# RACKCONNECT

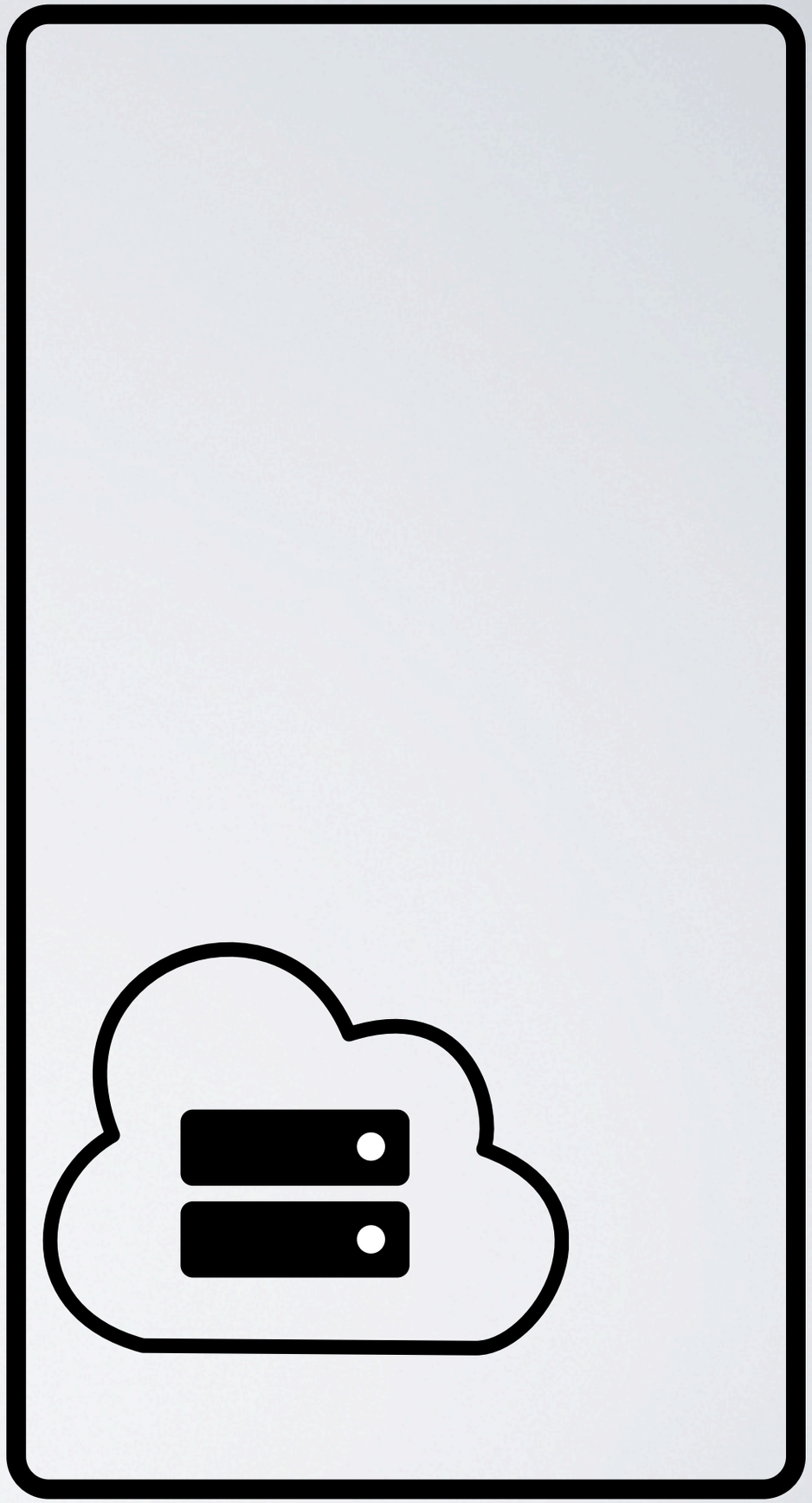
Infrastructure
Walkthrough

rackspace HOSTING

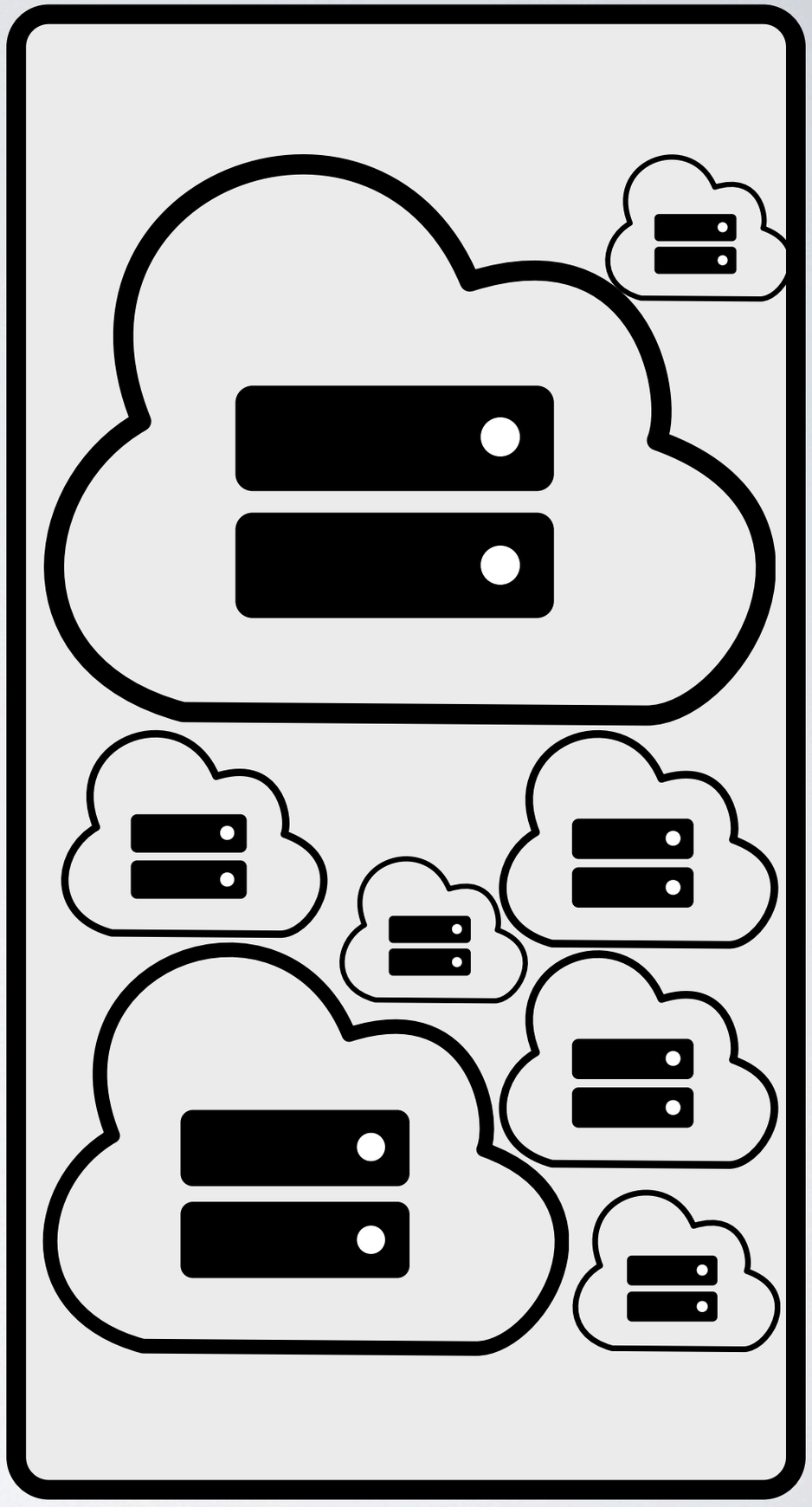
# A Quick Review

This is a Cloud Server.

Cloud Servers reside on physical devices called **hypervisors**.



Hypervisors hold many Cloud Servers.



Hypervisors are organized into logical groups called “Huddles”


DISCLAIMER: Yes, I know it isn’t really 200 hypervisors, but for the purposes of this training lets pretend it is.

# Huddles contain 200+ hypervisors

Cloud ServiceNet's IP Space is HUGE!

# CLOUD SERVICENET IP SPACE

Huddle IP Space

