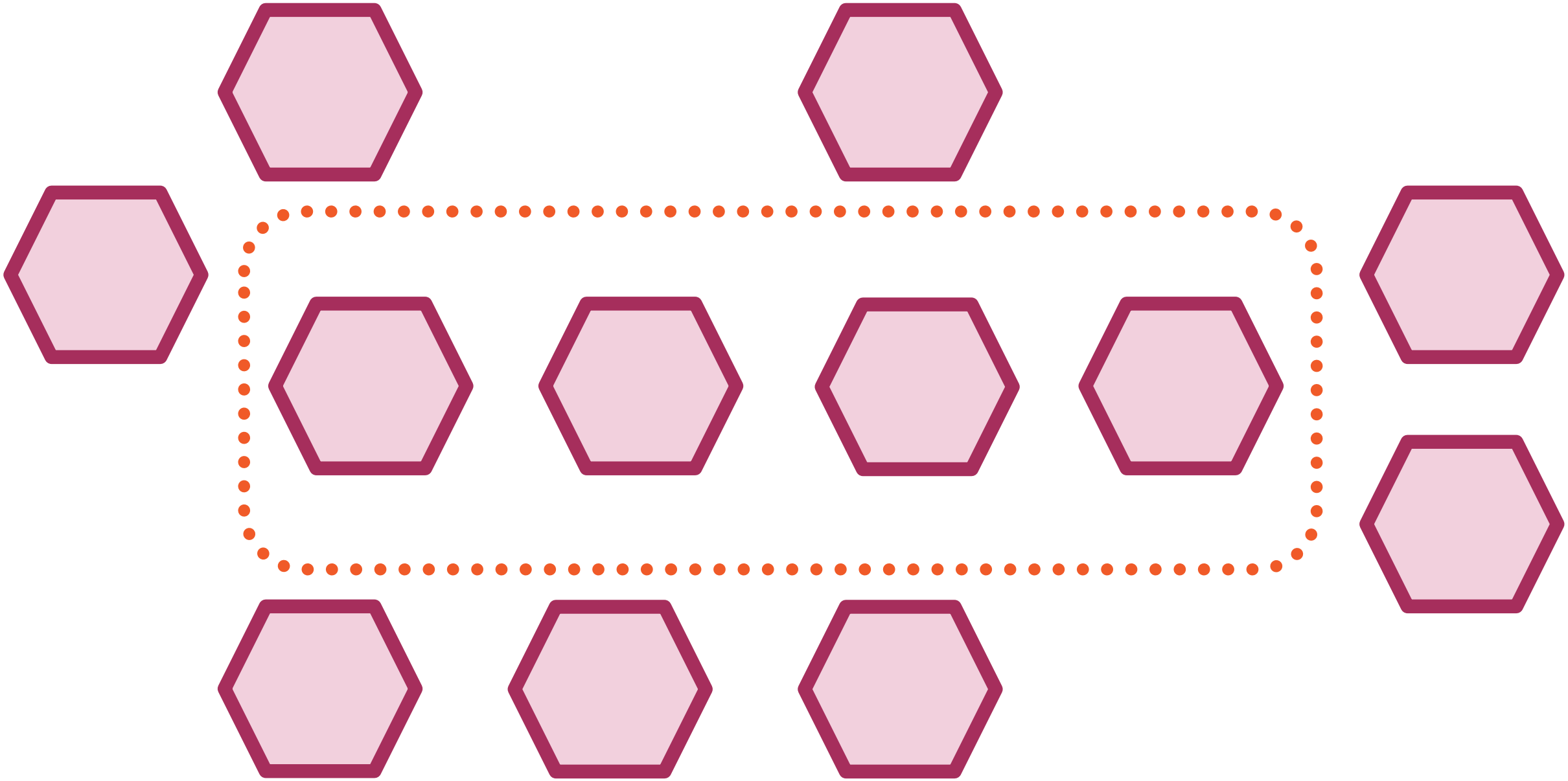
Local Node

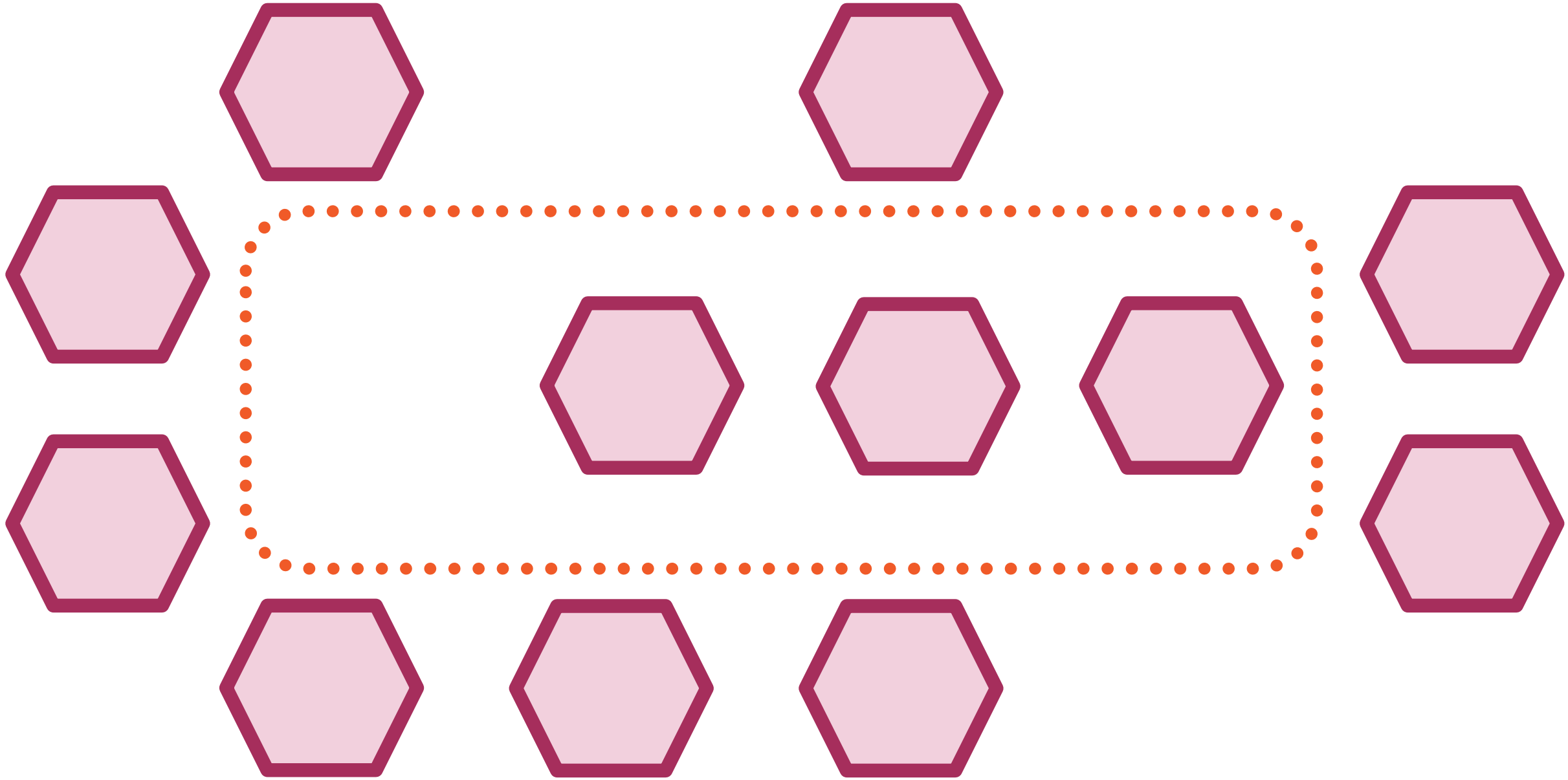


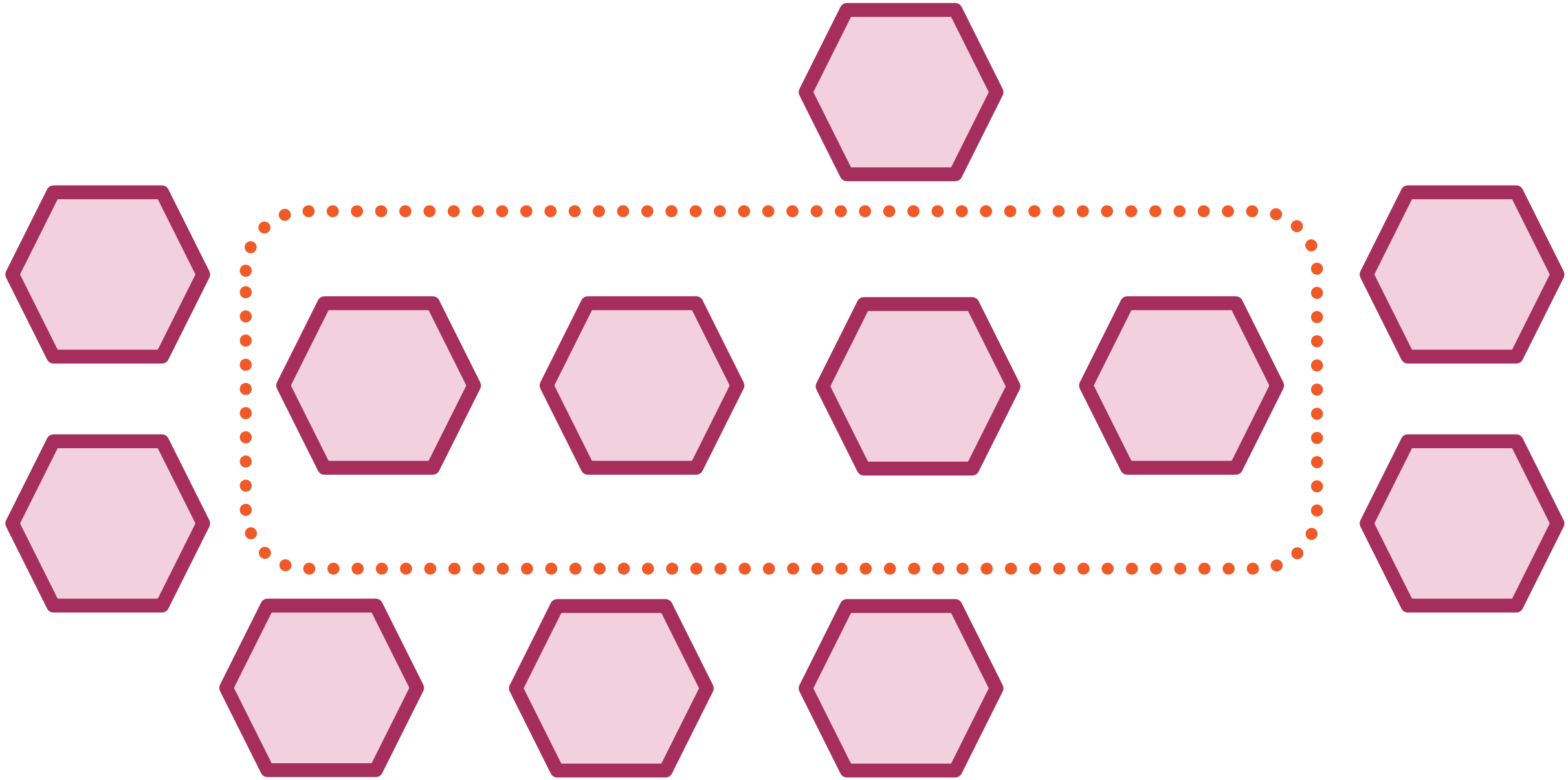


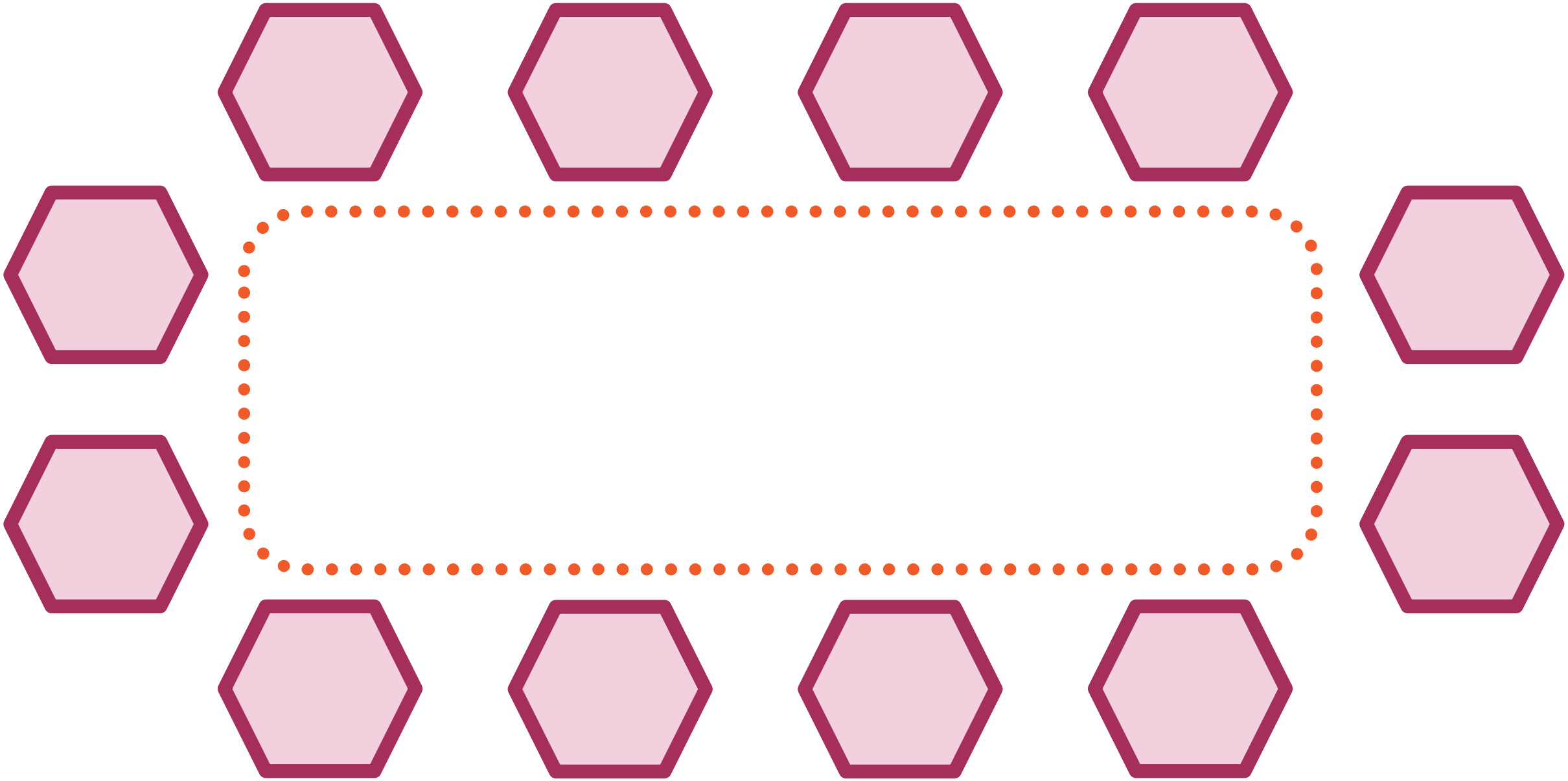


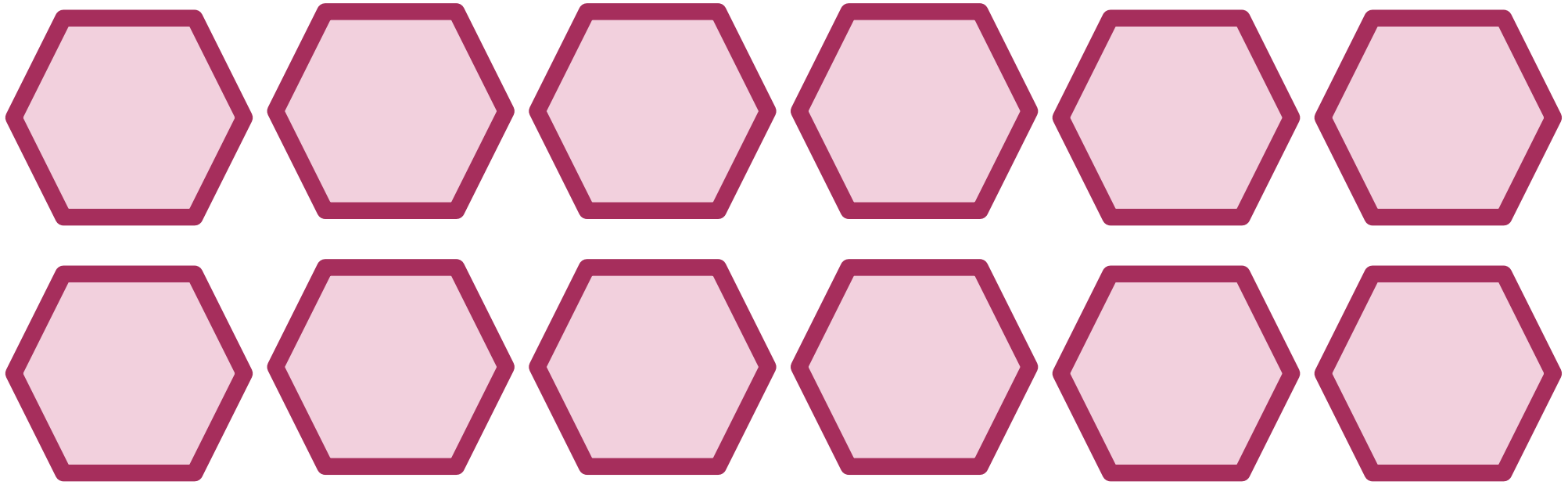












Ignite Node Attribute

```
<bean class="org.apache.ignite.IgniteConfiguration">
    ...
    <property name="userAttributes">
        <map>
            <entry key="ROLE" value="worker"/>
        </map>
    </property>
    ...
</bean>
```

