Macvlan 网络方案实践

通过实验来验证 Macvlan Bridge 模式的连通性

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1600 Words|Read in about 4 Min|本文总阅读量次

Tags: macvlan (https://www.yangcs.net/tags/macvlan/)

通过上篇文章 (https://www.yangcs.net/posts/netwnetwork-virtualization-macvlan/)的学习，我们已经知道 Macvlan 四种模式的工作原理，其中最常用的就是 Bridge 模式，本文我们将通过实验来验证 Macvlan Bridge 模式的连通性。

Macvlan 是 linux 内核比较新的特性，可以通过以下方法判断当前系统是否支持：

```
$ modprobe macvlan
$ lsmod | grep macvlan
  macvlan                19233  0
```

如果第一个命令报错，或者第二个命令没有返回，则说明当前系统不支持 Macvlan，需要升级系统或者升级内核。

1. 各个 Linux 发行版对 Macvlan 的支持

Macvlan 对 Kernel 版本依赖： `Linux kernel v3.9–3.19 and 4.0+` 。几个重要发行版支持情况：

- ubuntu： >= saucy(13.10)
- RHEL(Red Hat Enterprise Linux): >= 7.0(3.10.0)
- Fedora: >=19(3.9)
- Debian: >=8(3.16)

各个发行版的内核都可以自行手动升级，具体操作可以参考官方提供的文档。

以上版本信息参考了这些资料：

- List of ubuntu versions with corresponding linux kernel version (https://askubuntu.com/questions/517136/list-of-ubuntu-versions-with-corresponding-linux-kernel-version)
- Red Hat Enterprise Linux Release Dates (https://access.redhat.com/articles/3078)

2. 实验环境

后面的测试将会在以下环境进行：

OS	hostname	物理网卡	IP	Gateway
CentOS 7.3	node1	ens160	192.168.179.$^{9}/_{16}$	192.168.1.1
CentOS 7.3	node2	ens160	192.168.179.$^{10}/_{16}$	192.168.1.1

我的本地操作系统为 MacOS，IP 为 `10.8.0.241` ，网关为 `10.8.0.1` 。

3. 连通性测试

下面开始对 Bridge 模式下 Macvlan 的连通性进行测试。

首先在 `node1` 上创建两个 network namespace：

```
# 开启混杂模式
$ ip link set ens160 promisc on

$ ip netns add ns1
$ ip netns add ns2
```

然后创建 Macvlan 接口:

```
$ ip link add link ens160 mac1 type macvlan mode bridge
```

创建的格式为 `ip link add link <PARENT> <NAME> type macvlan mode <MODE>`，其中 `<PARENT>` 是 Macvlan 接口的父接口名称，`<NAME>` 是新建的 Macvlan 接口的名称，这个名字可以任意取，`<MODE>` 是 Macvlan 的模式。

可以查看创建接口的详细信息:

```
$ ip -d link show mac1

13: [email protected]: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN mod
    link/ether 5a:94:85:a6:96:95 brd ff:ff:ff:ff:ff:ff promiscuity 0
    macvlan  mode bridge addrgenmode eui64
```

下面就是把创建的 Macvlan 接口放到 network namespace 中，配置好 IP 地址，然后启用它:

```
$ ip link set mac1 netns ns1
$ ip netns exec ns1 ip addr add 192.168.179.12/16 dev mac1
$ ip netns exec ns1 ip link set dev mac1 up
```

同理可以配置另外一个 Macvlan 接口:

```
$ ip link add link ens160 mac2 type macvlan mode bridge
$ ip link set mac2 netns ns2
$ ip netns exec ns2 ip addr add 192.168.179.13/16 dev mac2
$ ip netns exec ns2 ip link set dev mac2 up
```

可以测试两个 IP 的连通性:

ns1 -> ns2

```
$ ip netns exec ns1 ping -c 3 192.168.179.13

PING 192.168.179.13 (192.168.179.13) 56(84) bytes of data.
64 bytes from 192.168.179.13: icmp_seq=1 ttl=64 time=0.090 ms
64 bytes from 192.168.179.13: icmp_seq=2 ttl=64 time=0.061 ms

--- 192.168.179.13 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 0.061/0.075/0.090/0.016 ms
```

ns2 -> ns1

```
$ ip netns exec ns2 ping -c 2 192.168.179.12

PING 192.168.179.12 (192.168.179.12) 56(84) bytes of data.
64 bytes from 192.168.179.12: icmp_seq=1 ttl=64 time=0.059 ms
64 bytes from 192.168.179.12: icmp_seq=2 ttl=64 time=0.043 ms

--- 192.168.179.12 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 0.043/0.051/0.059/0.008 ms
```

ns1 -> 192.168/16

首先测试 ns1 与 node2 的连通性：

```
$ ip netns exec ns1 ping -c 2 192.168.179.10

PING 192.168.179.10 (192.168.179.10) 56(84) bytes of data.
64 bytes from 192.168.179.10: icmp_seq=1 ttl=64 time=0.976 ms
64 bytes from 192.168.179.10: icmp_seq=2 ttl=64 time=0.430 ms

--- 192.168.179.10 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.430/0.703/0.976/0.273 ms
```