Huddle IP Space

Huddle IP Space

Huddle IP Space

Because of this, each huddle has its own smaller subnetwork within the larger Cloud ServiceNet IP Space.

# CLOUD SERVICENET

# IP SPACE

Huddle IP Space

Huddle VLAN

Huddle IP Space

Huddle VLAN

Huddle IP Space

Huddle VLAN

Huddle IP Space

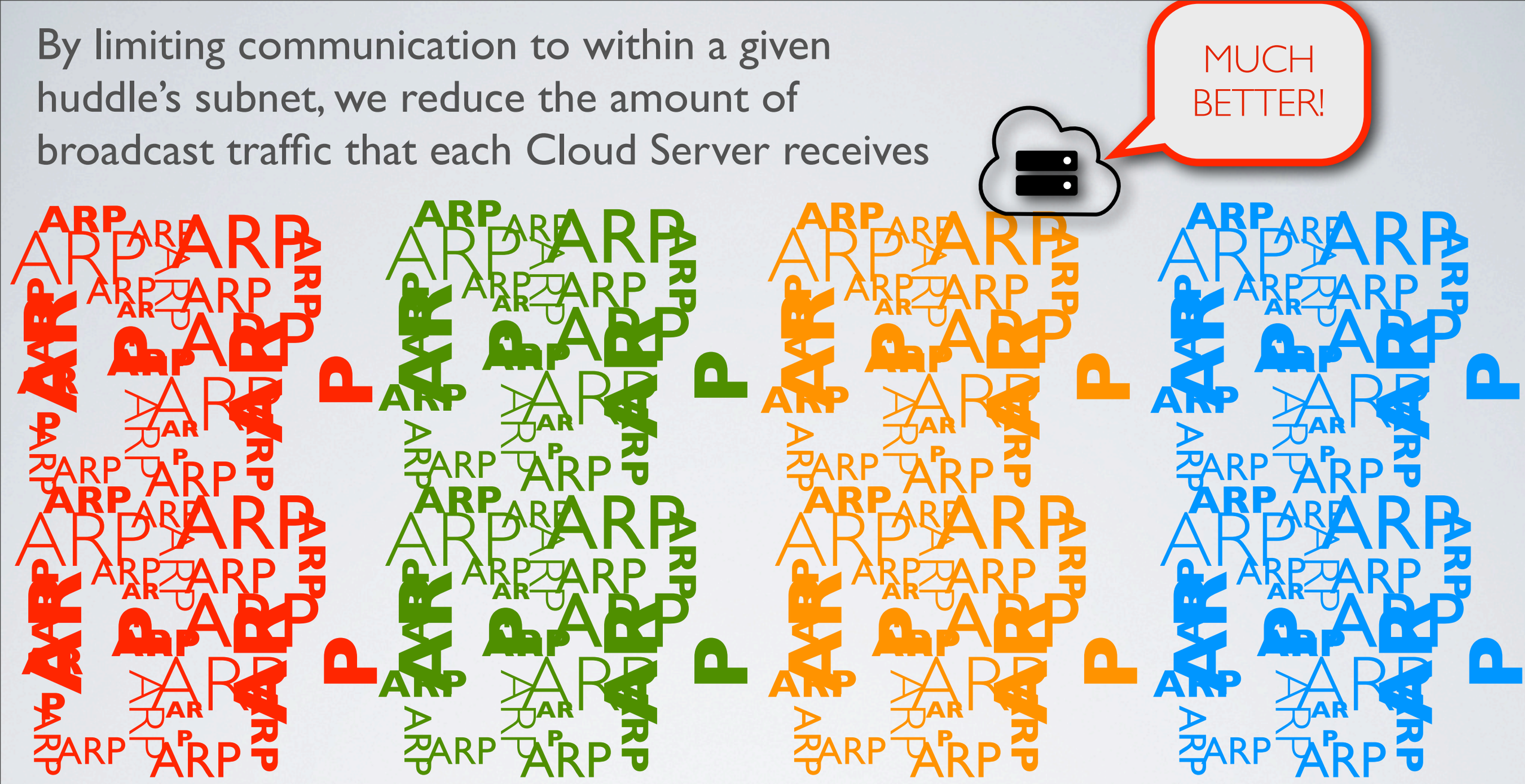
Huddle VLAN

Each Huddle's subnetwork is placed within its own VLAN.

# CLOUD SERVICENET IP SPACE

Without the subnets in place, Cloud Servers would receive broadcast traffic for the entire Cloud ServiceNet IP Space.