Time

Jobs

Memory

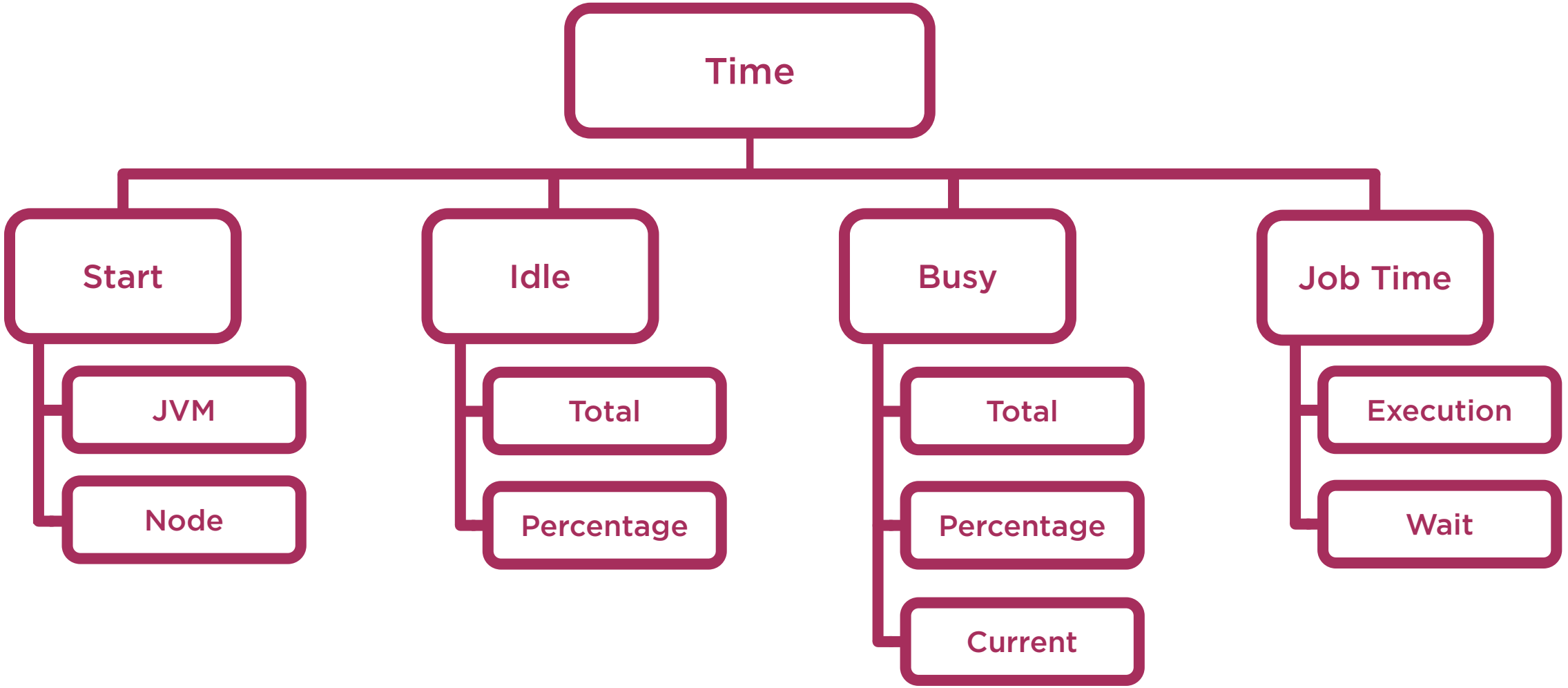
CPU

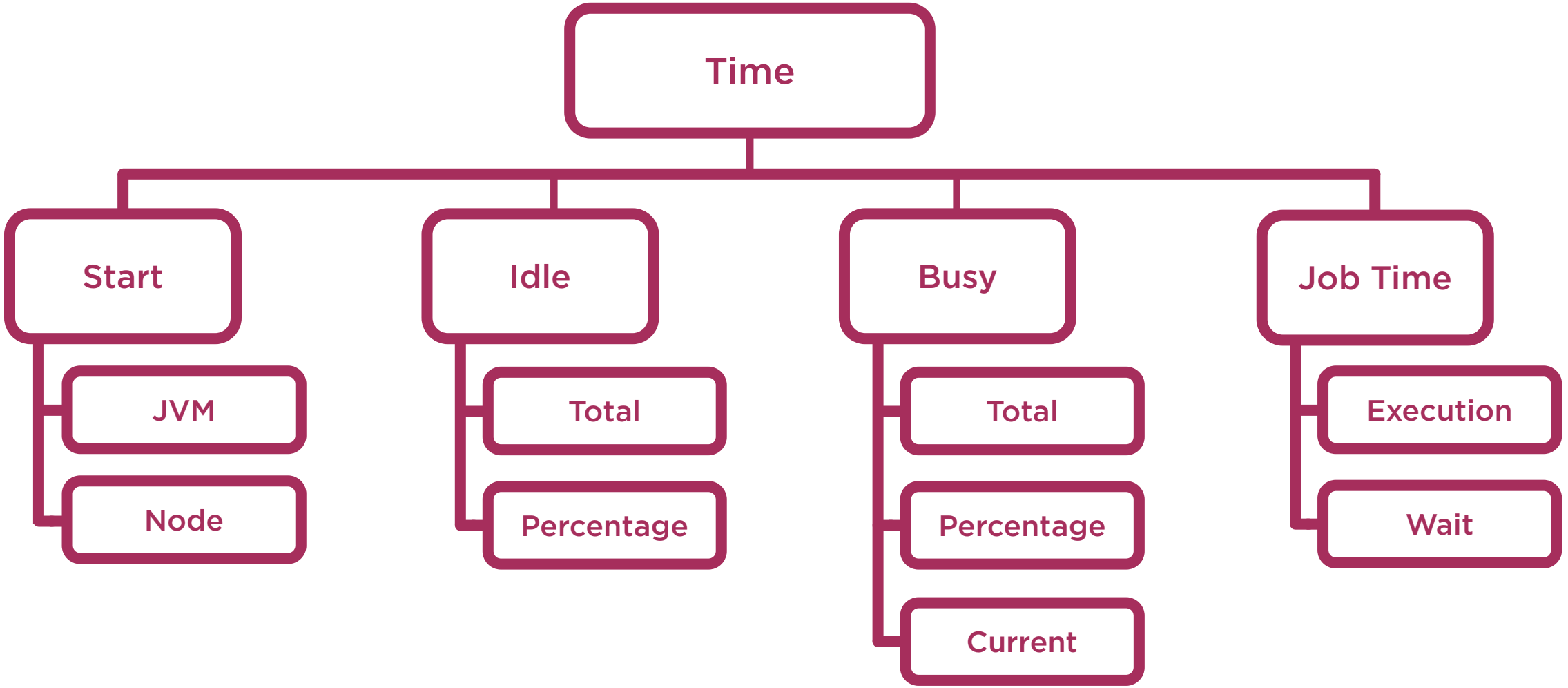
Threads

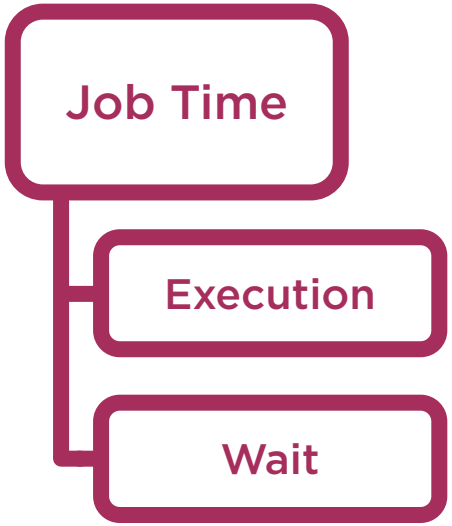
Messages

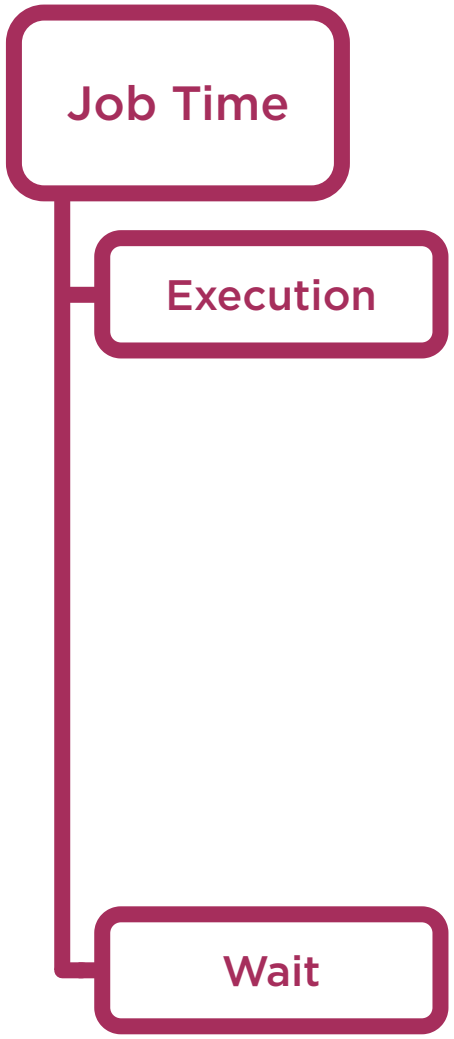
Tasks

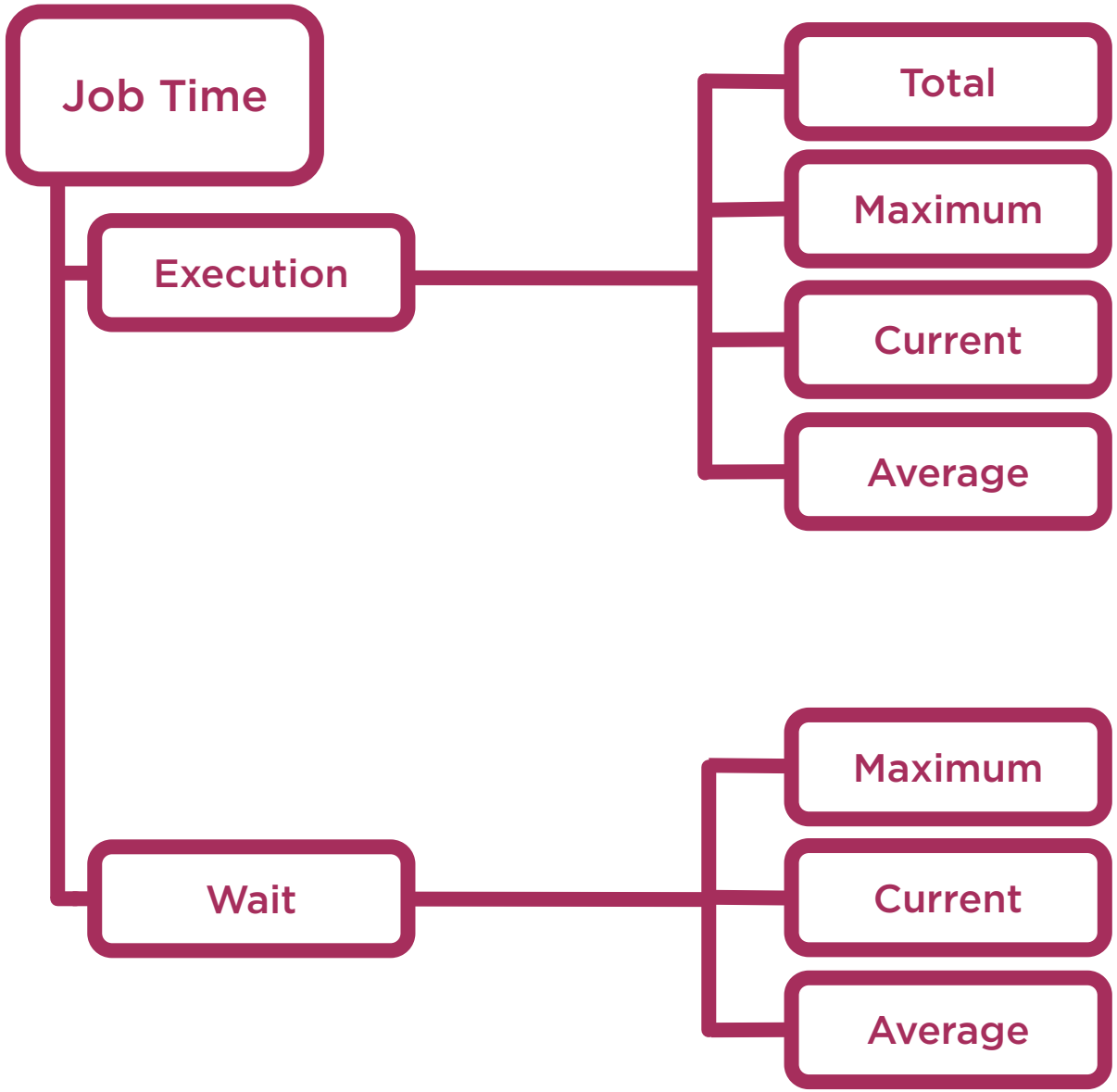
Nodes

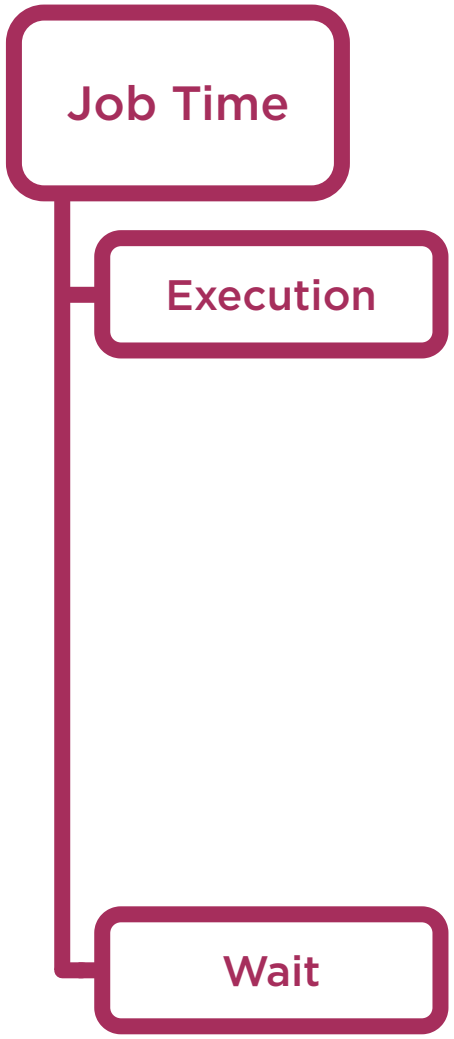

Time
Start
JVM
Node
Idle
Total
Percentage
Busy
Total
Percentage
Current
Job Time
Execution
Wait

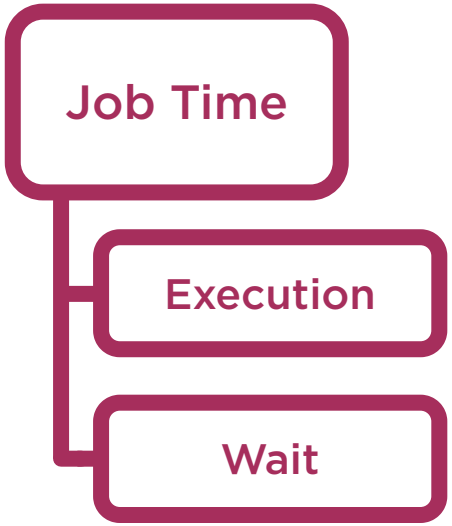

Time
Start
JVM
Node
Idle
Total
Percentage
Busy
Total
Percentage
Current
Job Time
Execution
Wait