下面测试 ns1 与 node2 中 network namespace 的连通性。

先在 node2 中配置一个 Macvlan 接口：

```
[[email protected] ~]# ip link set ens160 promisc on
[[email protected] ~]# ip netns add ns1
[[email protected] ~]# ip link add link ens160 mac1 type macvlan mode bridge
[[email protected] ~]# ip link set mac1 netns ns1
[[email protected] ~]# ip netns exec ns1 ip addr add 192.168.179.14/16 dev mac1
```

```
[[email protected] ~]# ip link set dev mac1 up
```

测试 node1 的 ns1 与 node2 的 ns1 的连通性：

```
[[email protected] ~]# ip netns exec ns1 ping -c 2 192.168.179.14

PING 192.168.179.14 (192.168.179.14) 56(84) bytes of data.
64 bytes from 192.168.179.14: icmp_seq=1 ttl=64 time=0.976 ms
64 bytes from 192.168.179.14: icmp_seq=2 ttl=64 time=0.430 ms

--- 192.168.179.14 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.430/0.703/0.976/0.273 ms
```

10.8%16 -> ns1

```
# 在本地的 MacOS 客户端 ping 192.168.179.12
$ ping 192.168.179.12 -c 2

PING 192.168.179.12 (192.168.179.12): 56 data bytes
Request timeout for icmp_seq 0

--- 192.168.179.12 ping statistics ---
2 packets transmitted, 0 packets received, 100.0% packet loss
```

发现跨三层网段是 ping 不通的。这个问题很好解决，我们刚刚给 ns1 和 ns2 分配 IP 的时候并没有指定默认路由，指定个默认路由问题就迎刃而解了。

```
$ ip netns exec ns1 ip route add default via 192.168.1.1 dev mac1
```

Note

如果你想开发 Macvlan cni 插件，这个地方需要注意一下，每次给 Pod 分配好 IP 以后要添加一条默认路由指向网关，不然无法跨三层通信。

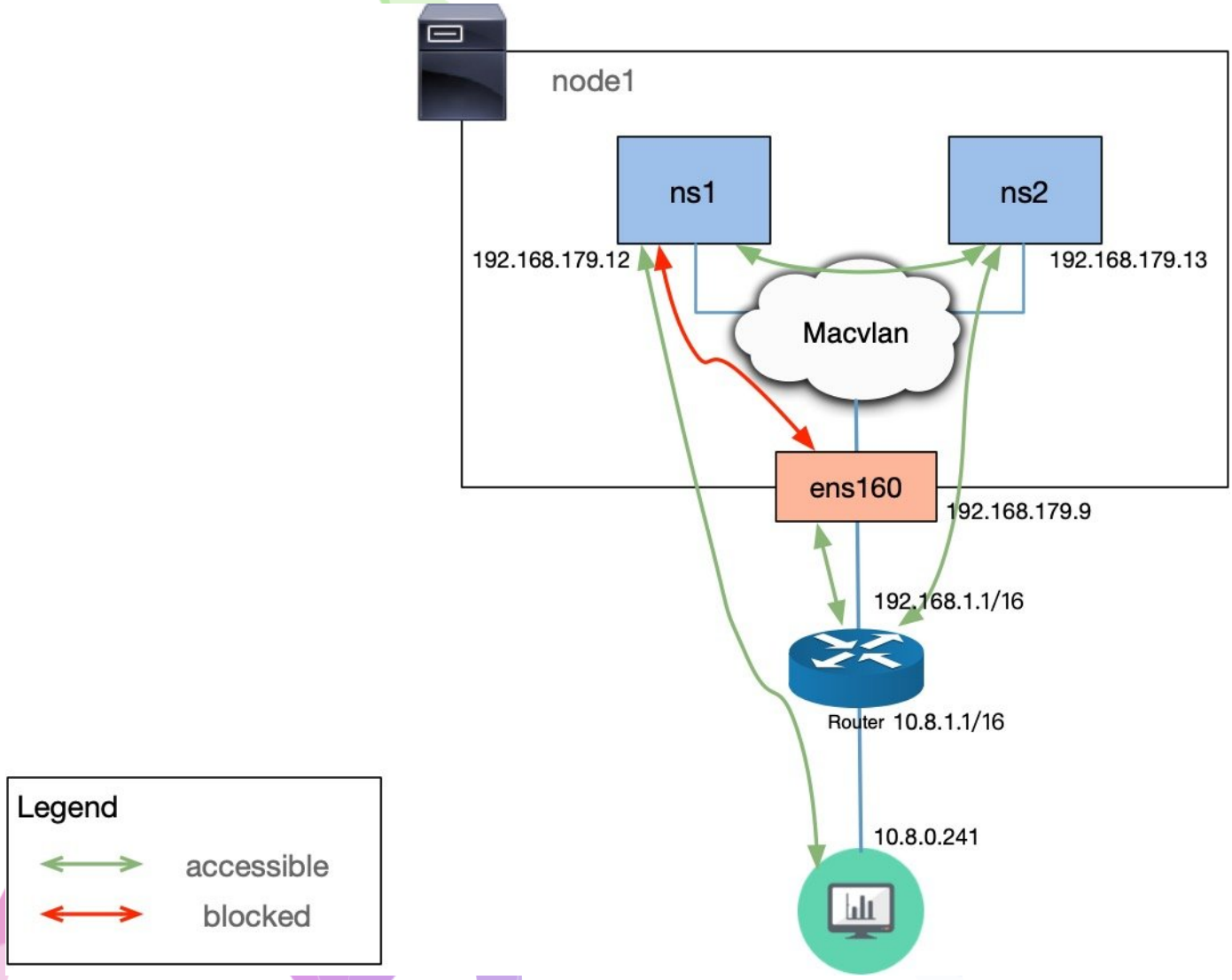
ns1 -> ens160

```
$ ip netns exec ns1 ping -c 2 192.168.179.9

PING 192.168.179.9 (192.168.179.9) 56(84) bytes of data.

--- 192.168.179.9 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 999ms
```