By limiting communication to within a given huddle's subnet, we reduce the amount of broadcast traffic that each Cloud Server receives



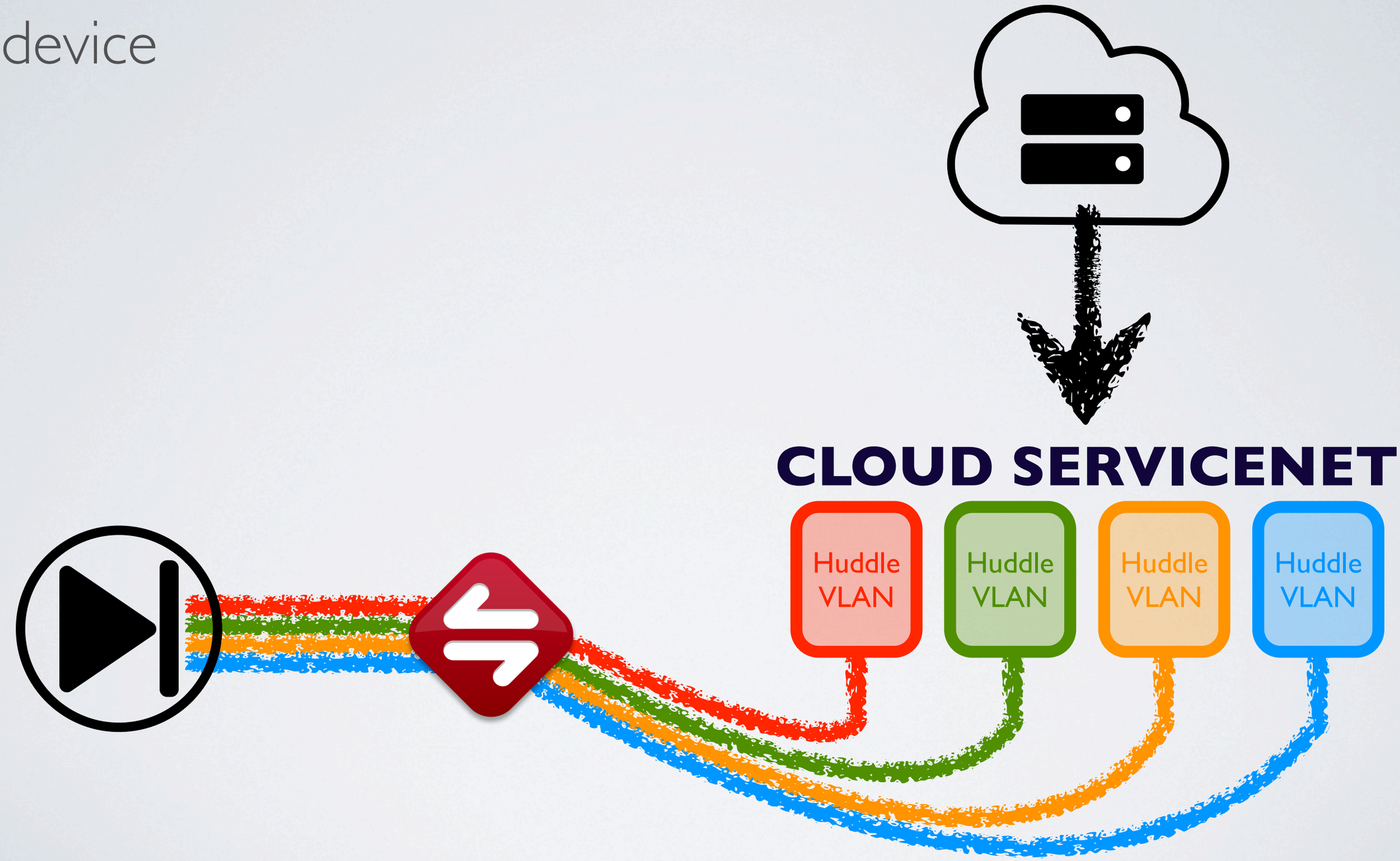

Huddle VLAN

Huddle VLAN

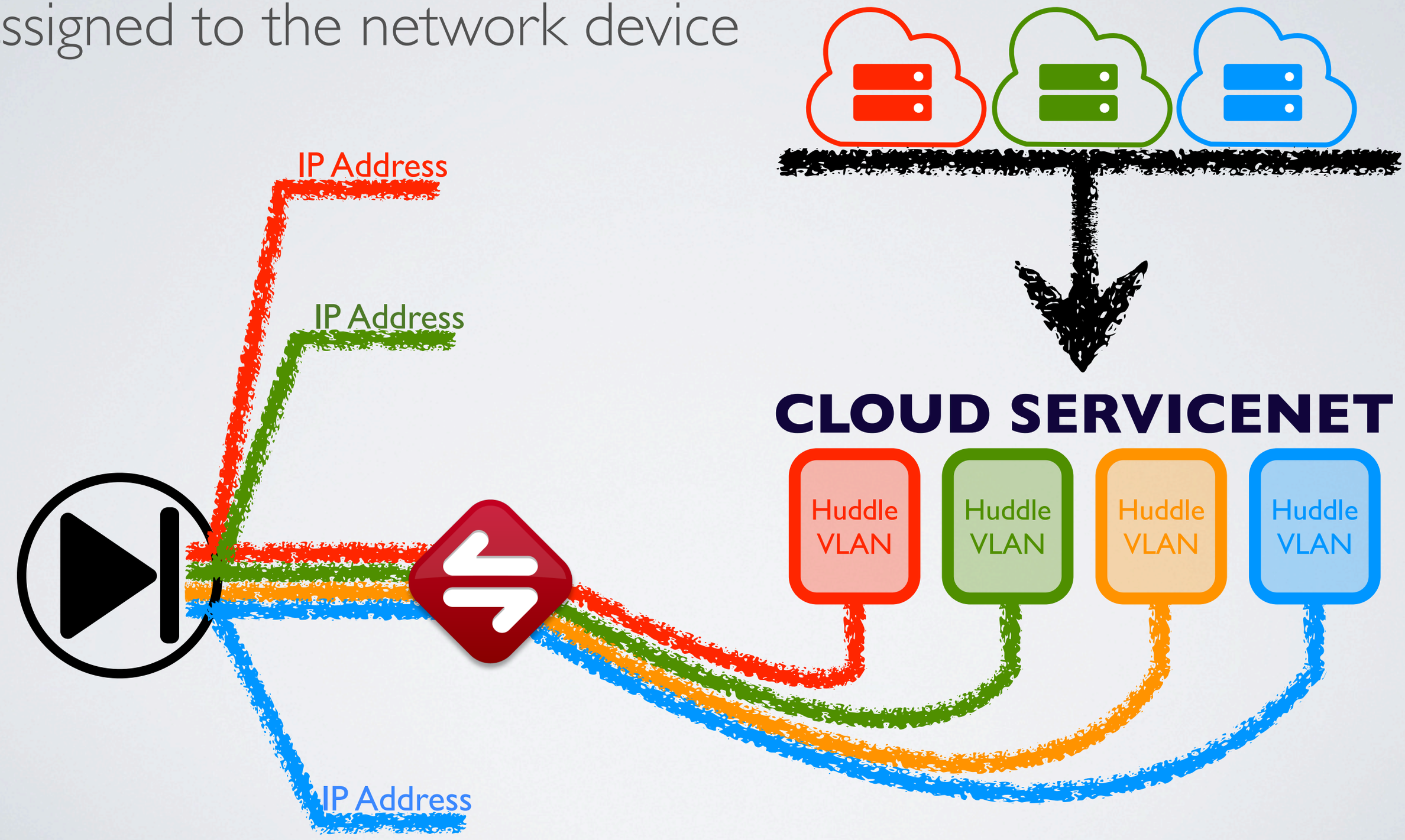
Huddle VLAN

Huddle VLAN

RackConnect connects each huddle VLAN to the dedicated network device



For every huddle that contains a customer's active Cloud Server, an IP within that huddle's subnet is assigned to the network device



I'll send my traffic through IP Address from now on!

IP Address

IP Address

IP Address

CLOUD SERVICENET

Huddle VLAN

Huddle VLAN

Huddle VLAN

Huddle VLAN

This IP will be used as the new default gateway for Cloud Servers within the huddle.

Before we dive in...

# Before we dive in...

**Layer 2 Switches** (**Forwarding Switches**) are **incapable** of **routing** based off **IP address**. These switches **forward traffic** based off of **MAC Addresses**.

(Forwarding Switch, RackConnect Distribution Switch)

**Layer 3 Switches** (**IP Routing Switches**) are capable of **forwarding traffic AS WELL AS** performing **IP routing between VLANs.**

(Aggregation Switch, RackConnect Aggregation Switch, Core ServiceNet Router, RackConnect Core Switch)

Before we dive in...

## When does L2 MAC Forwarding occur?

- L2 MAC Forwarding occurs when traffic is destined for an IP address OUTSIDE the local subnet.
- Traffic is forwarded via MAC Addresses only.
- MAC Addresses are discovered and stored via ARP (Net Devices and Hosts) as well as MAC Address Tables (Switching Infrastructure)

## When does L3 IP Routing occur?

- L3 IP Routing occurs when traffic is destined for an IP address OUTSIDE the local subnet.