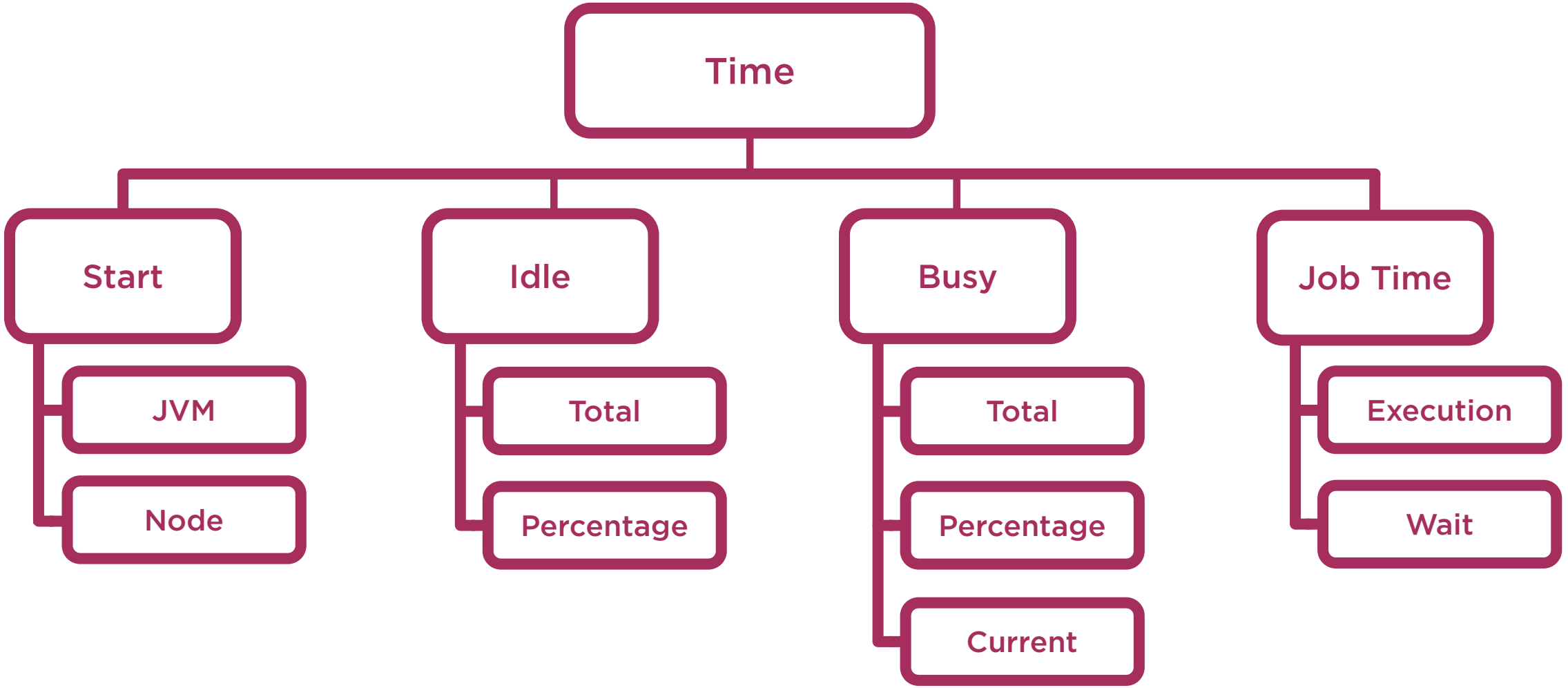

Job Time
Execution
Wait


Job Time
Execution
Wait


Job Time
Execution
Total
Maximum
Current
Average
Wait
Maximum
Current
Average


Job Time
Execution
Wait


Job Time
Execution
Wait


Time
Start
JVM
Node
Idle
Total
Percentage
Busy
Total
Percentage
Current
Job Time
Execution
Wait

Time

Jobs

Memory

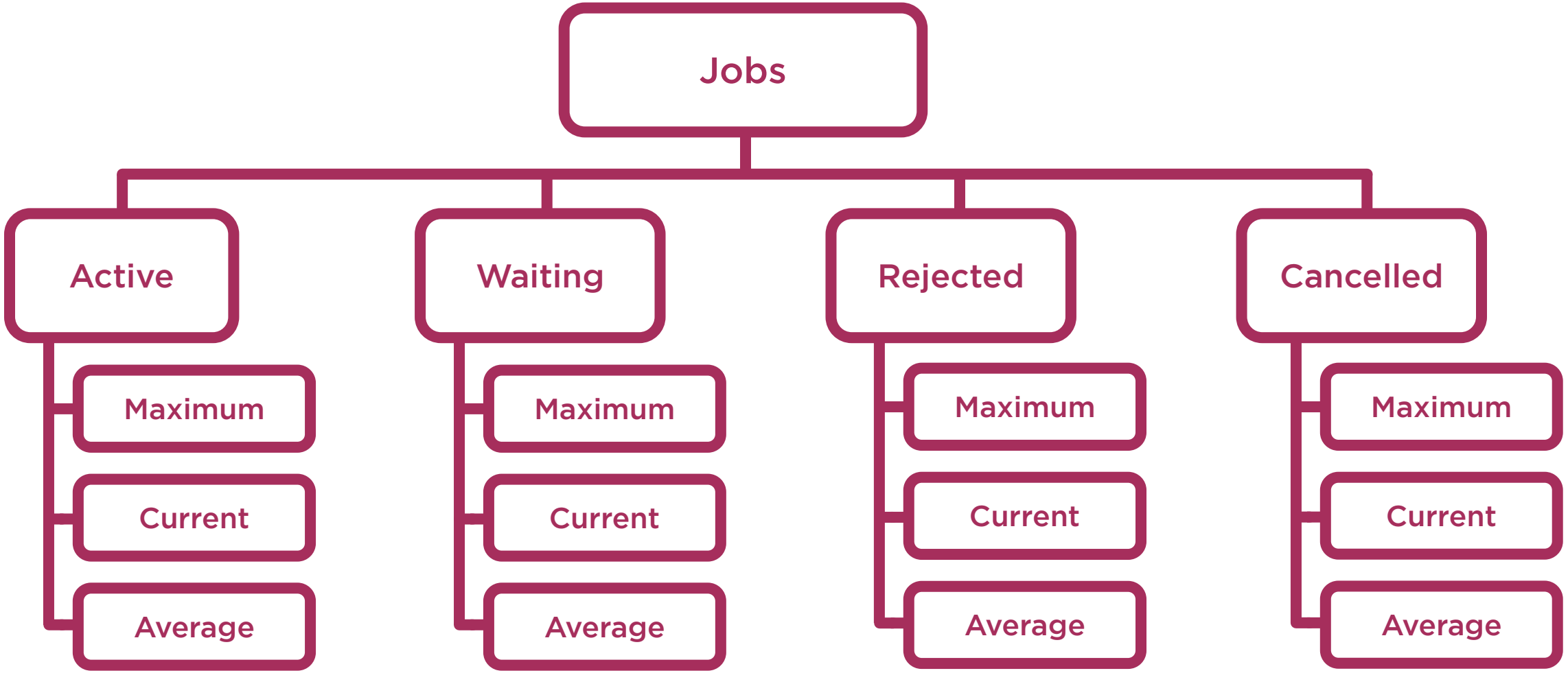
CPU

Threads

Messages

Tasks

Nodes


Jobs
Active
Maximum
Current
Average
Waiting
Maximum
Current
Average
Rejected
Maximum
Current
Average
Cancelled
Maximum
Current
Average

Time

Jobs

Memory

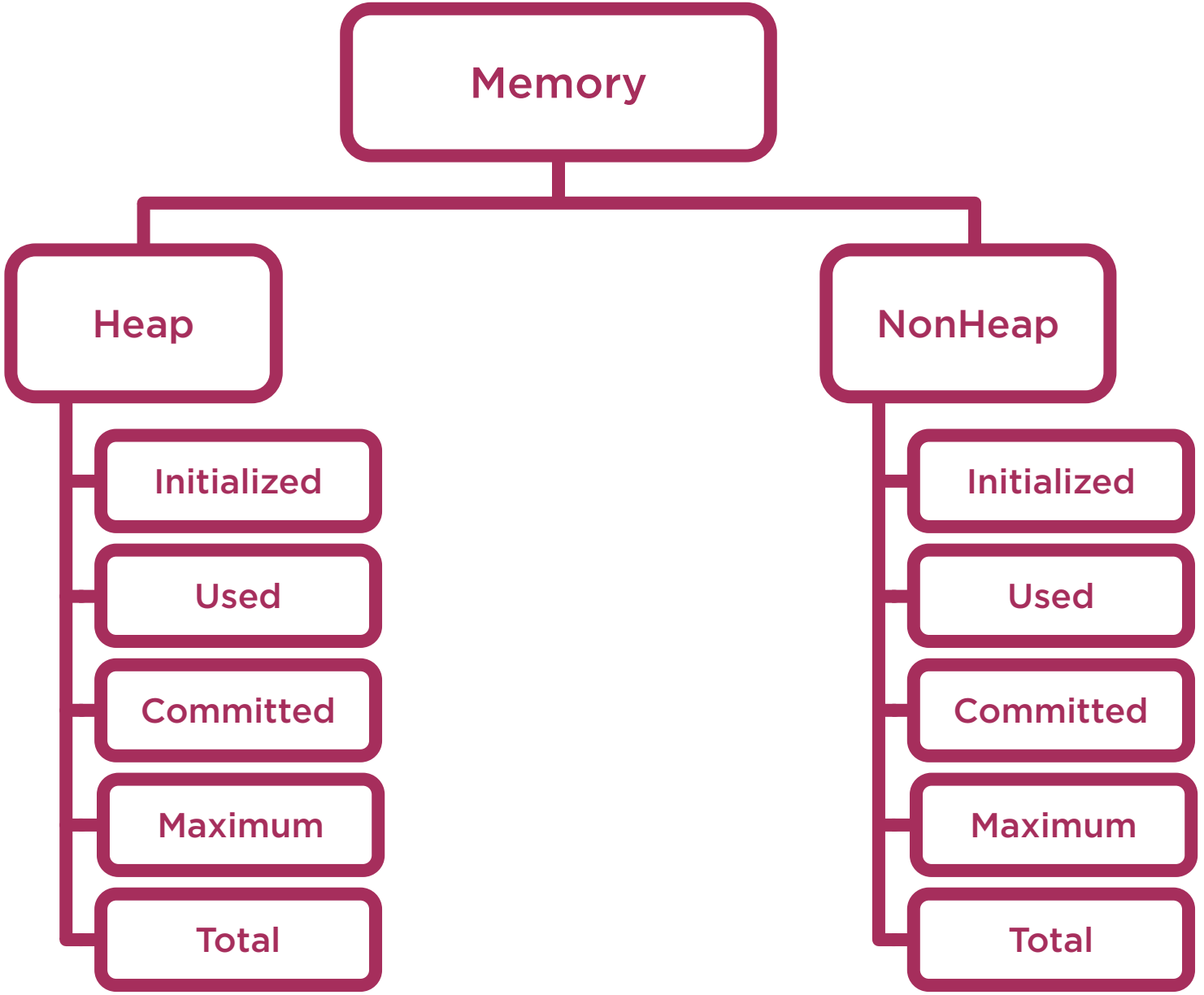
CPU

Threads

Messages

Tasks

Nodes


Memory
Heap
Initialized
Used
Committed
Maximum
Total
NonHeap
Initialized
Used
Committed
Maximum
Total