这里就遇到了我在上一篇文章 (https://www.yangcs.net/posts/netwnetwork-virtualization-macvlan/#span-id-inline-toc-1-span-macvlan-简介)开头提到的问题。到目前为止，整个实验的拓扑结构如下：



其实也很好解决，额外创建一个 Macvlan 子接口，并把 ens160 的 IP 分给这个子接口，最后还要修改默认路由。

```
$ ip link add link ens160 mac0 type macvlan mode bridge
# 下面的命令一定要放在一起执行，否则中间会失去连接
$ ip addr del 192.168.179.9/16 dev ens160 && \
  ip addr add 192.168.179.9/16 dev mac0 && \
  ip link set dev mac0 up && \
  ip route flush dev ens160 && \
  ip route flush dev mac0 && \
  ip route add 192.168.0.0/16 dev mac0 metric 0 && \
  ip route add default via 192.168.1.1 dev mac0 &
```

Note

这里一定不能 Down 掉 `ens160`，否则所有的子接口都将无法工作。

现在就能 ping 通了：

```
$ ip netns exec ns1 ping -c 2 192.168.179.9

PING 192.168.179.9 (192.168.179.9) 56(84) bytes of data.
64 bytes from 192.168.179.9: icmp_seq=1 ttl=64 time=0.137 ms
64 bytes from 192.168.179.9: icmp_seq=2 ttl=64 time=0.078 ms

--- 192.168.179.9 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.078/0.107/0.137/0.031 ms
```