- Traffic is forwarded based on a best possible match of existing routes to remote networks.
- Traffic is forwarded to a Next-Hop IP.
- The Next-Hop IP is an IP within a network's local subnet that will receive traffic and know where to send the traffic next.

**With that in mind:** There are 3 routes on EVERY RackConnected Cloud Server!

Most Specific

## The Local Subnet (/17-/19)

- This is the local segment (the network attached to Eth1).
- The Next-Hop IP will be the **Huddle/Cell Cloud ServiceNet Gateway IP**
- **Huddle/Cell Cloud ServiceNet Gateway IP** is the *first usable* IP Address for the subnet.
- This IP Route exists for every Public Cloud customer (regardless of RackConnect).

## Cloud ServiceNet (10.176.0.0/12,10.208.0.0/12)

- This is for all of the Cloud ServiceNet IP Space.
- The Next-Hop IP will be the **Huddle/Cell Cloud ServiceNet Gateway IP**
- **Huddle/Cell Cloud ServiceNet Gateway IP** is the *first usable* IP Address for the subnet.
- This IP Route exists for every Public Cloud customer (regardless of RackConnect).

OMG A NEW Cloud ServiceNet SUBNET!

Least Specific

## The Default Route (0.0.0.0/0)

- This is for all traffic that did not match the two routes mentioned above.
- The Next-Hop IP will be the **Huddle/Cell RackConnect Gateway IP**
- **Huddle/Cell RackConnect Gateway IP** is an IP Address within the Huddle/Cell's subnet, and is assigned and reserved via RC's Automation!
- This IP Route is unique to RackConnected Cloud Servers.

# Infrastructure Deep Dive

## Cloud ServiceNet

# Cloud Servers

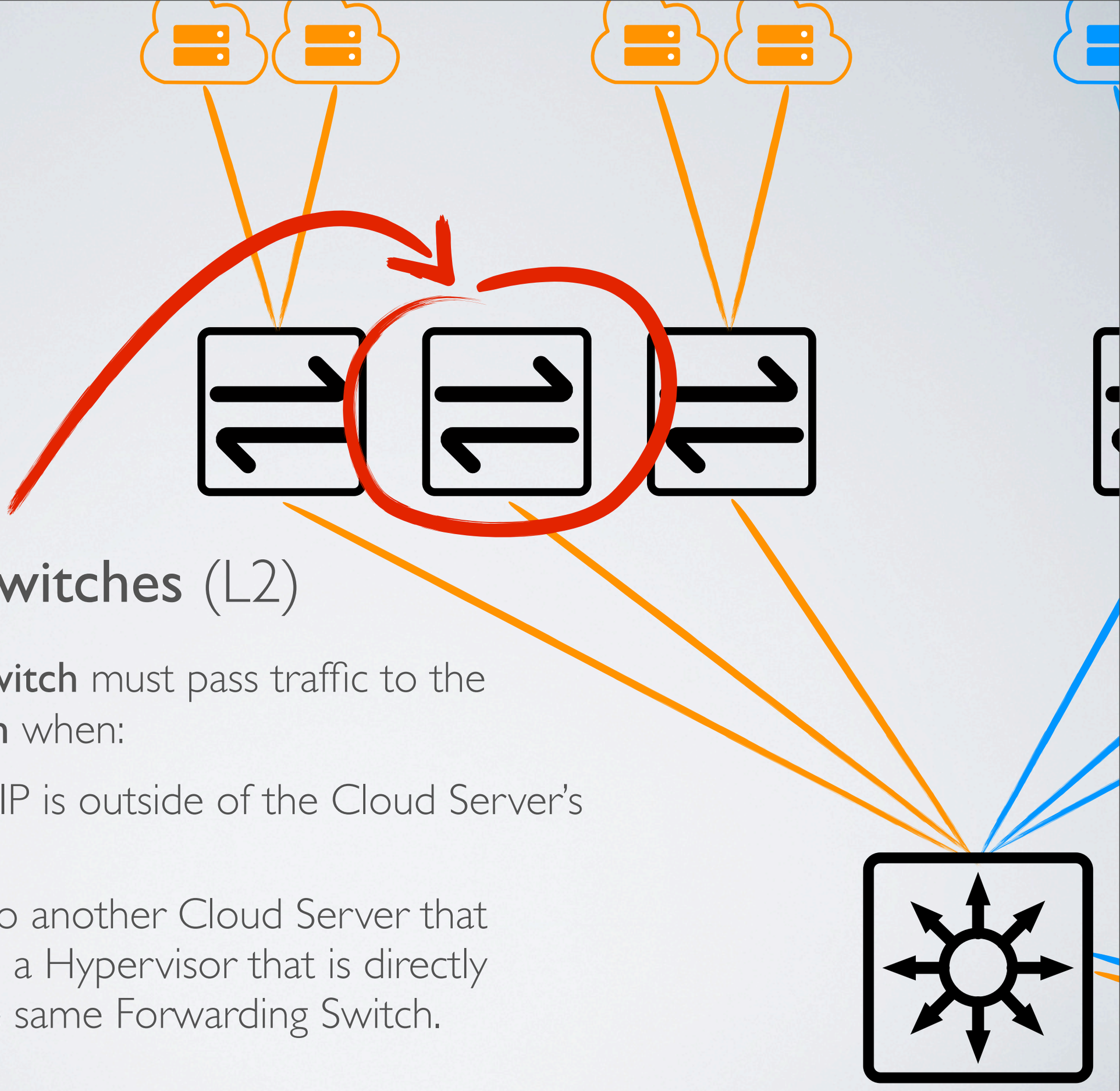
**Cloud Servers** reside on **Hypervisors**, which are **directly connected** to **Forwarding Switches**.