Time

Jobs

Memory

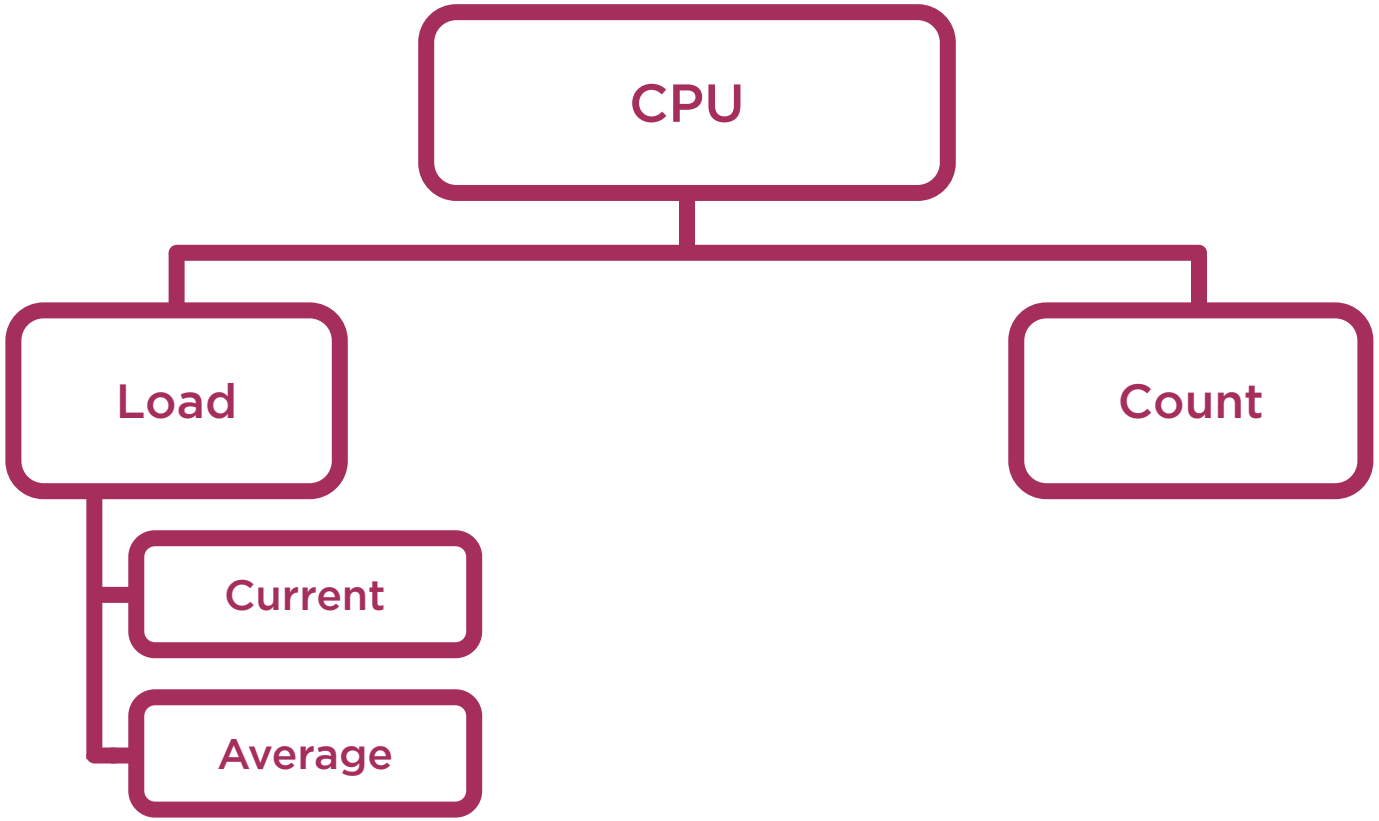
CPU

Threads

Messages

Tasks

Nodes


CPU
Load
Count
Current
Average

Time

Jobs

Memory

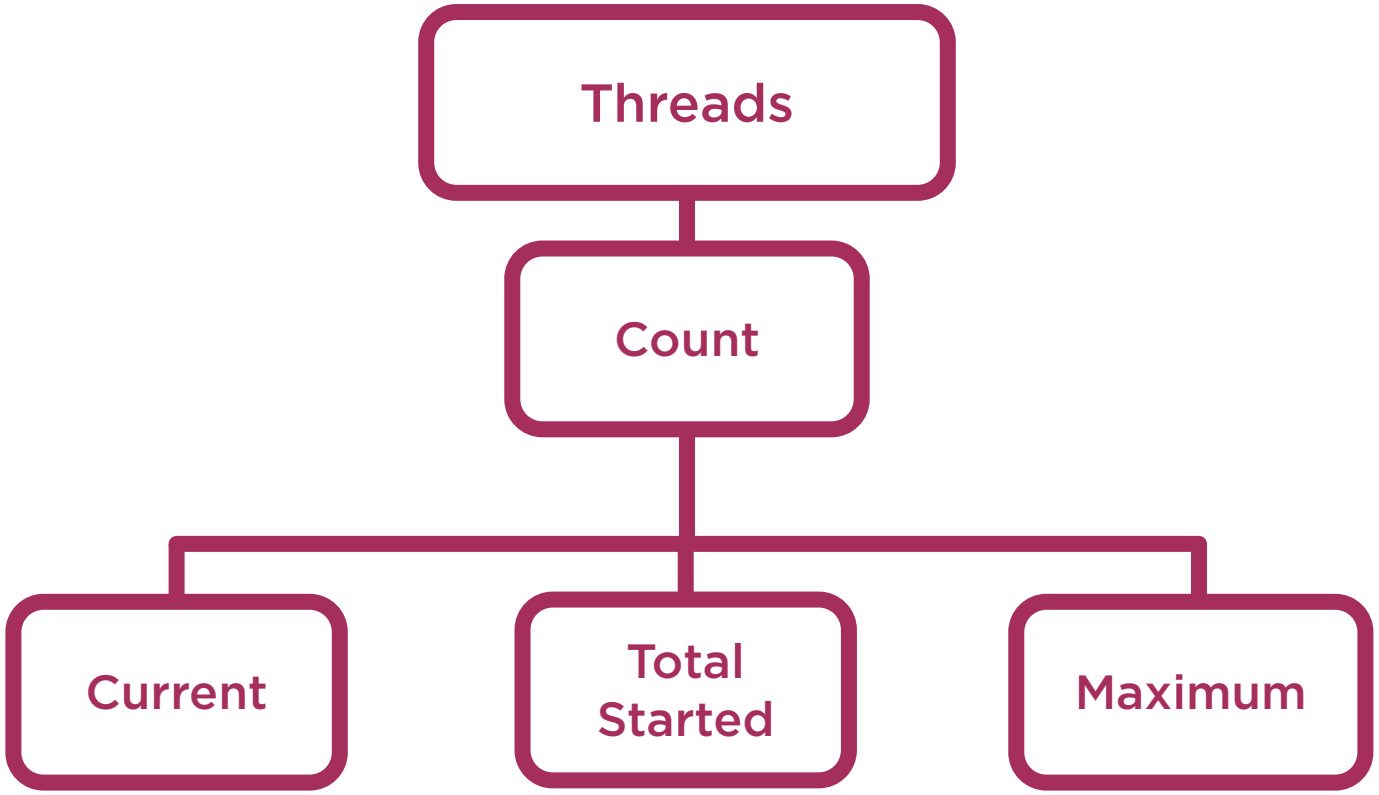
CPU

Threads

Messages

Tasks

Nodes


Threads
Count
Current
Total Started
Maximum

Time

Jobs

Memory

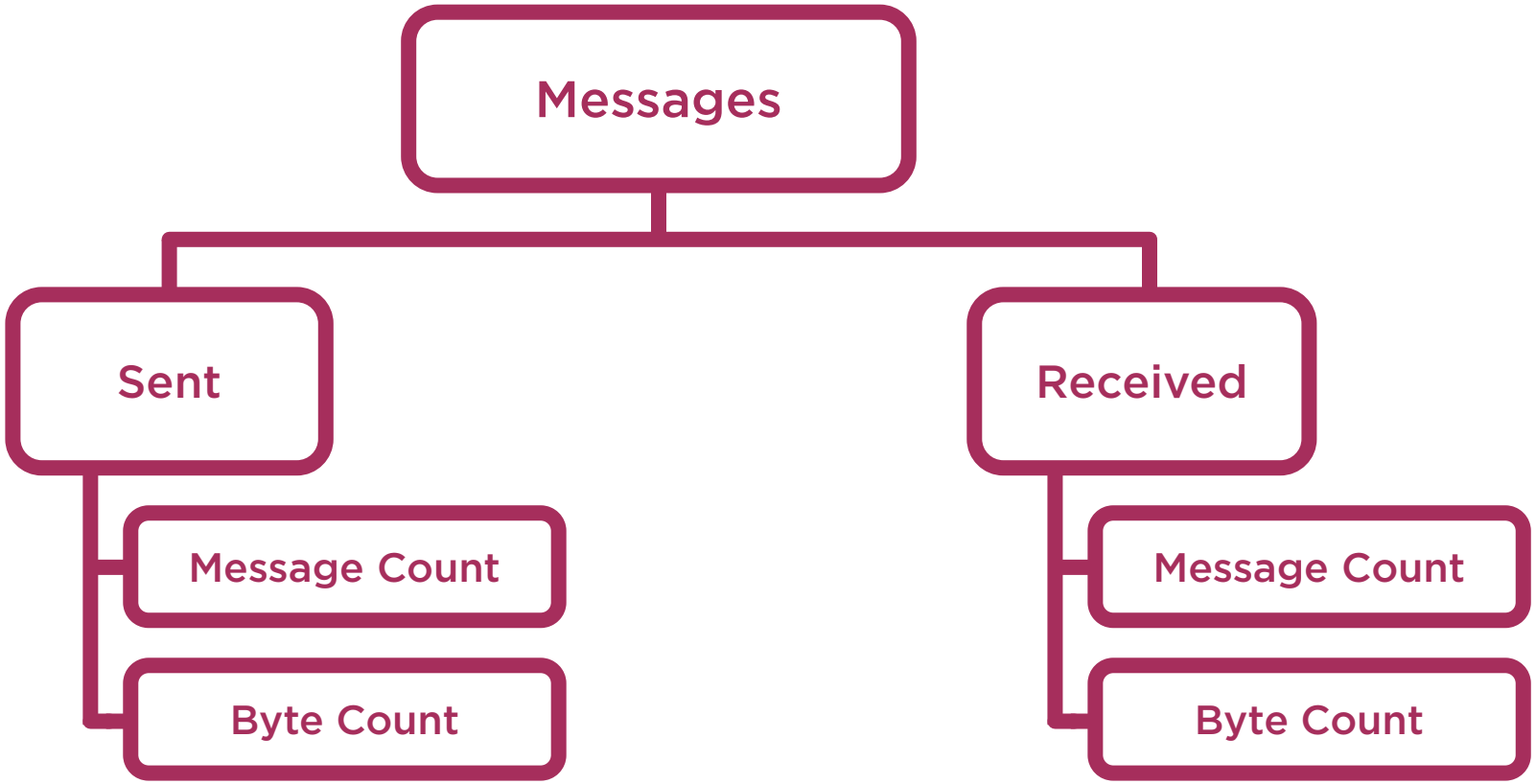
CPU

Threads

Messages

Tasks

Nodes


Messages
Sent
Received
Message Count
Byte Count
Message Count
Byte Count

Time

Jobs

Memory

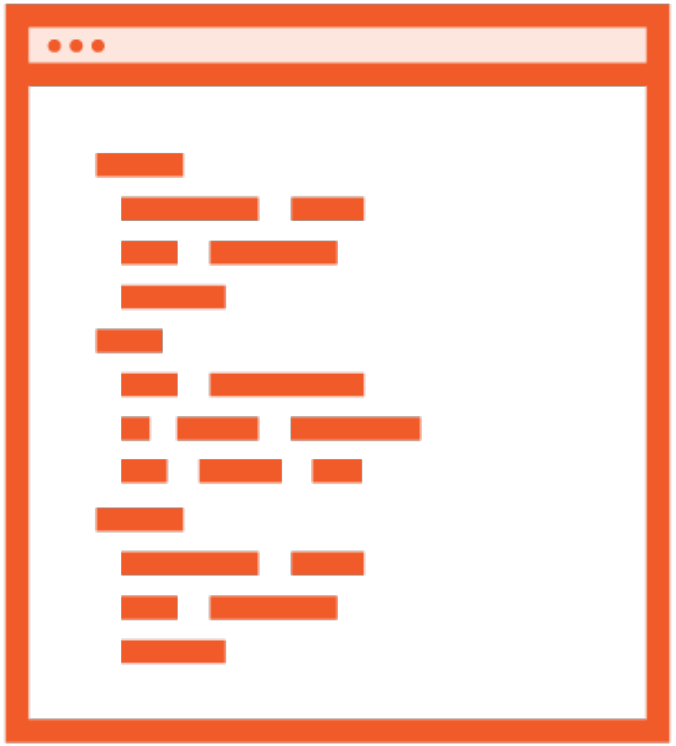
CPU

Threads

Messages

Tasks

Nodes



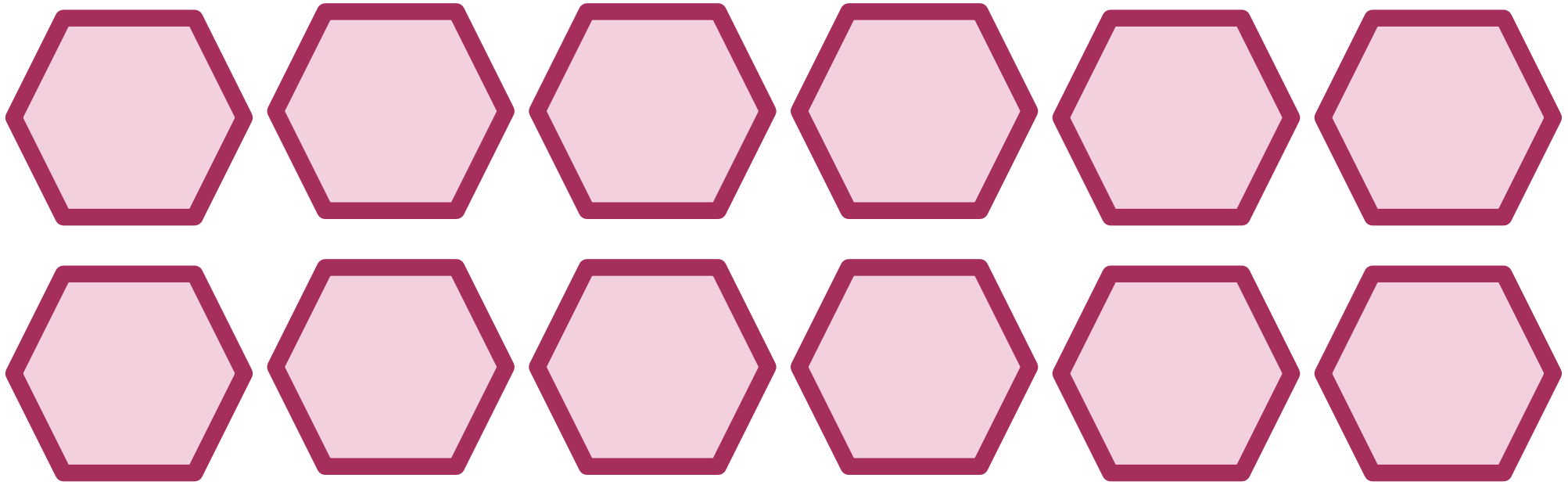
Collection of node IDs

Nodes not part of a group

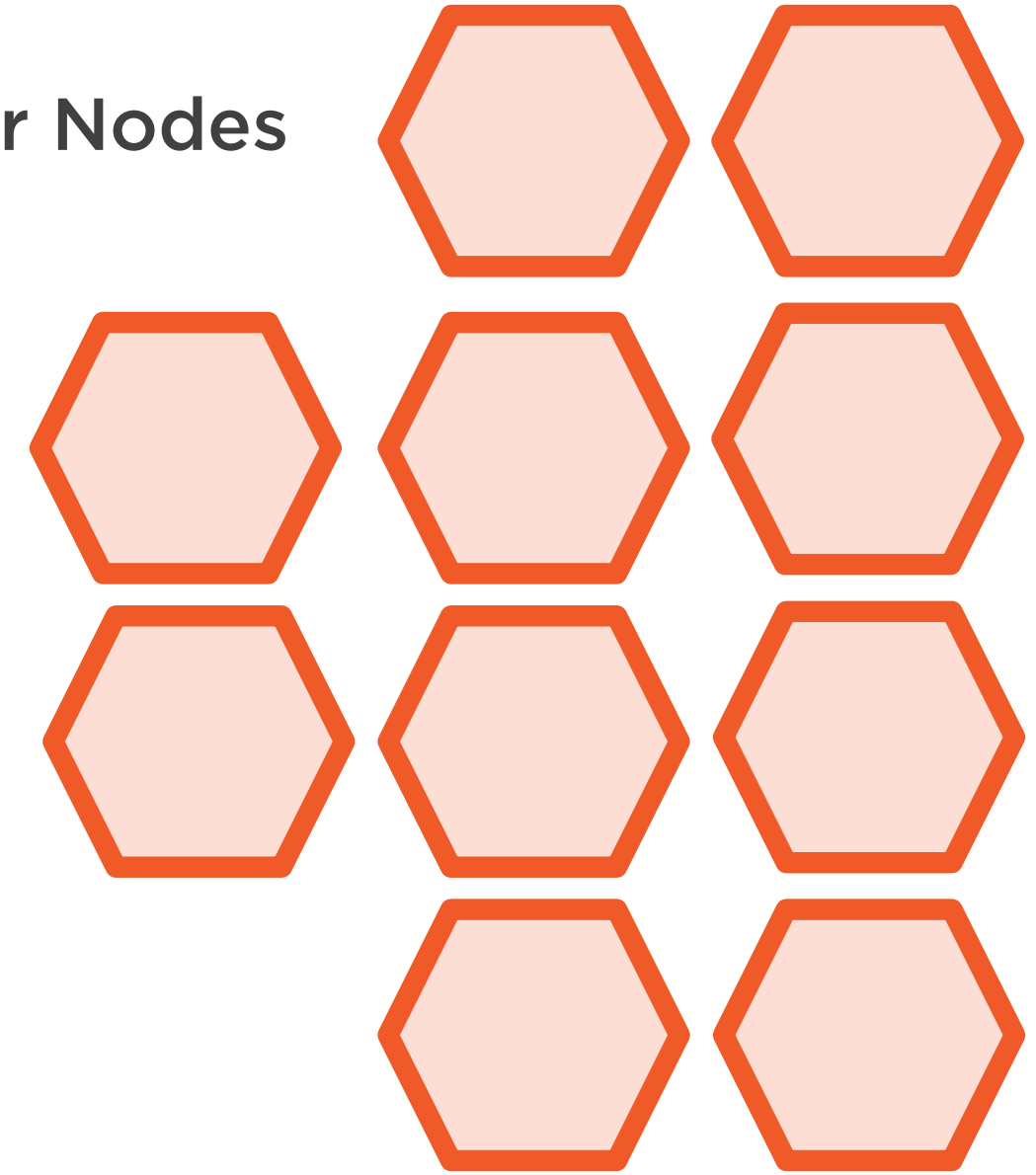
Nodes on a specific host

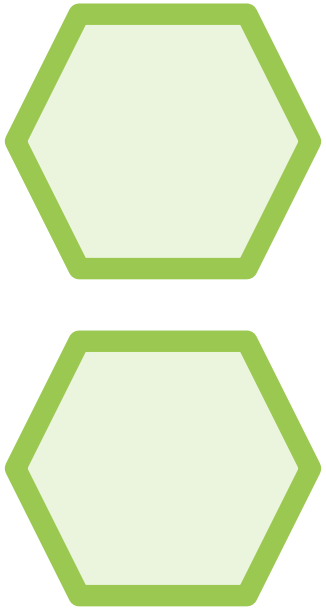
Random node

All nodes part of a cache



Server Nodes





Client Nodes

```
<bean
class="org.apache.ignite.configuration.IgniteConfiguration">
    ...
    <!-- Enable client mode. -->
    <property name="clientMode" value="true"/>
    ...
</bean>
```

Spring XML Configuration File

Set the clientMode property to true in order to start the node as a client node.

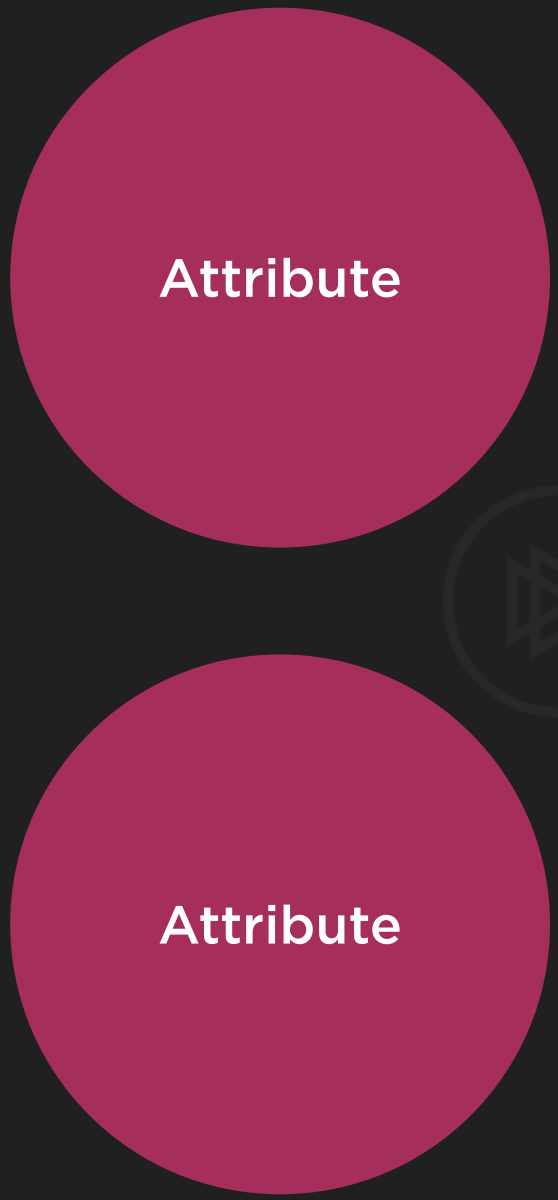
```
Ignition.setClientMode(true);

// Start Ignite in client mode.
Ignite ignite = Ignition.start();
```

Configuration in Java Code

Call the Ignition class's setClientMode to enable client mode.