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「真诚赞赏，手留余香」

赏

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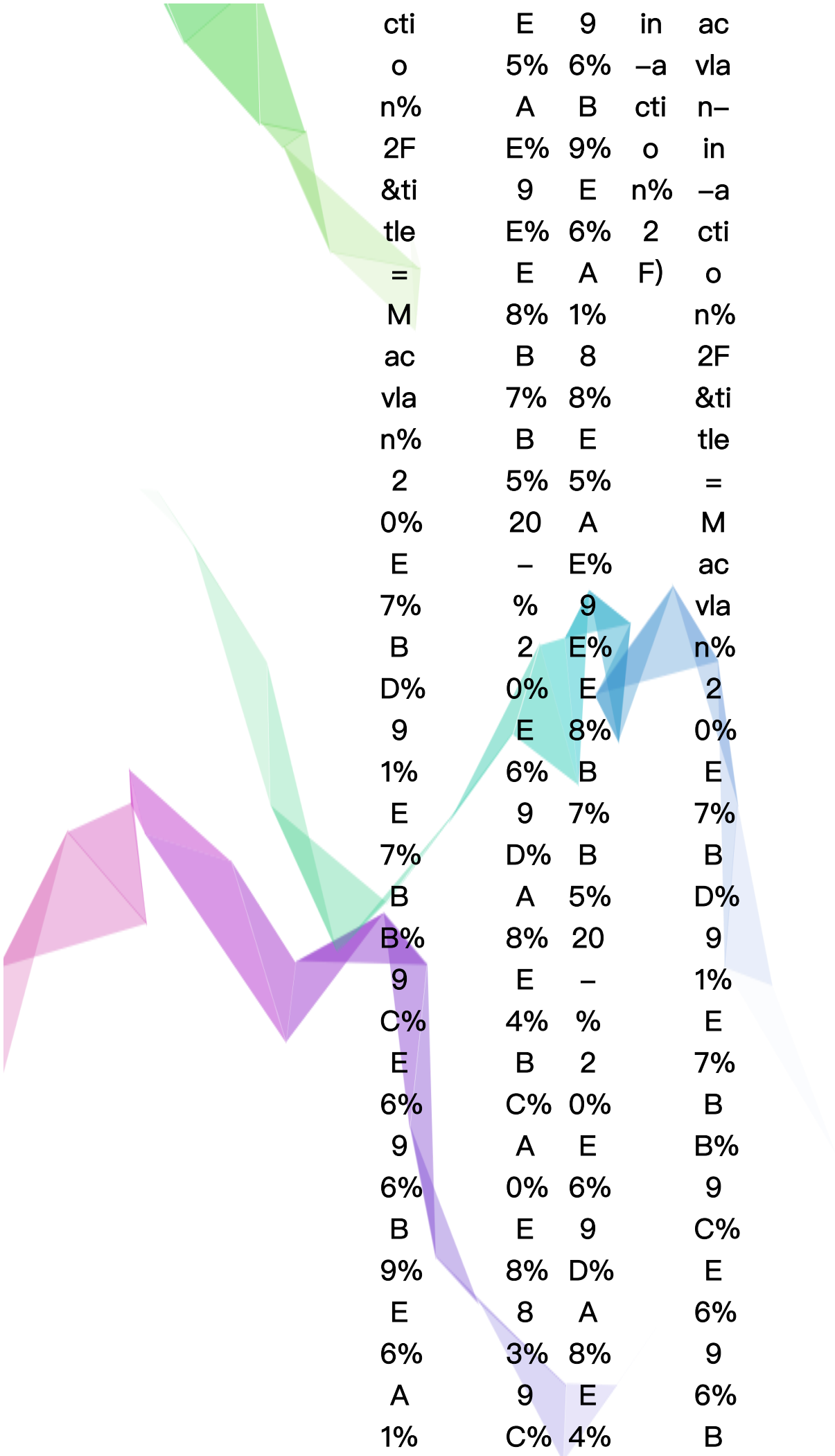