For the purposes of this presentation, each color presented will represent a different subnet (and VLAN)

# **Forwarding Switches** (L2)

The **Forwarding Switch** must pass traffic to the **Aggregation Switch** when:

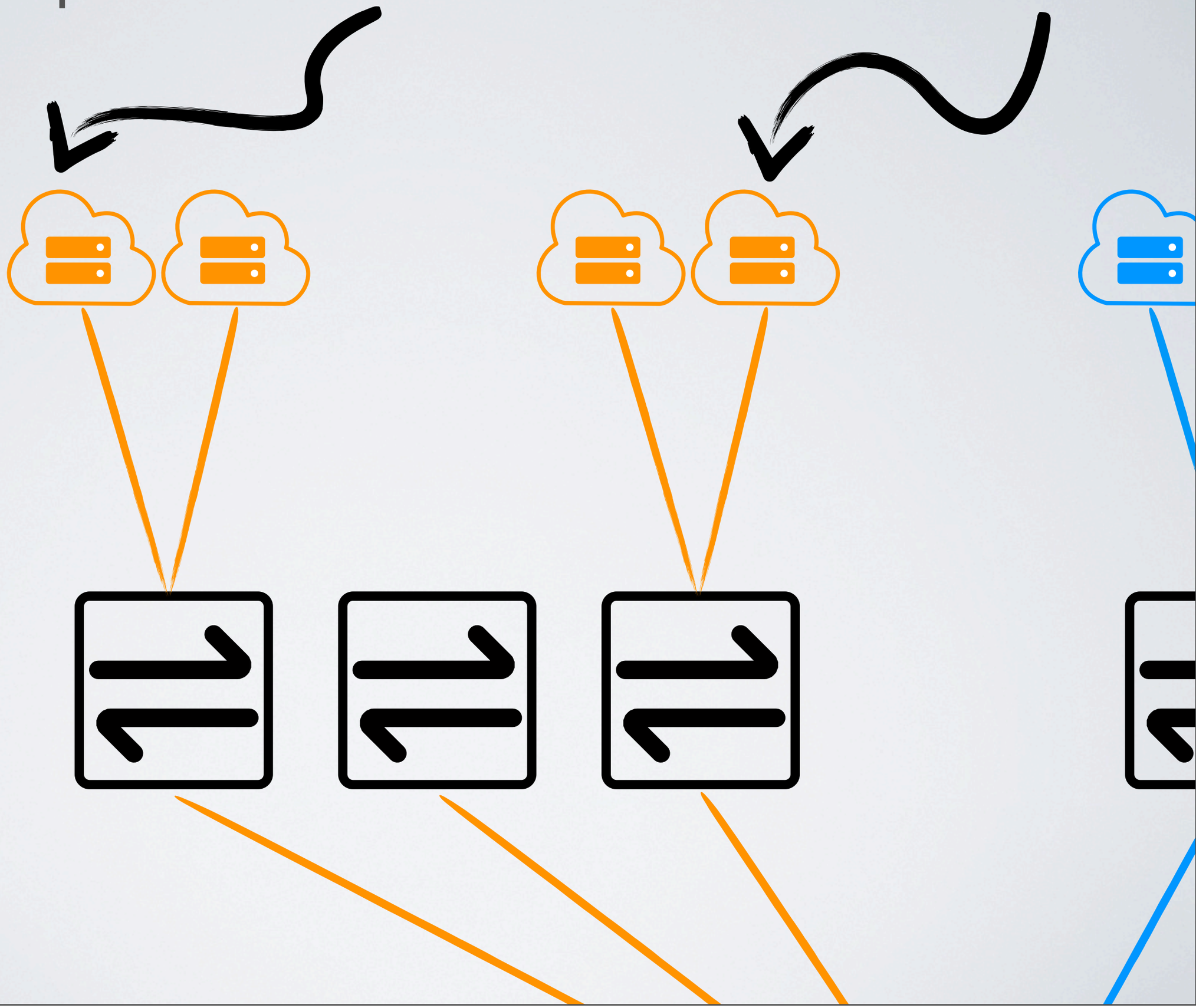
- the destination IP is outside of the Cloud Server's local subnet.
- sending traffic to another Cloud Server that doesn't reside on a Hypervisor that is directly connected to the same Forwarding Switch.