Up Next

Cluster Grouping Demo


Attribute
Attribute


Metrics

Discovery

Computer cluster

Computer clusters have each node set to perform the same task, controlled and scheduled by software

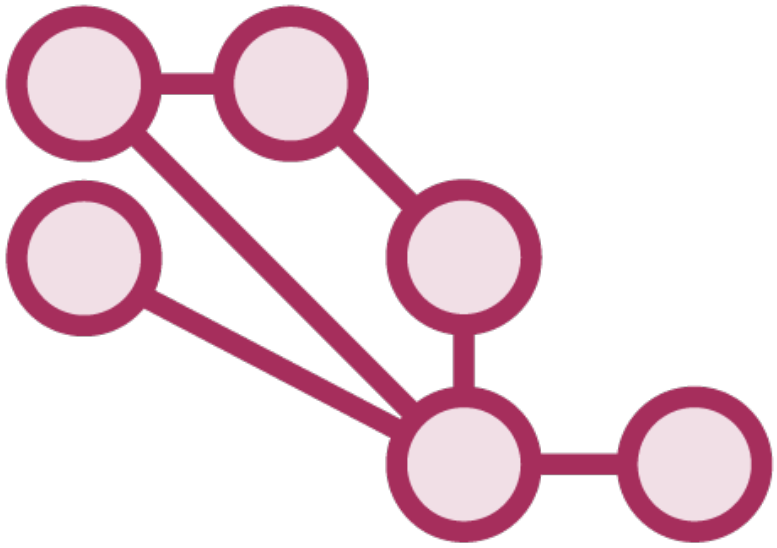
Grid computing

Grids are a form of distributed computing whereby a "super virtual computer" is composed of many networked loosely coupled computers acting together to perform large tasks.

Cluster vs. Grid

Cluster	Grid
Node is physical machine	Node is software on a machine
All on same LAN	Geographically dispersed
Centralized Management	Peer to peer
One large cohesive computing unit	Each node works on its own task
Single system image	Heterogeneous machines

IP Finders



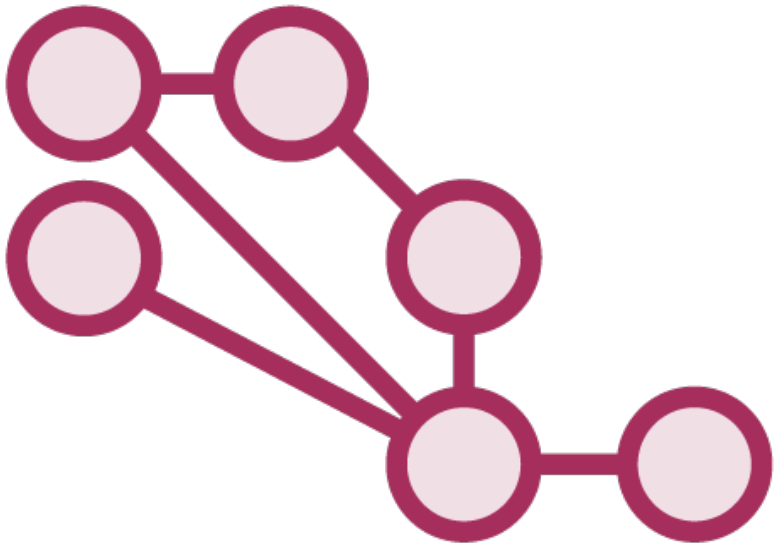
- Multicast
- Static IP addresses
- JDBC
- Shared Filesystem
- Amazon S3
- Apache JClouds
- Google Cloud Storage
- Apache Zookeeper
- Kubernetes

Up Next

IP Finders

IP Finders

IP Finders



- Multicast
- Static IP addresses
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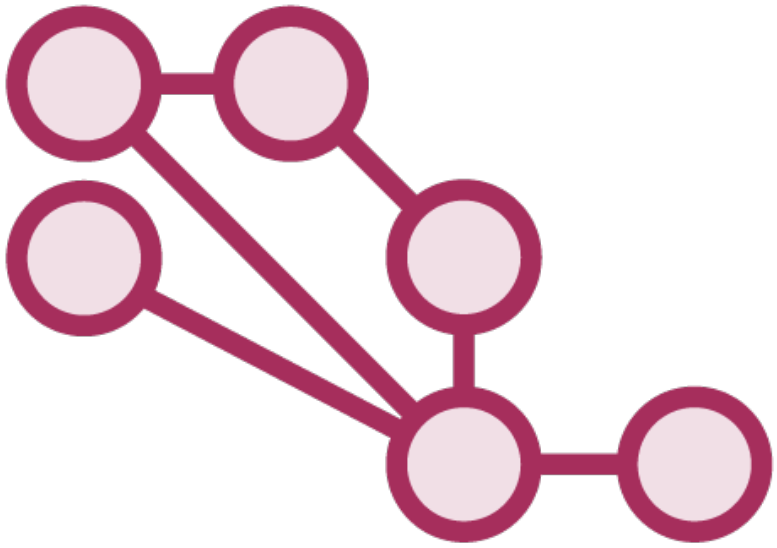
- Apache JClouds
- Google Cloud Storage
- Apache Zookeeper
- Kubernetes

DiscoverySPI Interface

```
public interface DiscoverySpi extends IgniteSpi {
    public Collection<ClusterNode> getRemoteNodes();
    public ClusterNode getLocalNode();
    @Nullable public ClusterNode getNode(UUID nodeId);
    public boolean pingNode(UUID nodeId);
    public void setNodeAttributes(Map<String, Object> attrs, IgniteProductVersion ver);
    public void setListener(@Nullable DiscoverySpiListener lsnr);
    public void setDataExchange(DiscoverySpiDataExchange exchange);
    public void setMetricsProvider(DiscoveryMetricsProvider metricsProvider);
    public void disconnect() throws IgniteSpiException;
    public void setAuthenticator(DiscoverySpiNodeAuthenticator auth);
    public long getGridStartTime();
    public void sendCustomEvent(DiscoverySpiCustomMessage msg) throws IgniteException;
    public void failNode(UUID nodeId, @Nullable String warning);
    public boolean isClientMode() throws IllegalStateException;
}
```

IP Finders



- Multicast
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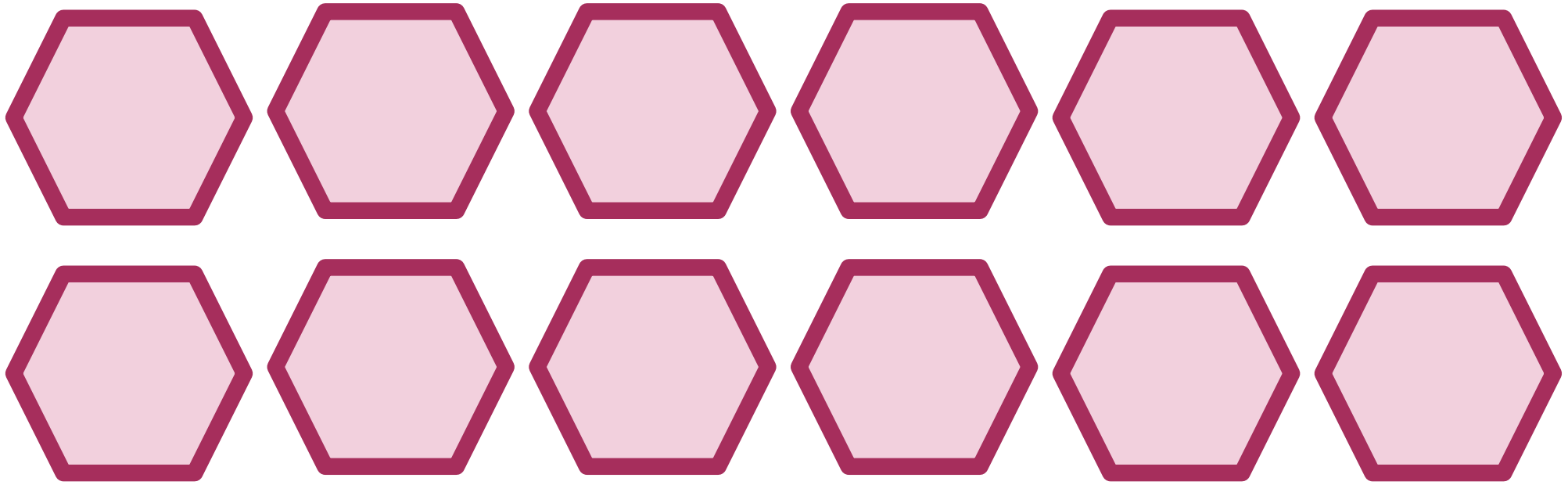
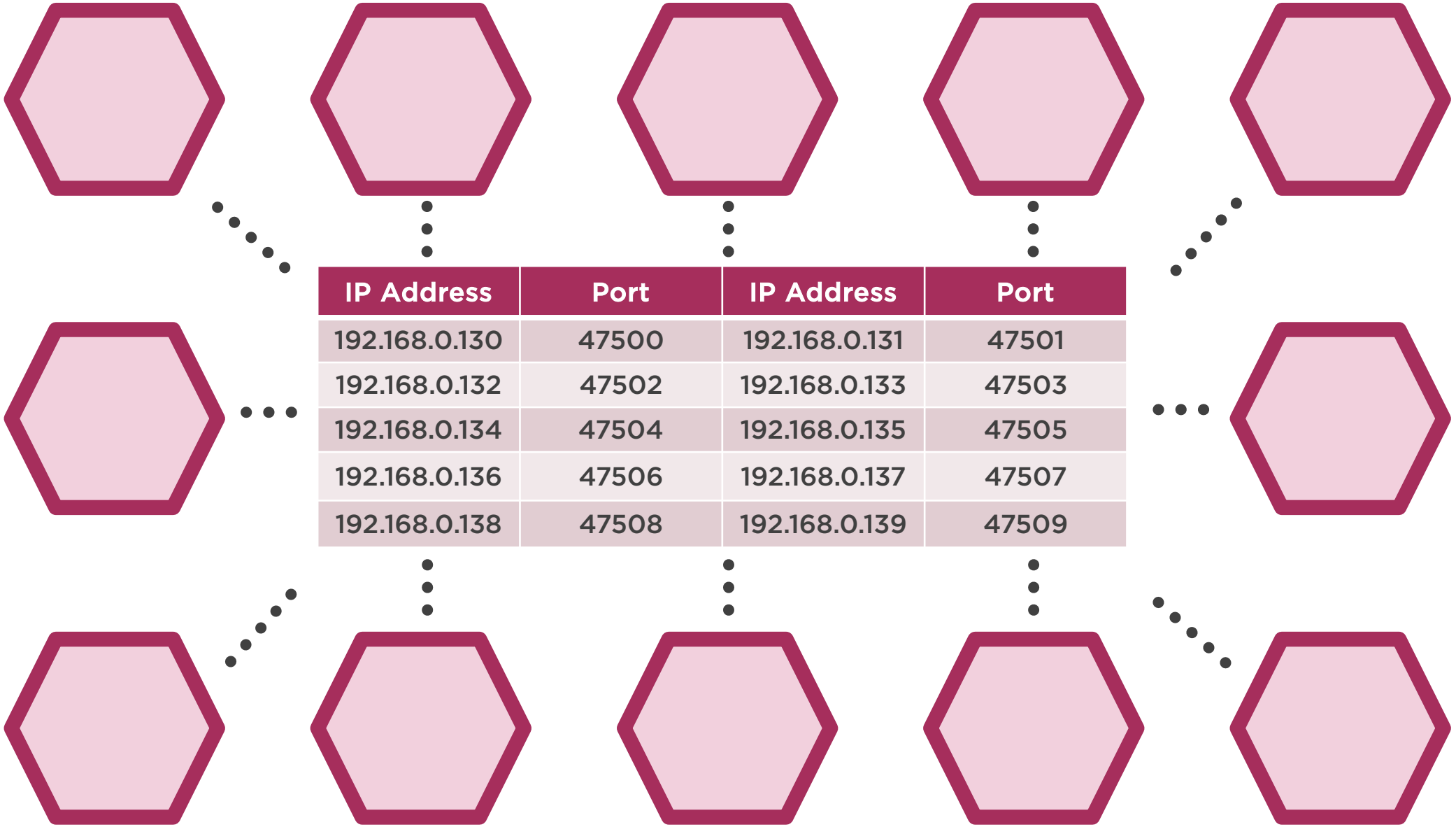
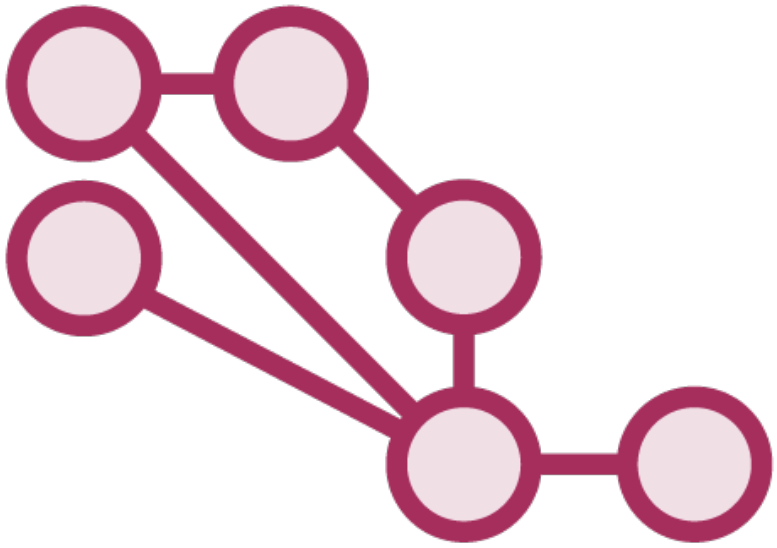
https://apacheignite.readme.io/docs/cluster-config





IP Address	Port	IP Address	Port
192.168.0.130	47500	192.168.0.131	47501
192.168.0.132	47502	192.168.0.133	47503
192.168.0.134	47504	192.168.0.135	47505
192.168.0.136	47506	192.168.0.137	47507
192.168.0.138	47508	192.168.0.139	47509

IP Finders



- Multicast
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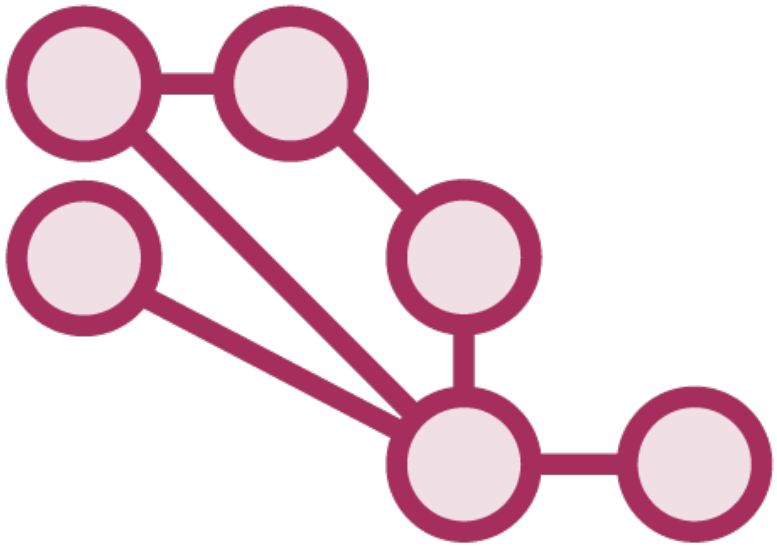
IP Finders