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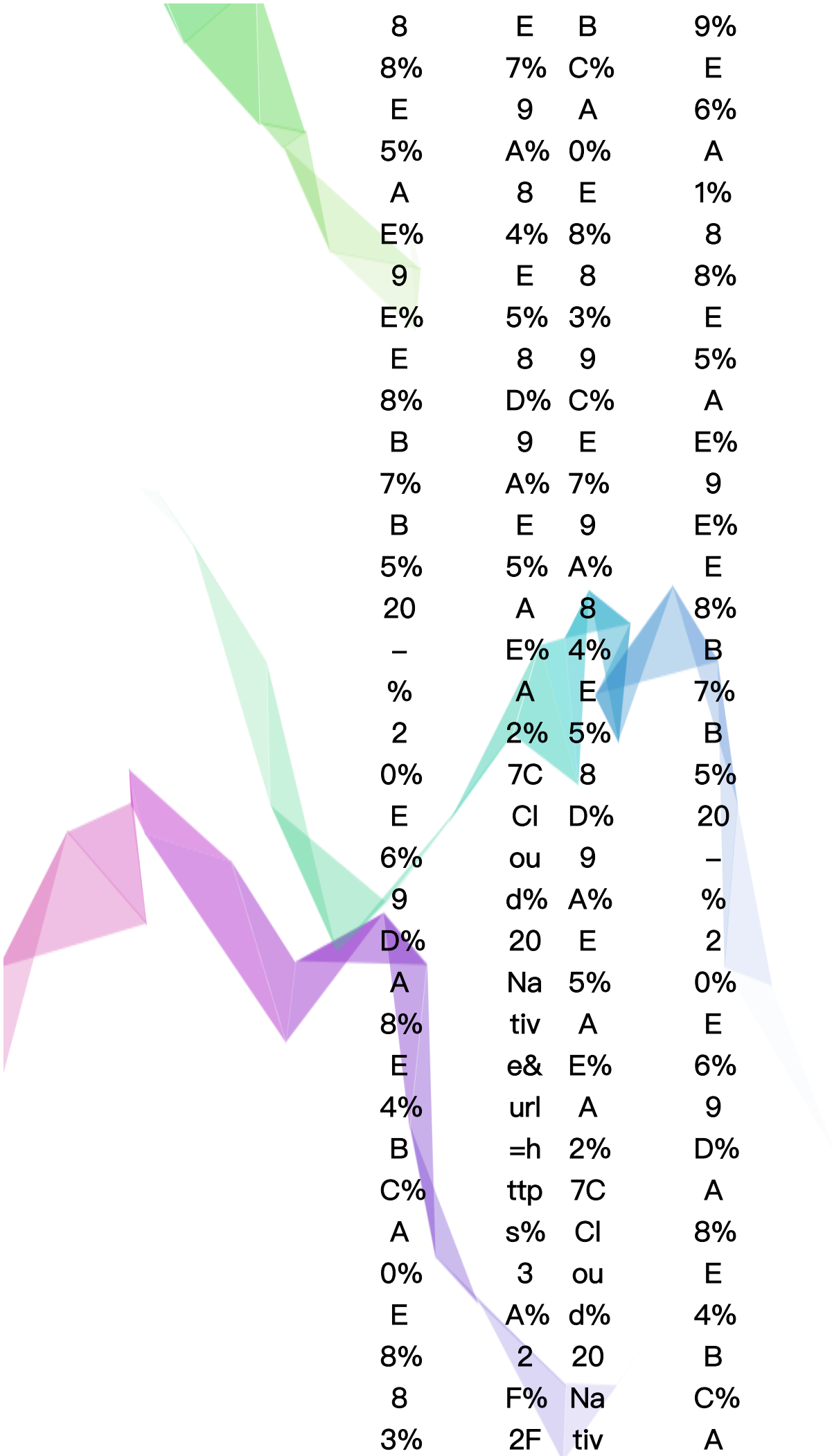
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