(aka Orange 1)

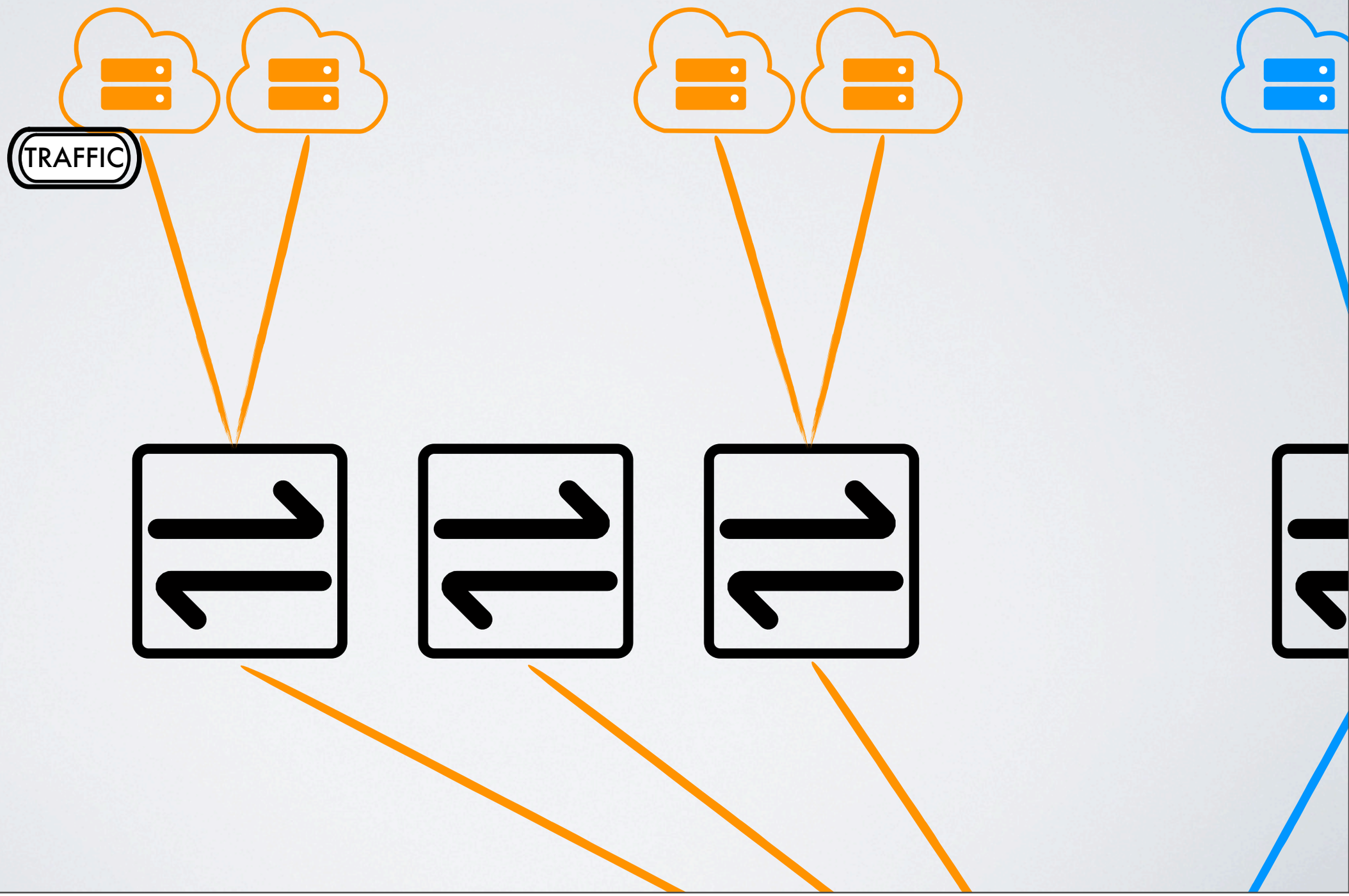
(aka Orange 4)