- Multicast
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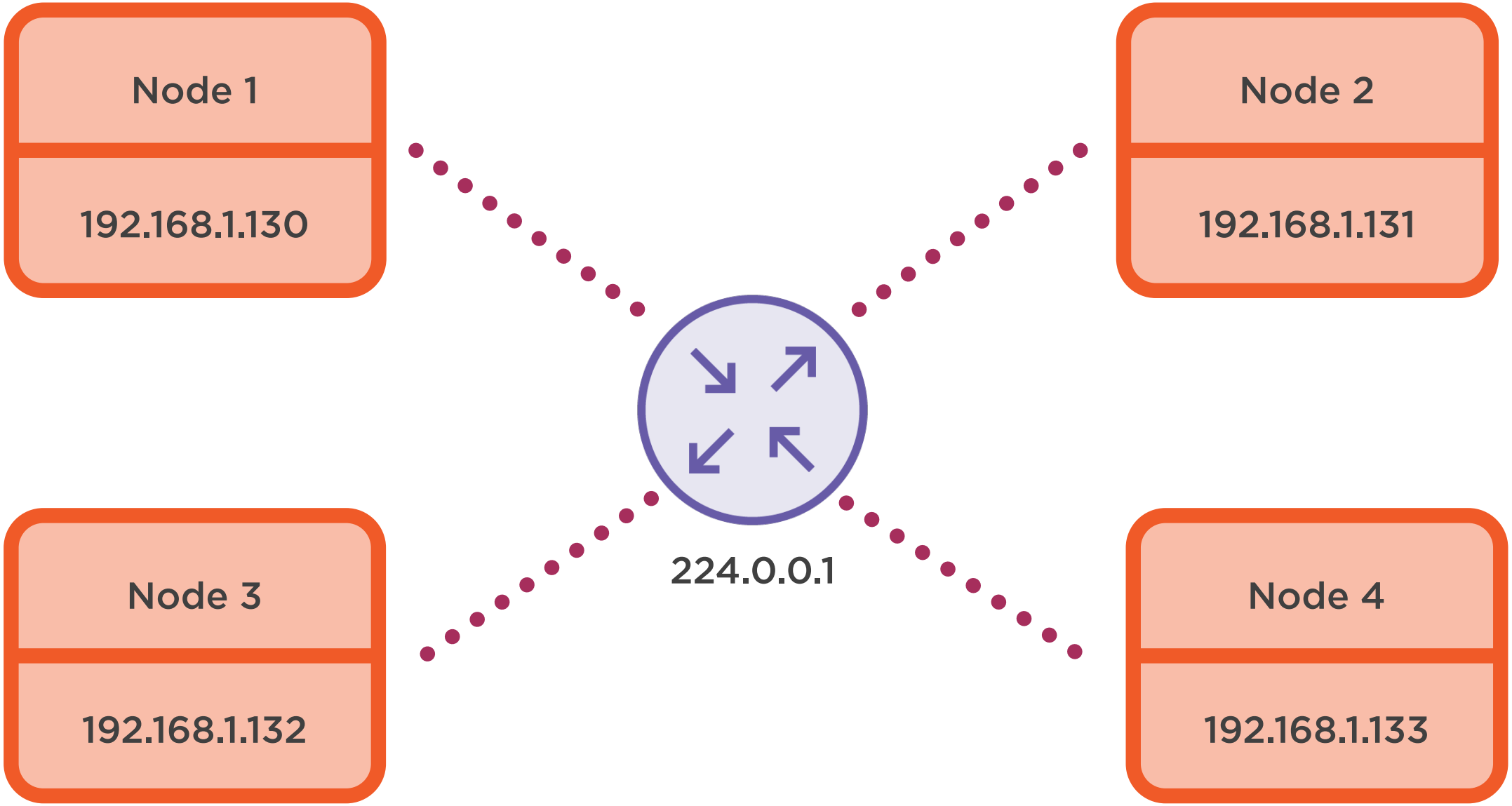
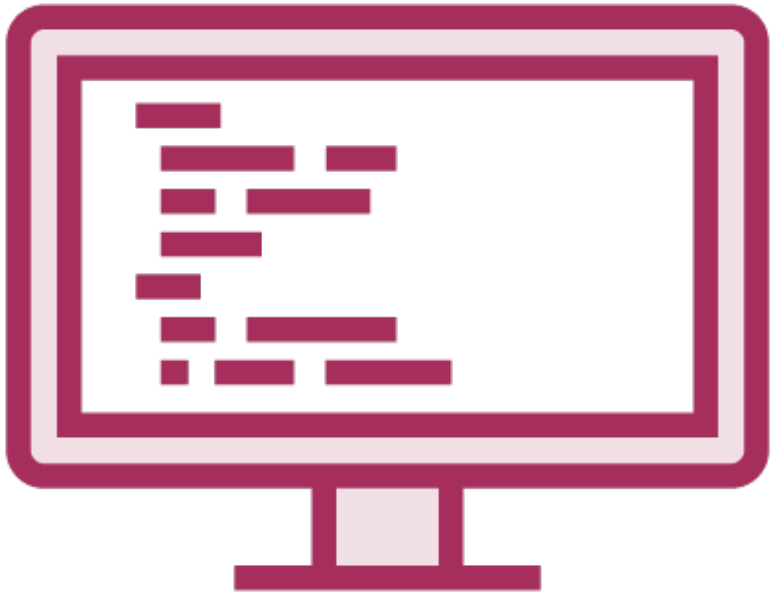

Node 1
192.168.1.130
Node 2
192.168.1.131
224.0.0.1
Node 3
192.168.1.132
Node 4
192.168.1.133

Multicast IP Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder
                                .multicast.TcpDiscoveryMulticastIpFinder">
                <property name="multicastGroup" value="224.0.0.251"/>
                <property name="localAddress" value="192.168.52.40"/>
                <property name="addresses">
                    <list>
                        <value>127.0.0.1</value>
                    </list>
                </property>
            </bean>
        </property>
    </bean>
</property>
```

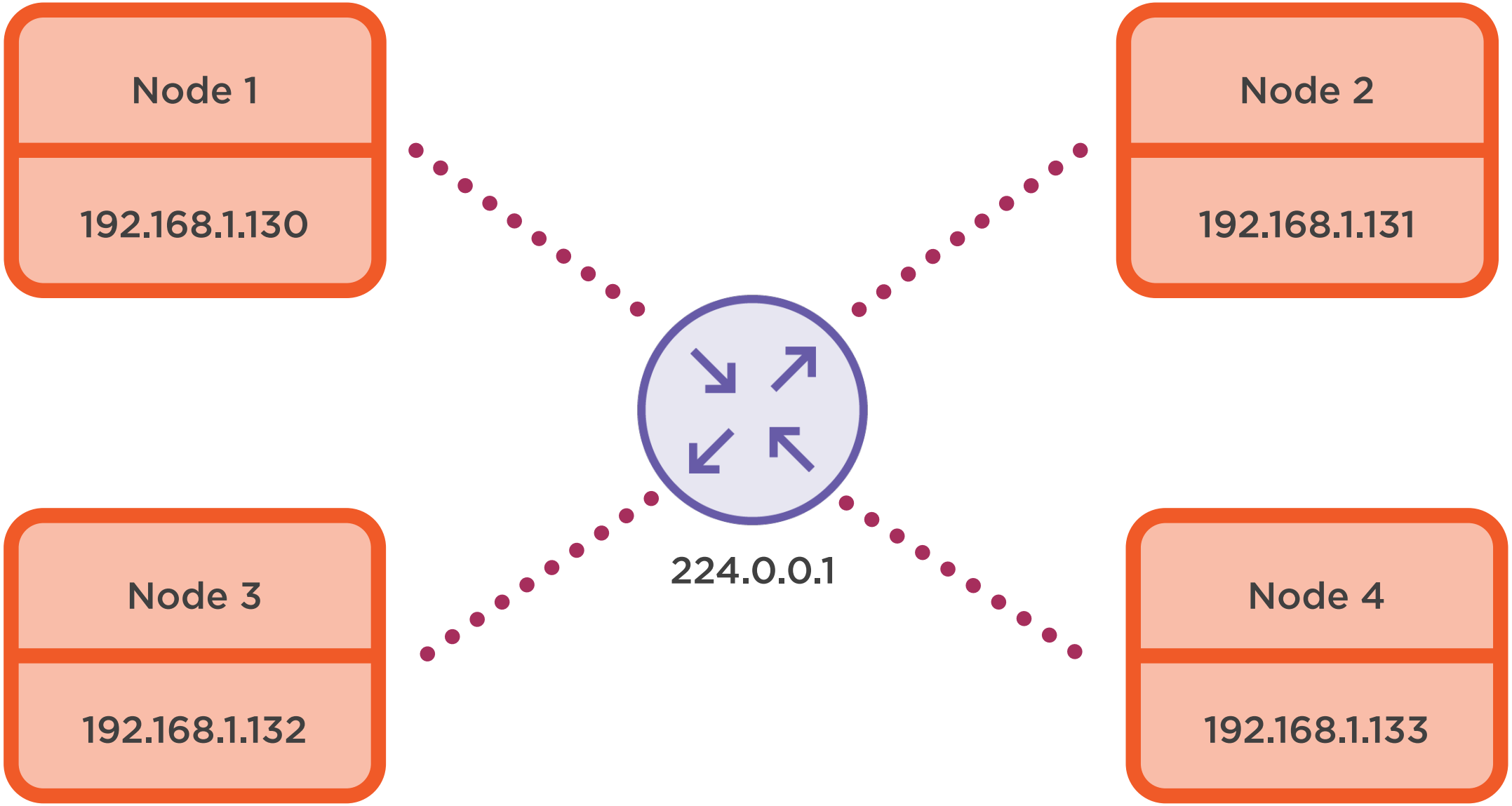
Multicast IP Finder Properties



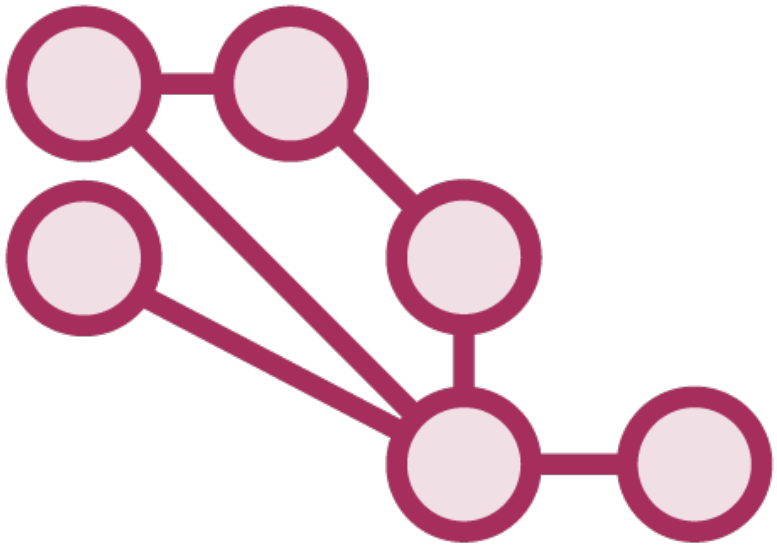
- AddressRequestAttempts
- LocalAddress
- MulticastGroup
- MulticastPort
- RegisteredAddresses
- ResponseWaitTime
- TimeToLive

Multicast IP Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder
                                .multicast.TcpDiscoveryMulticastIpFinder">
                <property name="multicastGroup" value="224.0.0.251"/>
                <property name="localAddress" value="192.168.52.40"/>
                <property name="addresses">
                    <list>
                        <value>127.0.0.1</value>
                    </list>
                </property>
            </bean>
        </property>
    </bean>
</property>
```


Node 1
192.168.1.130
Node 2
192.168.1.131
224.0.0.1
Node 3
192.168.1.132
Node 4
192.168.1.133

IP Finders



Multicast

Static IP addresses

JDBC

Shared Filesystem

Amazon S3

Apache JClouds

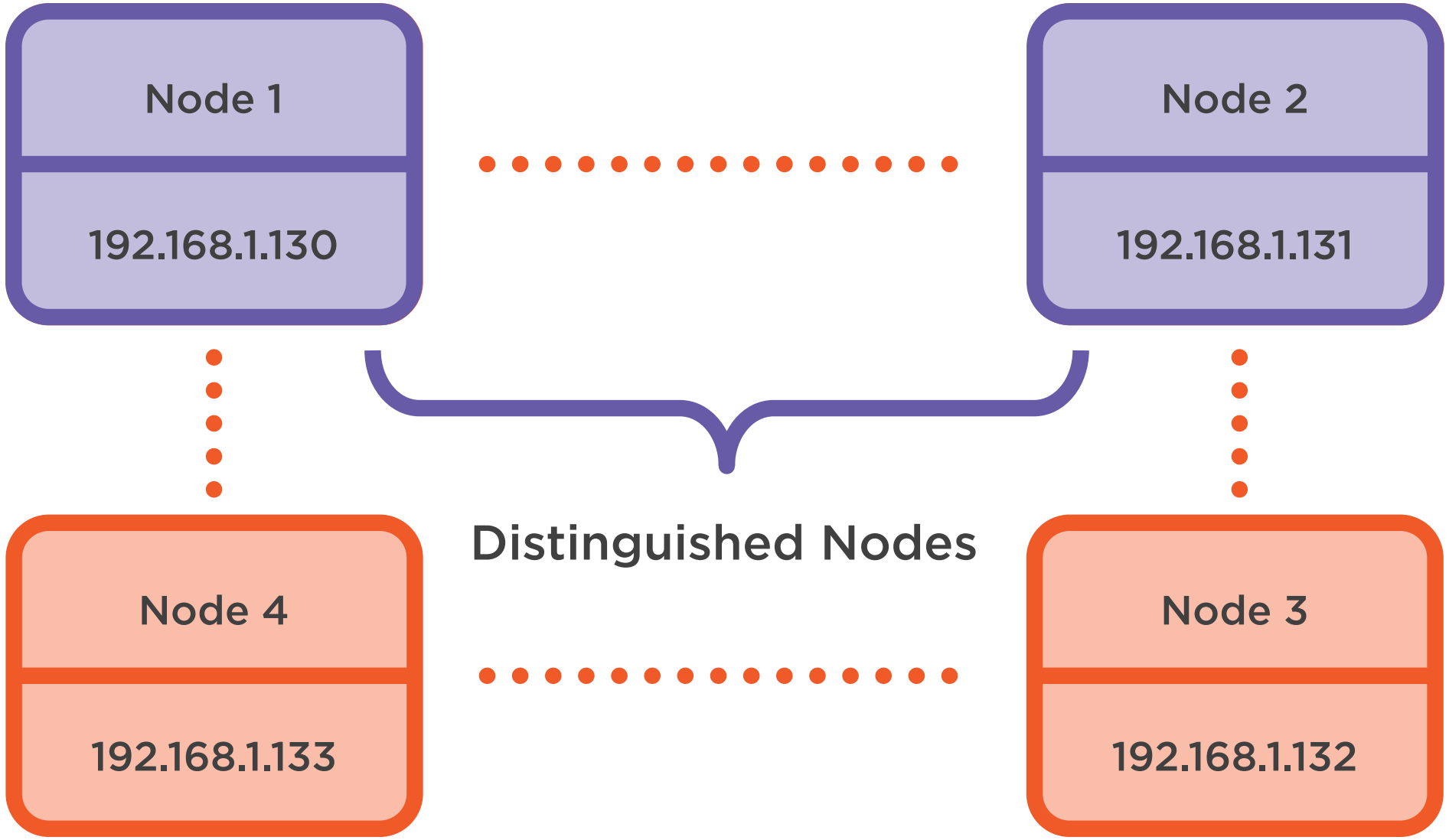
Google Cloud Storage

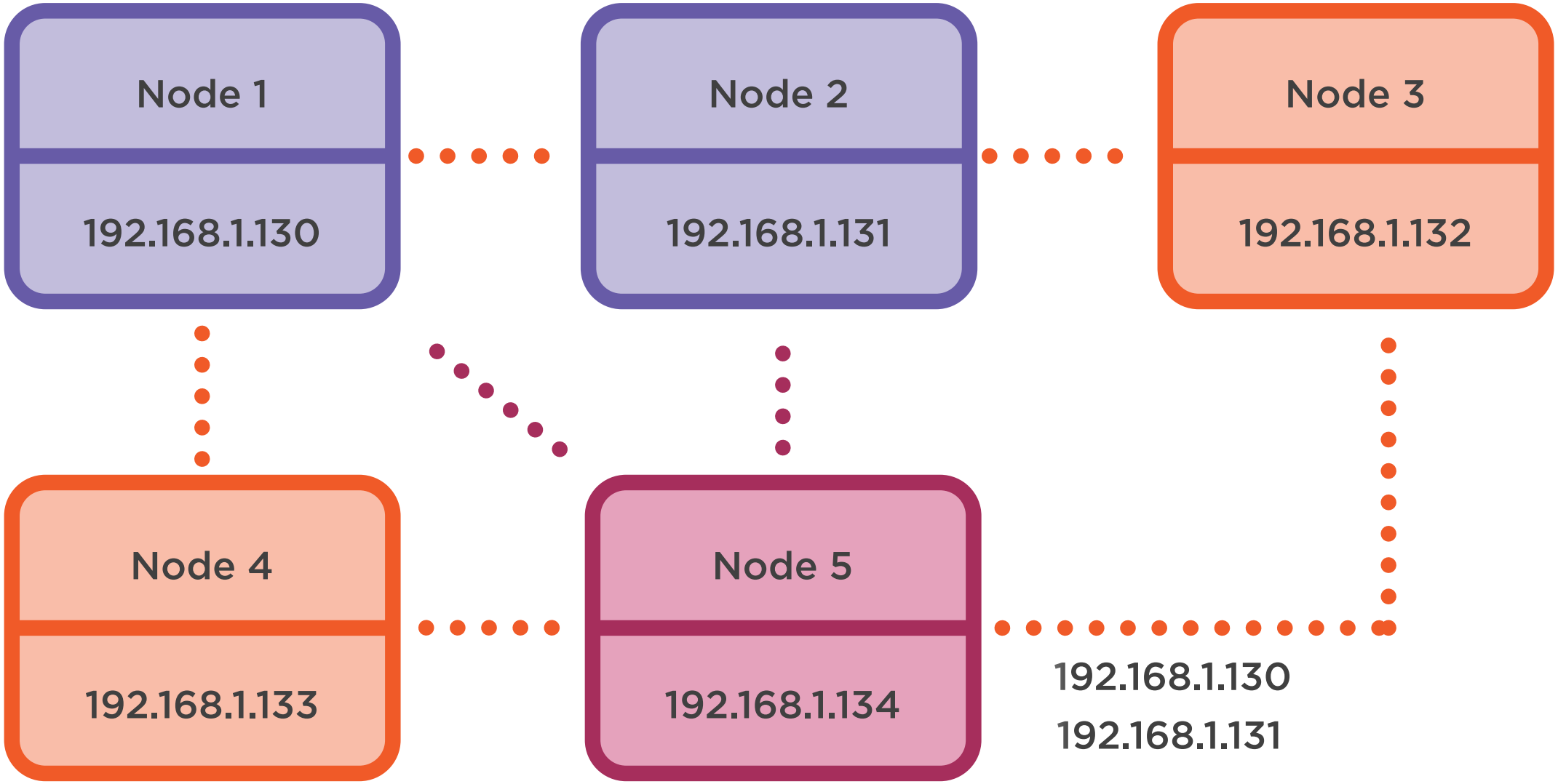
Apache Zookeeper

Kubernetes

Static IP Address Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder
                        .vm.TcpDiscoveryVmIpFinder">
                <property name="addresses">
                    <list>
                        <value>127.168.1.130</value>
                        <value>192.168.1.131</value>
                    </list>
                </property>
            </bean>
        </property>
    </bean>
</property>
```


Node 1
192.168.1.130
Node 2
192.168.1.131
Distinguished Nodes
Node 4
192.168.1.133
Node 3
192.168.1.132


Node 1
192.168.1.130
Node 2
192.168.1.131
Node 3
192.168.1.132
Node 4
192.168.1.133
Node 5
192.168.1.134
192.168.1.130
192.168.1.131

Port Ranges