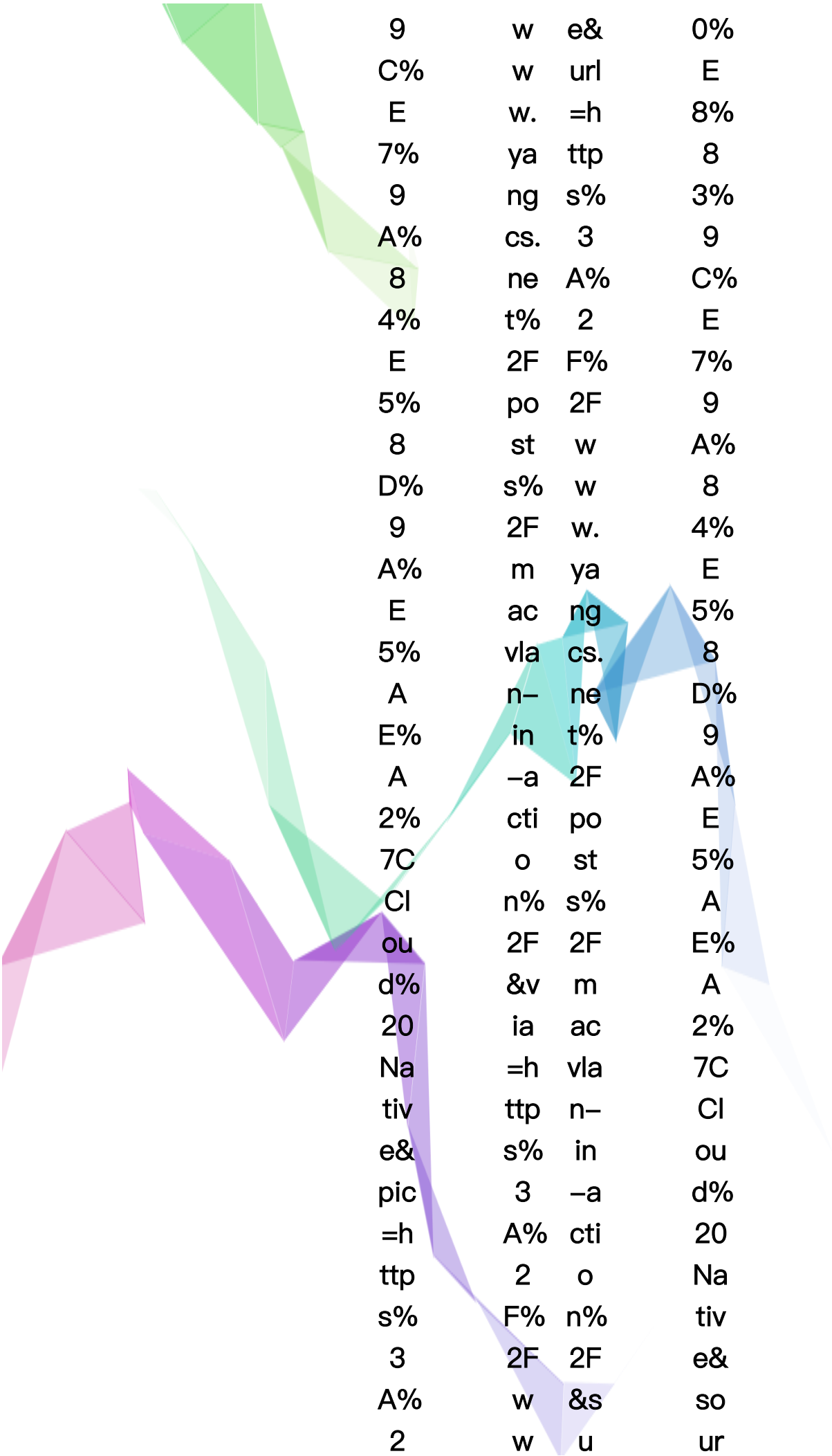
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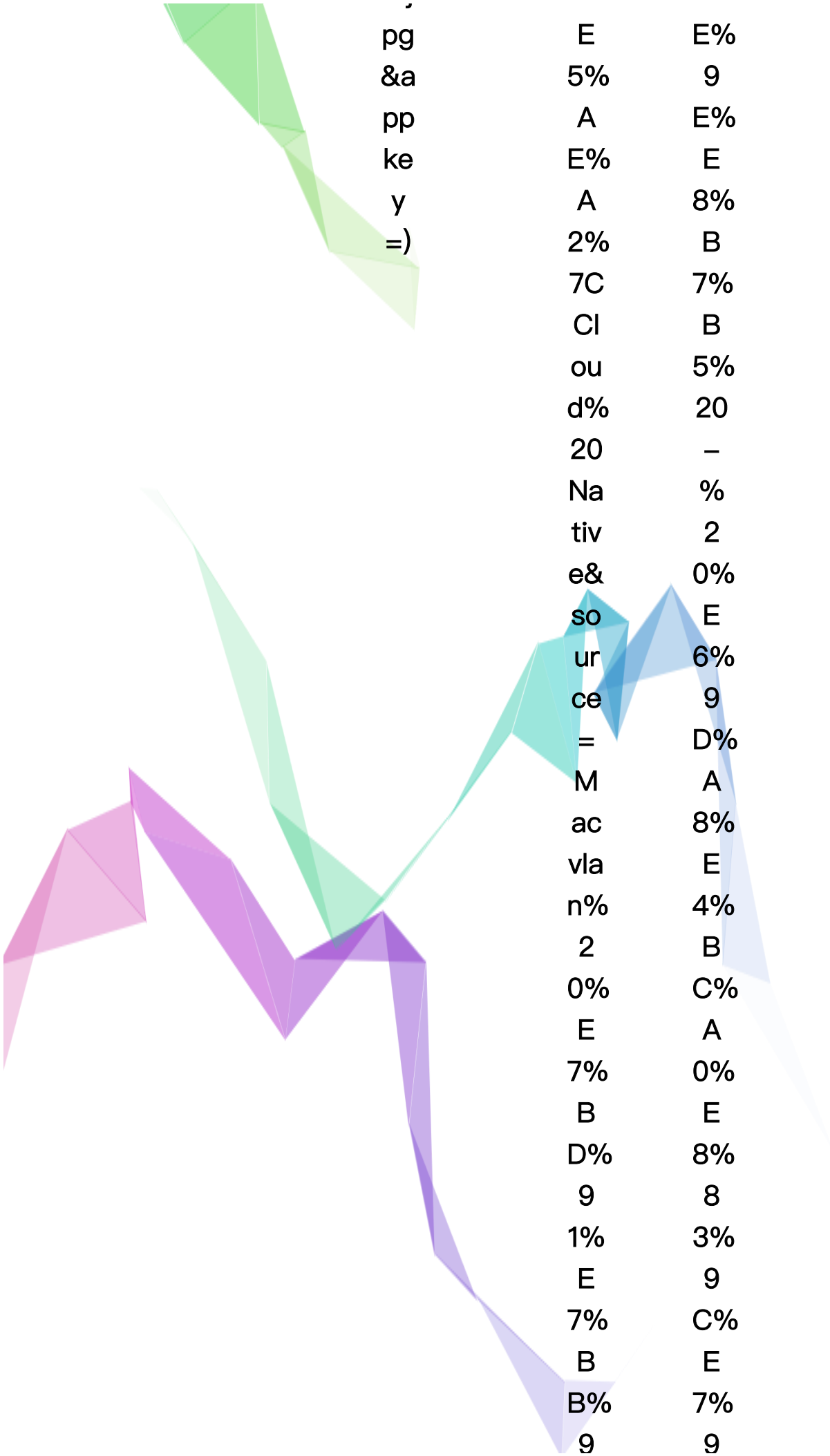
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