# For Example: This Cloud Server wants to reach this Cloud Server

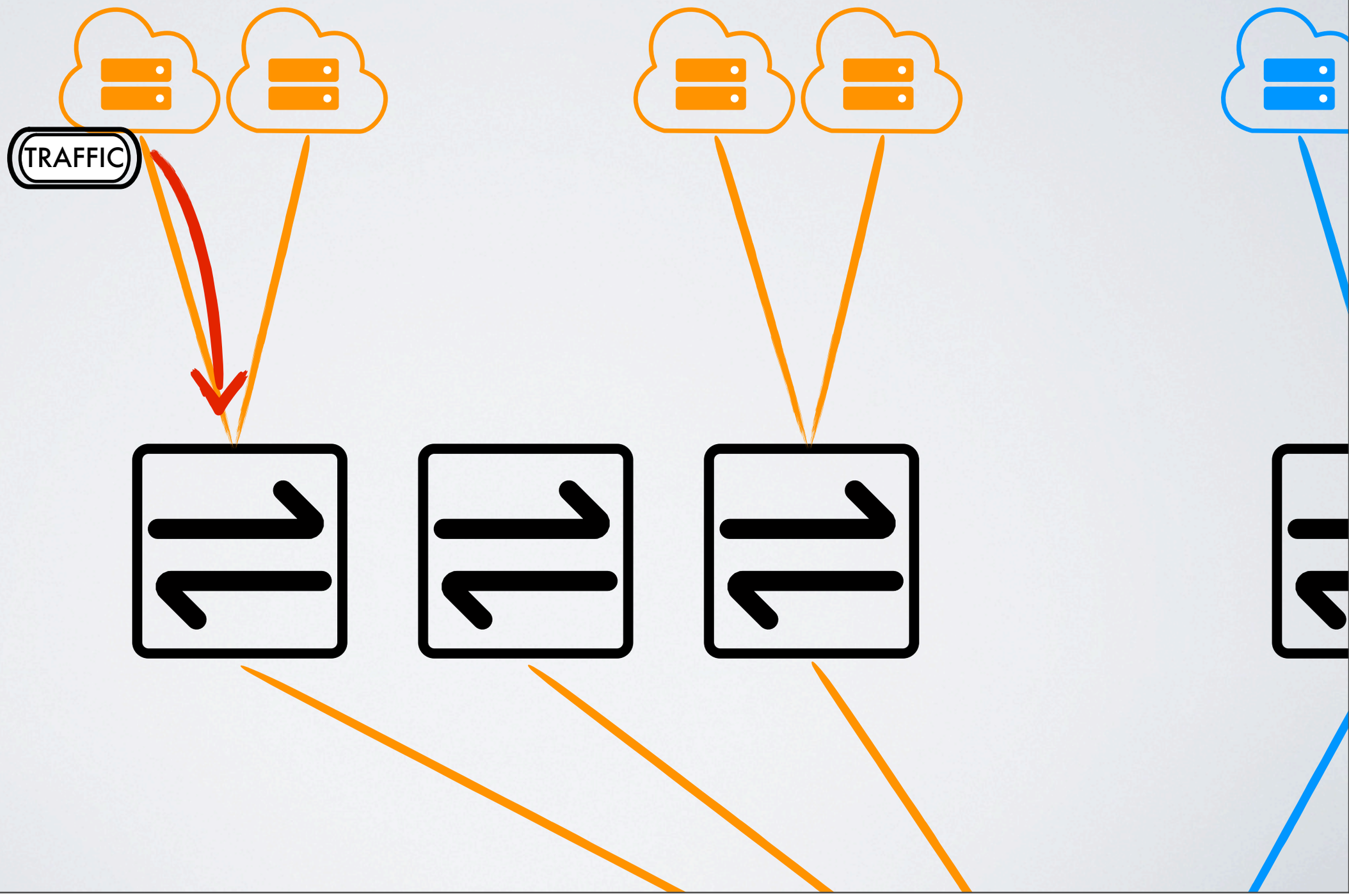


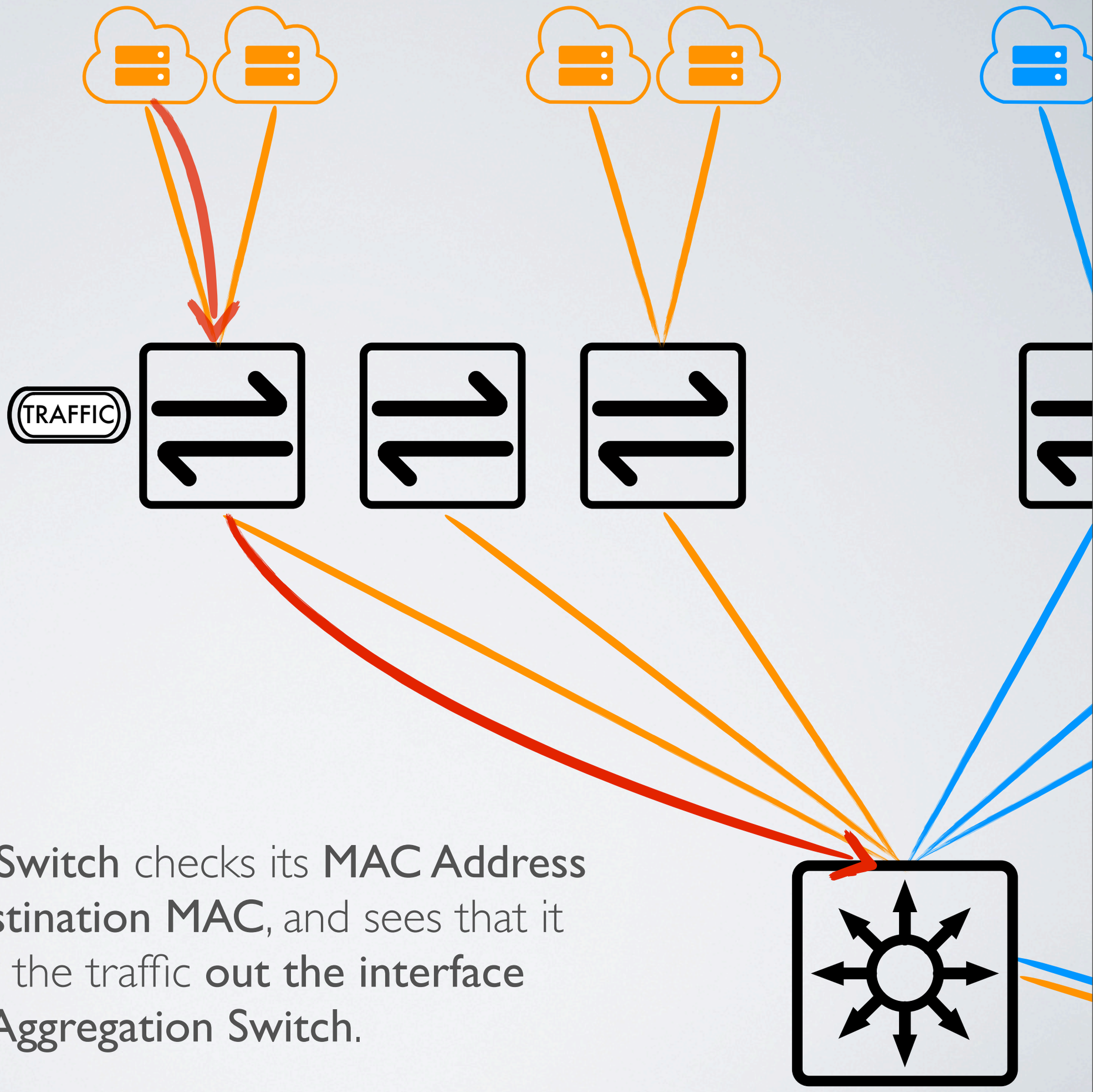
Has the Cloud Server made an **IP routing decision** (L3) or will it **forward based on MAC Address** (L2)?

Traffic will be forwarded based on **MAC Address** only since the **destination IP is within the same subnet**.