```
<property name="discoverySpi">
    ...
</property>

<property name="communicationSpi">
    <bean class="org.apache.ignite.spi.communication.tcp.TcpCommunicationSpi">
        <property name="localPort" value="50000"/>
        <property name="localPortRange" value="2000"/>
    </bean>
</property>
```

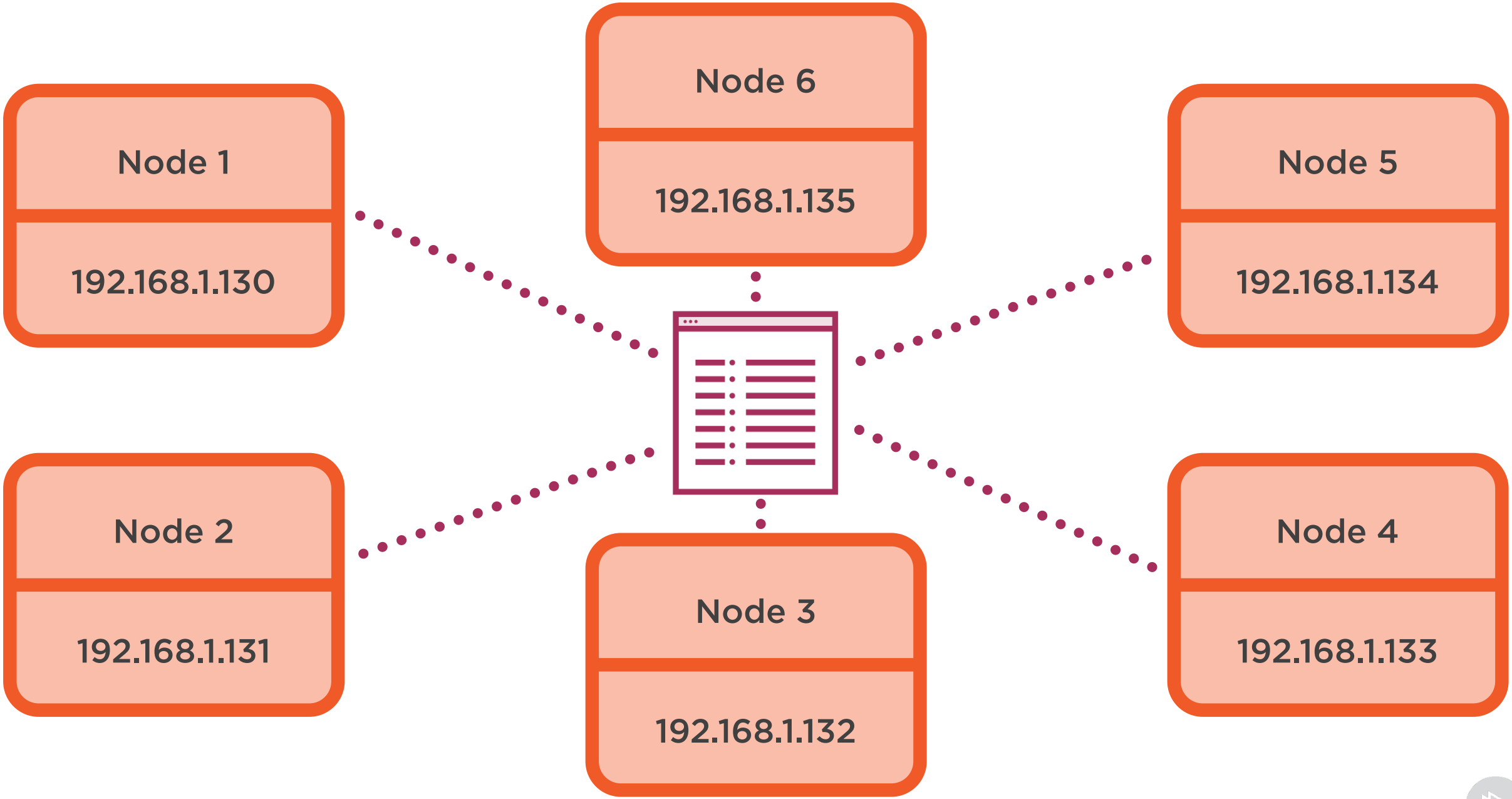
Web console demo place holder

Port Ranges

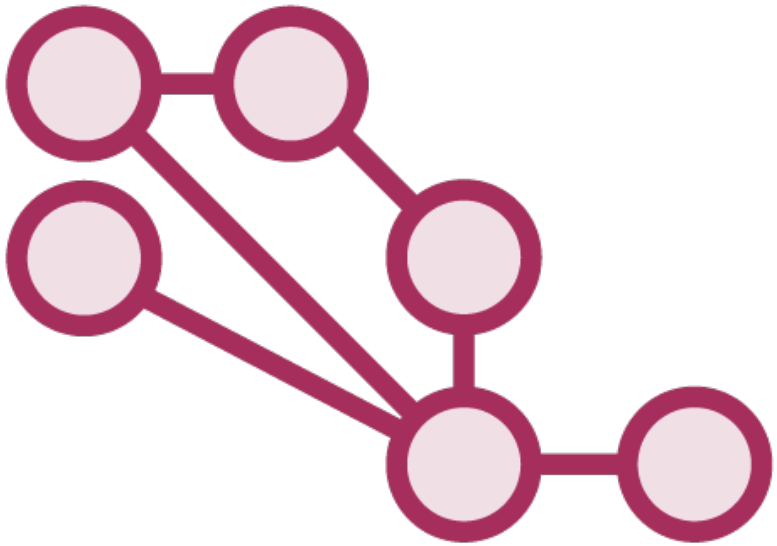
```
<property name="discoverySpi">
    ...
    <property name="localPort" value="55000"/>
    <property name="localPortRange" value="2000"/>
</property>

<property name="communicationSpi">
    <bean class="org.apache.ignite.spi.communication.tcp.TcpCommunicationSpi">
        <property name="localPort" value="50000"/>
        <property name="localPortRange" value="2000"/>
    </bean>
</property>
```

Static IP Address Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder
                    .vm.TcpDiscoveryVmIpFinder">
                <property name="addresses">
                    <list>
                        <value>192.168.1.140:34880..35500</value>
                        <value>...</value>
                    </list>
                </property>
            </bean>
        </property>
    </bean>
</property>
```


Node 1
192.168.1.130
Node 6
192.168.1.135
Node 5
192.168.1.134
Node 2
192.168.1.131
Node 3
192.168.1.132
Node 4
192.168.1.133

IP Finders



- Multicast
- Static IP addresses
- JDBC
- Shared filesystem
- Amazon S3
- Apache JClouds
- Google Cloud Storage
- Apache Zookeeper
- Kubernetes

JDBC IP Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder
                    .jdbc.TcpDiscoveryJdbcIpFinder">
                <property name="dataSource" ref="ds"/>
                <property name="initSchema" value="true"/>
            </bean>
        </property>
    </bean>
</property>

<!-- Configured data source instance. -->
<bean id="ds" class="some.Datasource">



</bean>
```

JDBC IP Finder Table

Hostname (varchar 1024)	Port (int)
192.168.0.130	47500
0:0:0:0:0:0:0:1	47500
127.0.0.1	47500
192.168.0.131	47524
0:0:0:0:0:0:0:1	47524
127.0.0.1	47524
192.168.0.132	47507
0:0:0:0:0:0:0:1	47507
127.0.0.1	47507

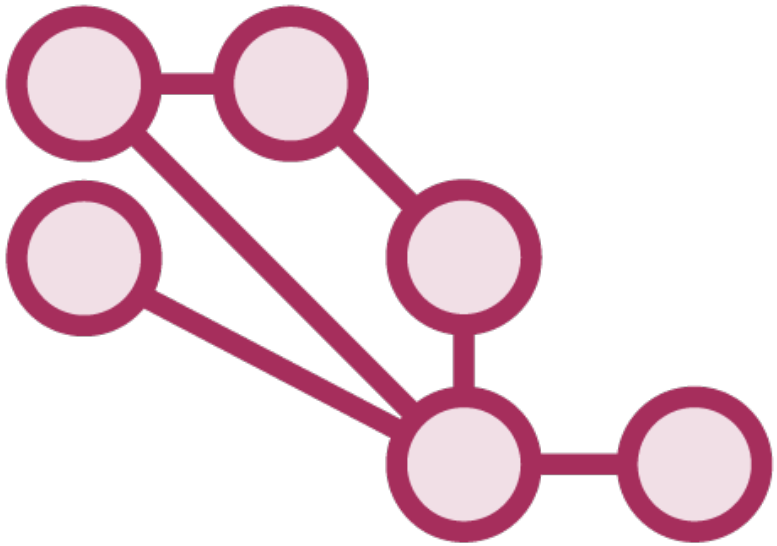
JDBC IP Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder
                    .jdbc.TcpDiscoveryJdbcIpFinder">
                <property name="dataSource" ref="ds"/>
                <property name="initSchema" value="true"/>
            </bean>
        </property>
    </bean>
</property>

<!-- Configured data source instance. -->
<bean id="ds" class="some.Datasource">



</bean>
```

JDBC IP Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder
                    .jdbc.TcpDiscoveryJdbcIpFinder">
                <property name="dataSource" ref="ds"/>
                <property name="initSchema" value="true"/>
            </bean>
        </property>
    </bean>
</property>

<!-- Configured data source instance. -->
<bean id="ds" class=" com.mysql.jdbc.jdbc2.optional.MysqlDataSource">
    <property name="URL" value="${dsMySQL.jdbc.url}"/>
    <property name="user" value="${dsMySQL.jdbc.username}"/>
    <property name="password" value="${dsMySQL.jdbc.password}"/>
</bean>
```

IP Finders



- Multicast
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- JDBC
- Shared Filesystem
- Amazon S3
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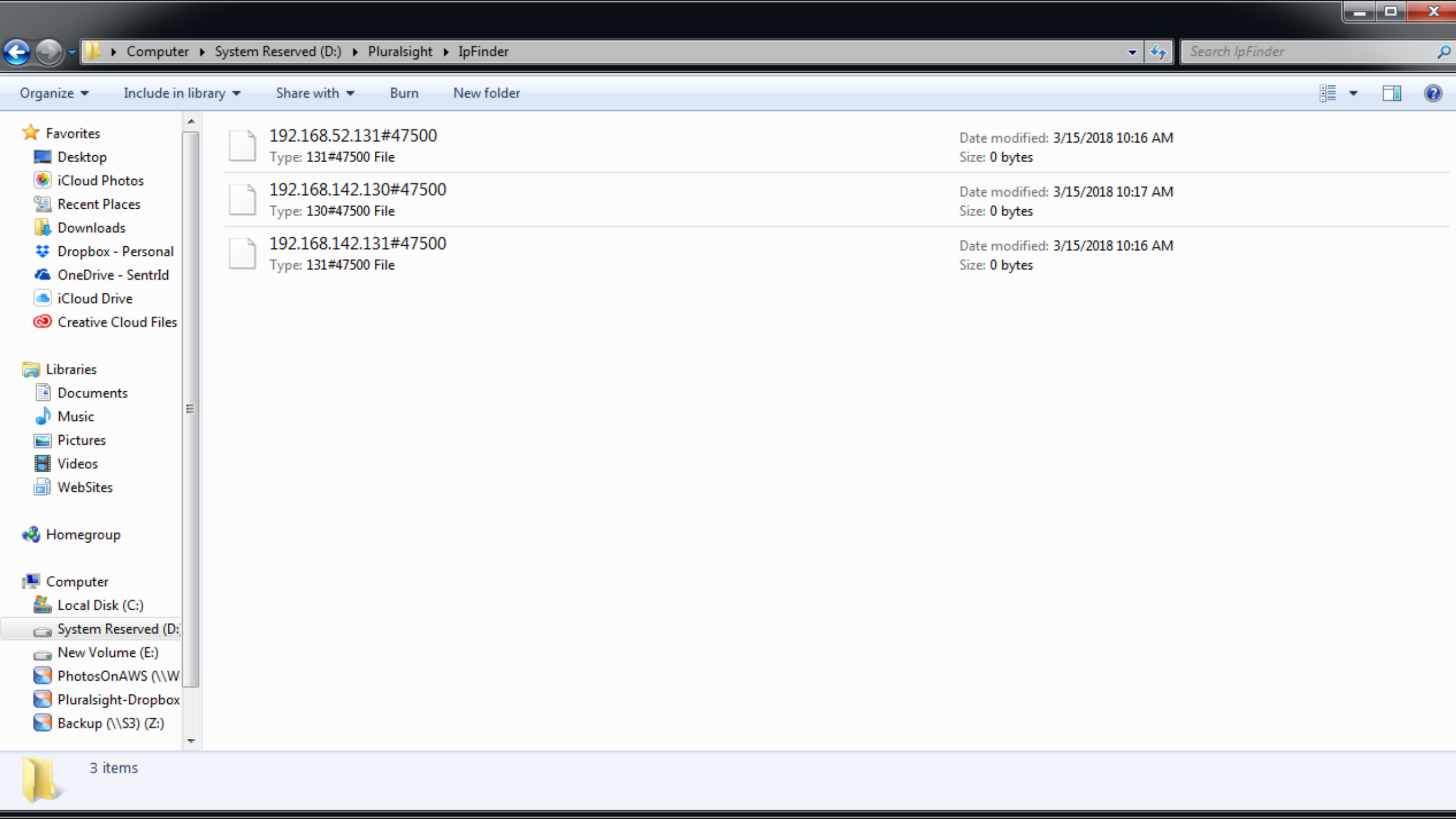
- Apache Zookeeper
- Kubernetes

Shared File System IP Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder.
                    sharedfs.TcpDiscoverySharedFsIpFinder">
                <property name="path" value="/Ignite/Discovery"/>
            </bean>
        </property>
    </bean>
</property>
```