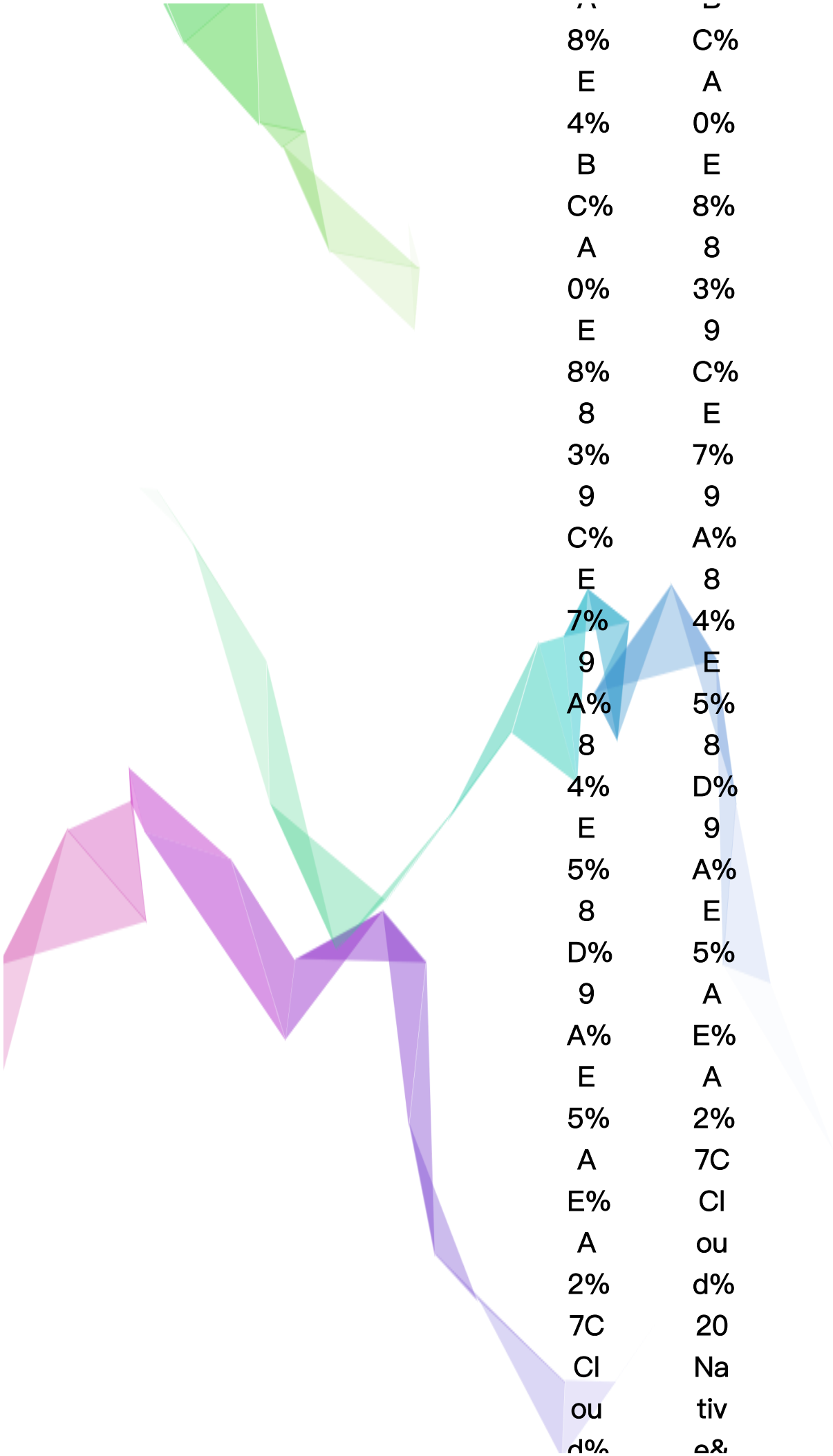
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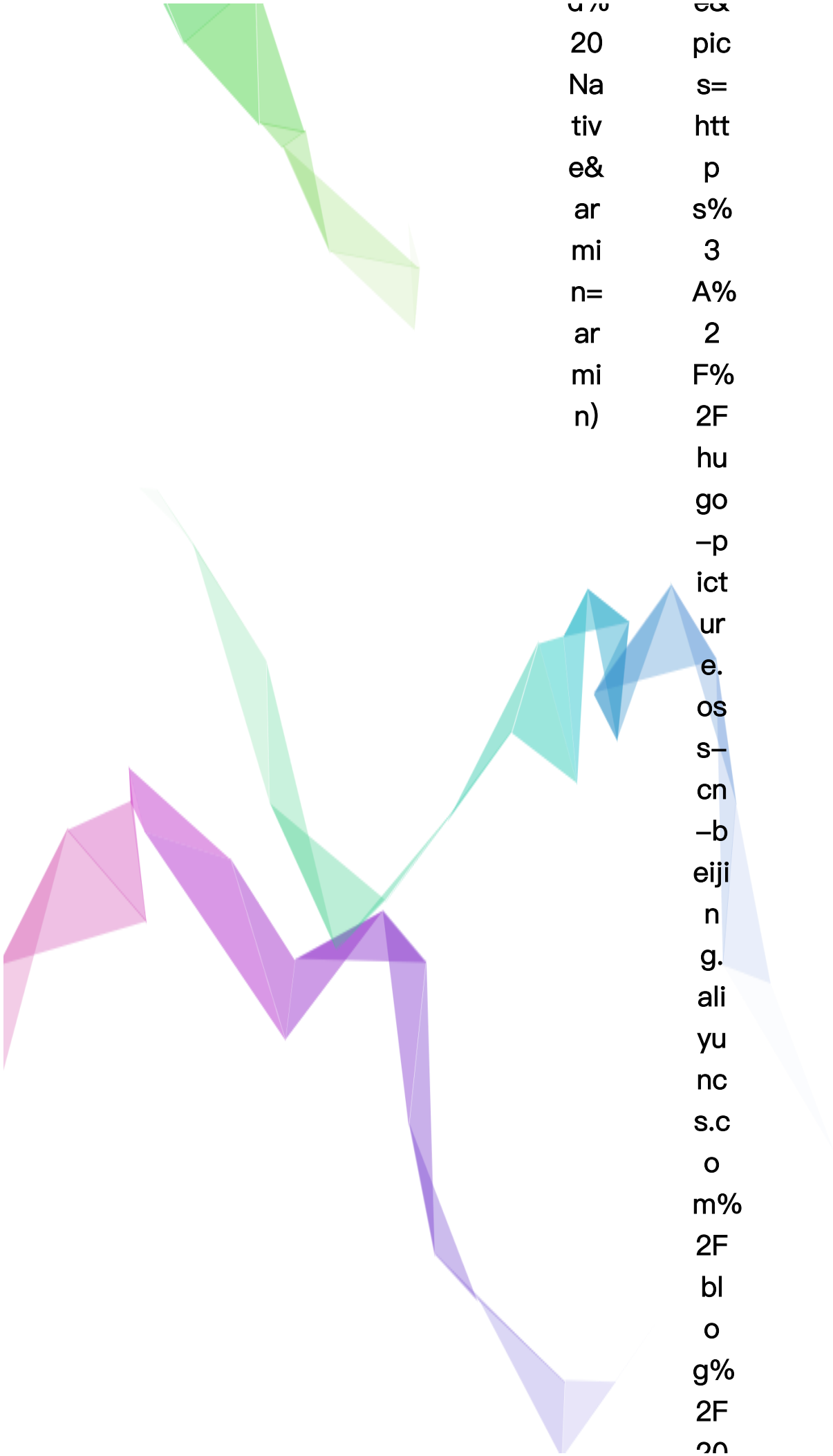

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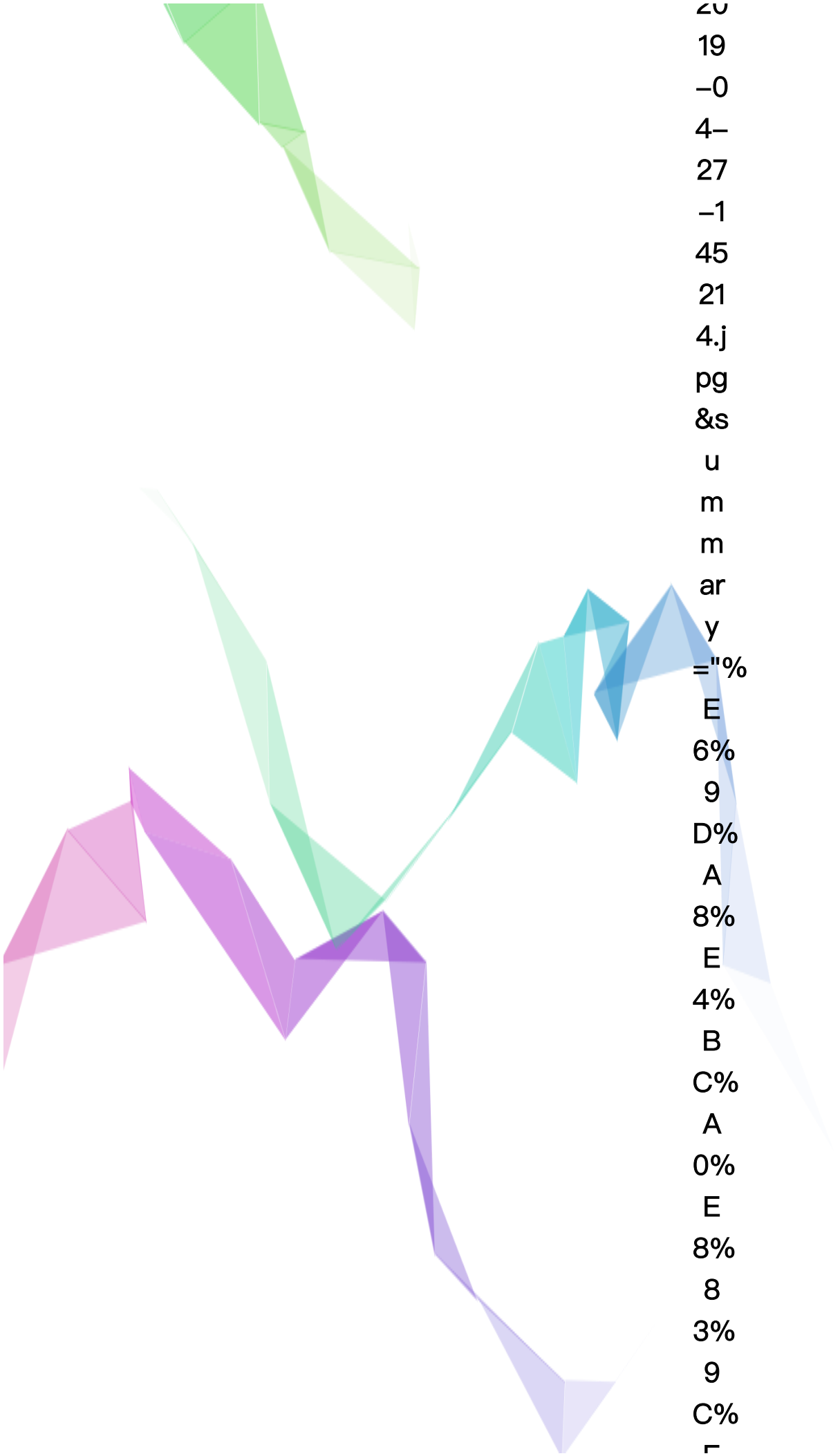
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