Shared File System IP Finder

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder.
                    sharedfs.TcpDiscoverySharedFsIpFinder">
                <property name="path" value="/Ignite/Discovery"/>
            </bean>
        </property>
    </bean>
</property>
```


Computer ▸ System Reserved (D:) ▸ Pluralsight ▸ IpFinder
Search IpFinder
Organize
Include in library
Share with
Burn
New folder
Favorites
Desktop
iCloud Photos
Recent Places
Downloads
Dropbox - Personal
OneDrive - SentrId
iCloud Drive
Creative Cloud Files
Libraries
Documents
Music
Pictures
Videos
WebSites
Homegroup
Computer
Local Disk (C:)
System Reserved (D:)
New Volume (E:)
PhotosOnAWS (\\W
Pluralsight-Dropbox
Backup (\\S3) (Z:)
192.168.52.131#47500
Type: 131#47500 File
Date modified: 3/15/2018 10:16 AM
Size: 0 bytes
192.168.142.130#47500
Type: 130#47500 File
Date modified: 3/15/2018 10:17 AM
Size: 0 bytes
192.168.142.131#47500
Type: 131#47500 File
Date modified: 3/15/2018 10:16 AM
Size: 0 bytes
3 items

Amazon S3 > [redacted]

Overview | Properties | Permissions | Management

Type a prefix and press Enter to search. Press ESC to clear.

Upload | Create folder | More

US East (N. Virginia)

Viewing 1 to 4

Name	Last modified	Size	Storage class
0:0:0:0:0:0:0:1#47500	Mar 2, 2018 2:56:32 PM GMT-0500	1.0 B	Standard
127.0.0.1#47500	Mar 2, 2018 2:56:32 PM GMT-0500	1.0 B	Standard
192.168.142.128#47500	Mar 2, 2018 2:56:32 PM GMT-0500	1.0 B	Standard
192.168.52.140#47500	Mar 2, 2018 2:56:32 PM GMT-0500	1.0 B	Standard

Viewing 1 to 4

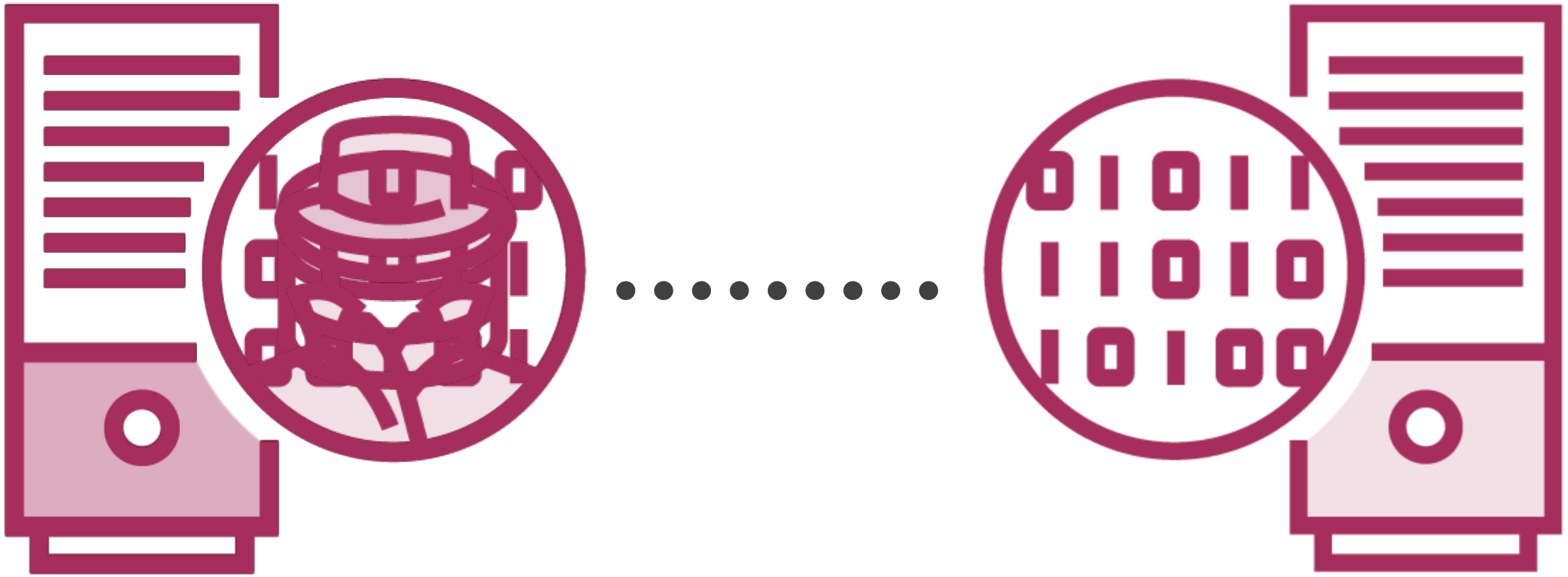
Amazon S3 IP Finder

```
<bean class="org.apache.ignite.configuration.IgniteConfiguration">
   <property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
      <property name="ipFinder">
        <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder
                           .s3.TcpDiscoveryS3IpFinder">
          <property name="awsCredentials" ref="aws.creds"/>
          <property name="bucketName" value="YOUR_BUCKET_NAME"/>
        </bean>
      </property>
    </bean>
  </property>
</bean>

<!-- AWS credentials. Provide your access key ID and secret access key. -->
<bean id="aws.creds" class="com.amazonaws.auth.BasicAWSCredentials">
  <constructor-arg value="YOUR_ACCESS_KEY_ID" />
  <constructor-arg value="YOUR_SECRET_ACCESS_KEY" />
</bean>
```

Up Next

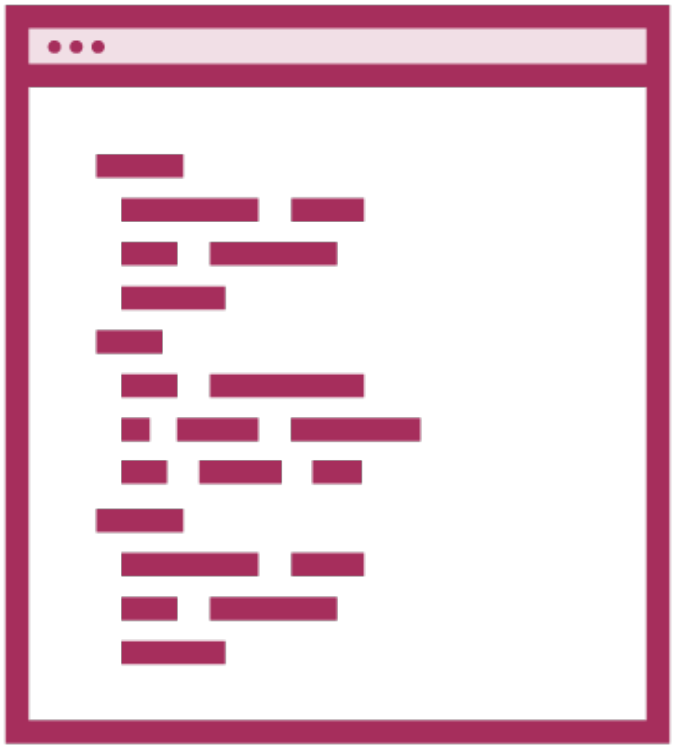
Internode Security



SSL Context Factory

```
<bean class="org.apache.ignite.configuration.IgniteConfiguration">
  <property name="sslContextFactory">
    <bean class="org.apache.ignite.ssl.SslContextFactory">
      <property name="keyStoreFilePath" value="keystore/server.jks"/>
      <property name="keyStorePassword" value="123456"/>
      <property name="trustStoreFilePath" value="keystore/trust.jks"/>
      <property name="trustStorePassword" value="123456"/>
    </bean>
  </property>
</bean>
```

SSL Context Factory Default Values

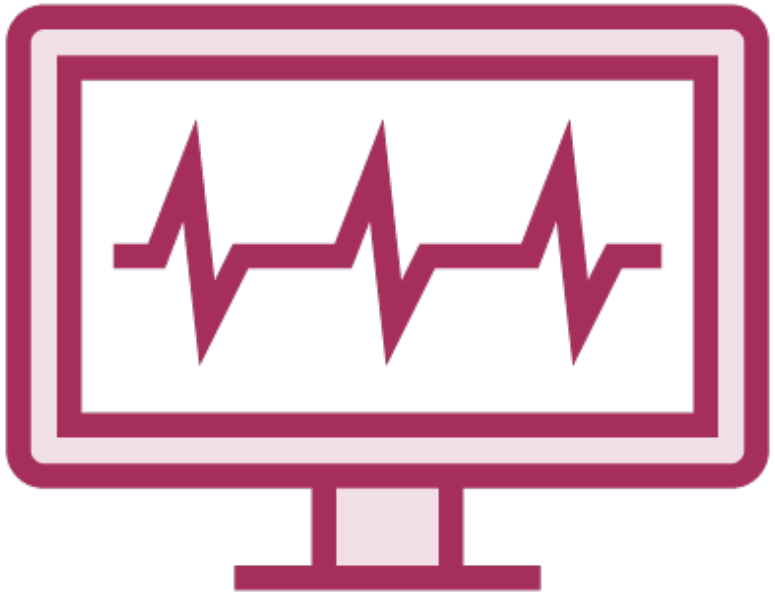


Property	Default Value
Store type	JKS
SSL protocol	TLS
Key Algorithm	SunX509

SSL Context Factory

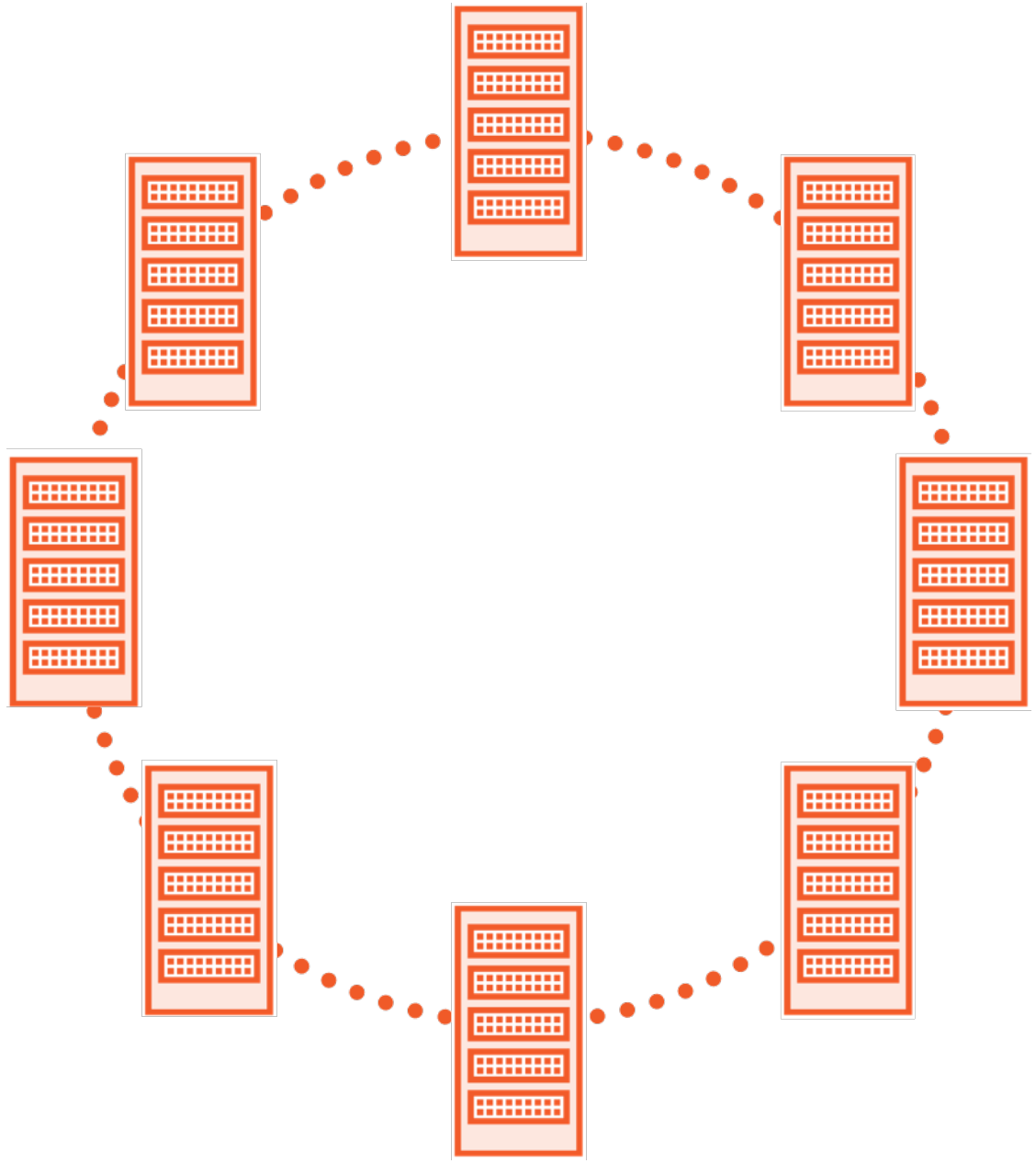
```
<bean class="org.apache.ignite.configuration.IgniteConfiguration">
  <property name="sslContextFactory">
    <bean class="org.apache.ignite.ssl.SslContextFactory">
      <property name="keyStoreFilePath" value="keystore/server.jks"/>
      <property name="keyStorePassword" value="123456"/>
      <property name="trustManagers">
         <bean class="org.apache.ignite.ssl.SslContextFactory"
               factory-method="getDisabledTrustManager"/>
      </property>
    </bean>
  </property>
</bean>
```

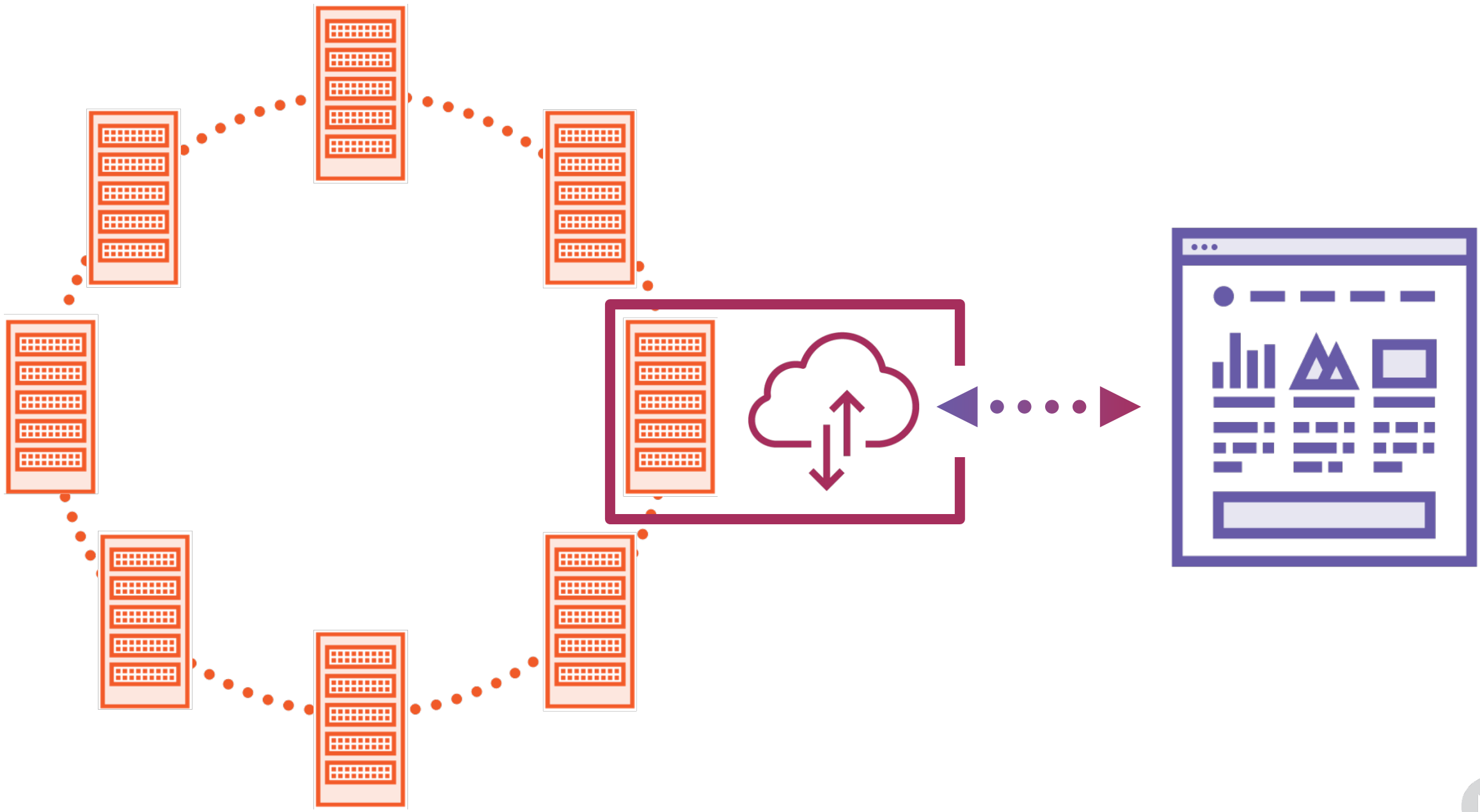
Management & Monitoring



Apache Ignite web console

Visor





Summary

- Nodes
- Groups
- Discovery
- Internode security
- Monitoring and management