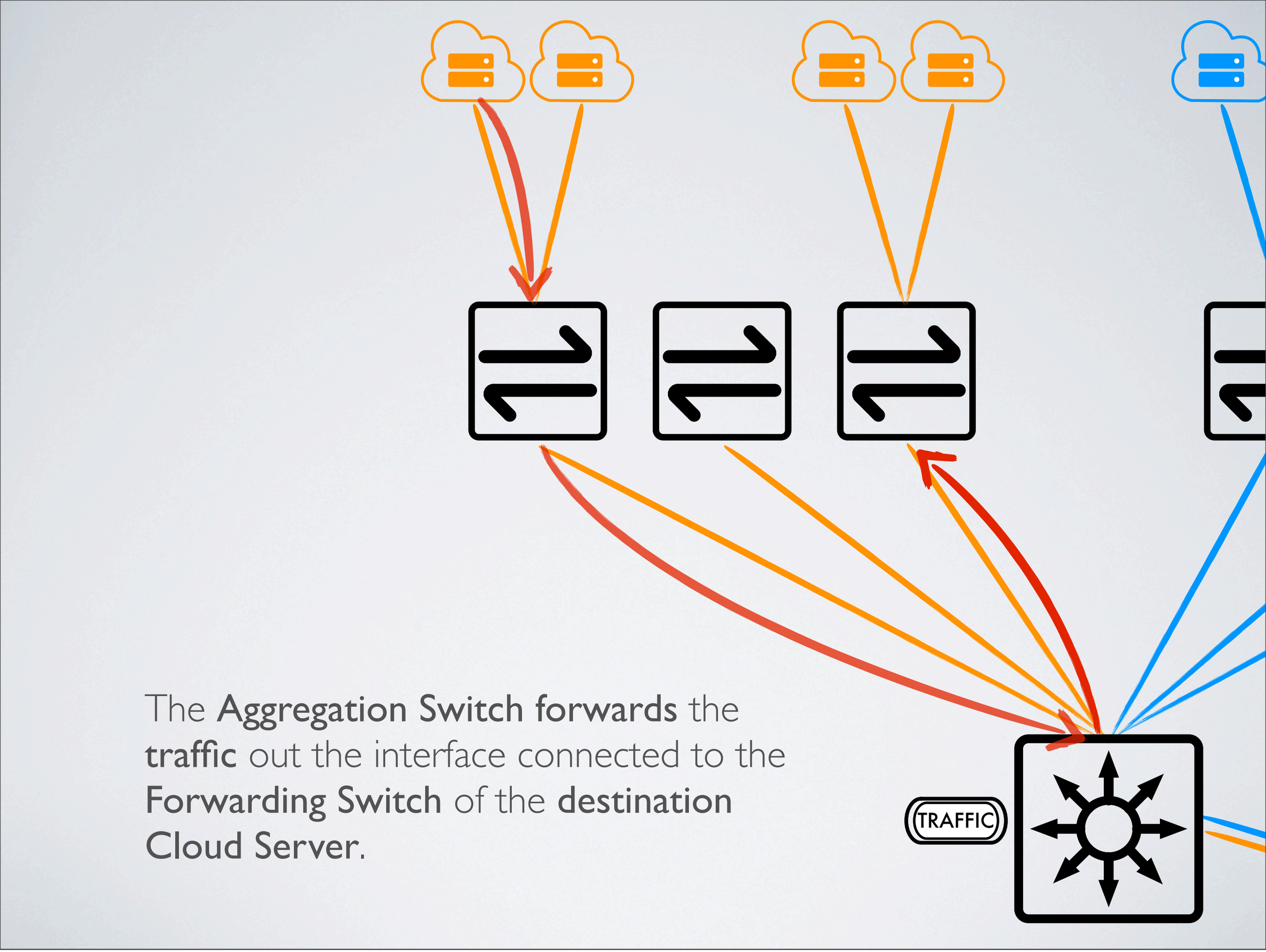


The traffic is passed to the Hypervisor's directly connected **Forwarding Switch**.

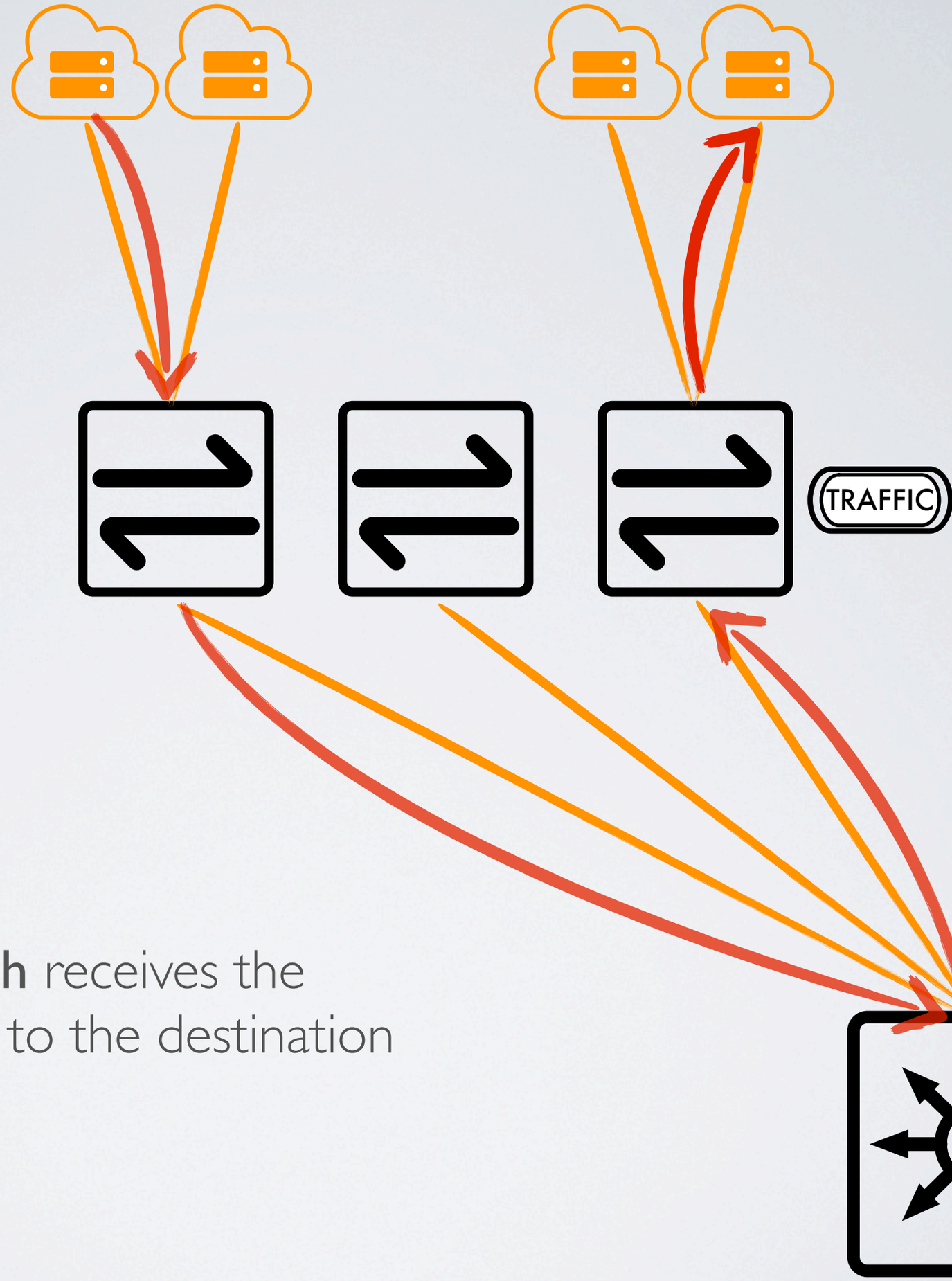




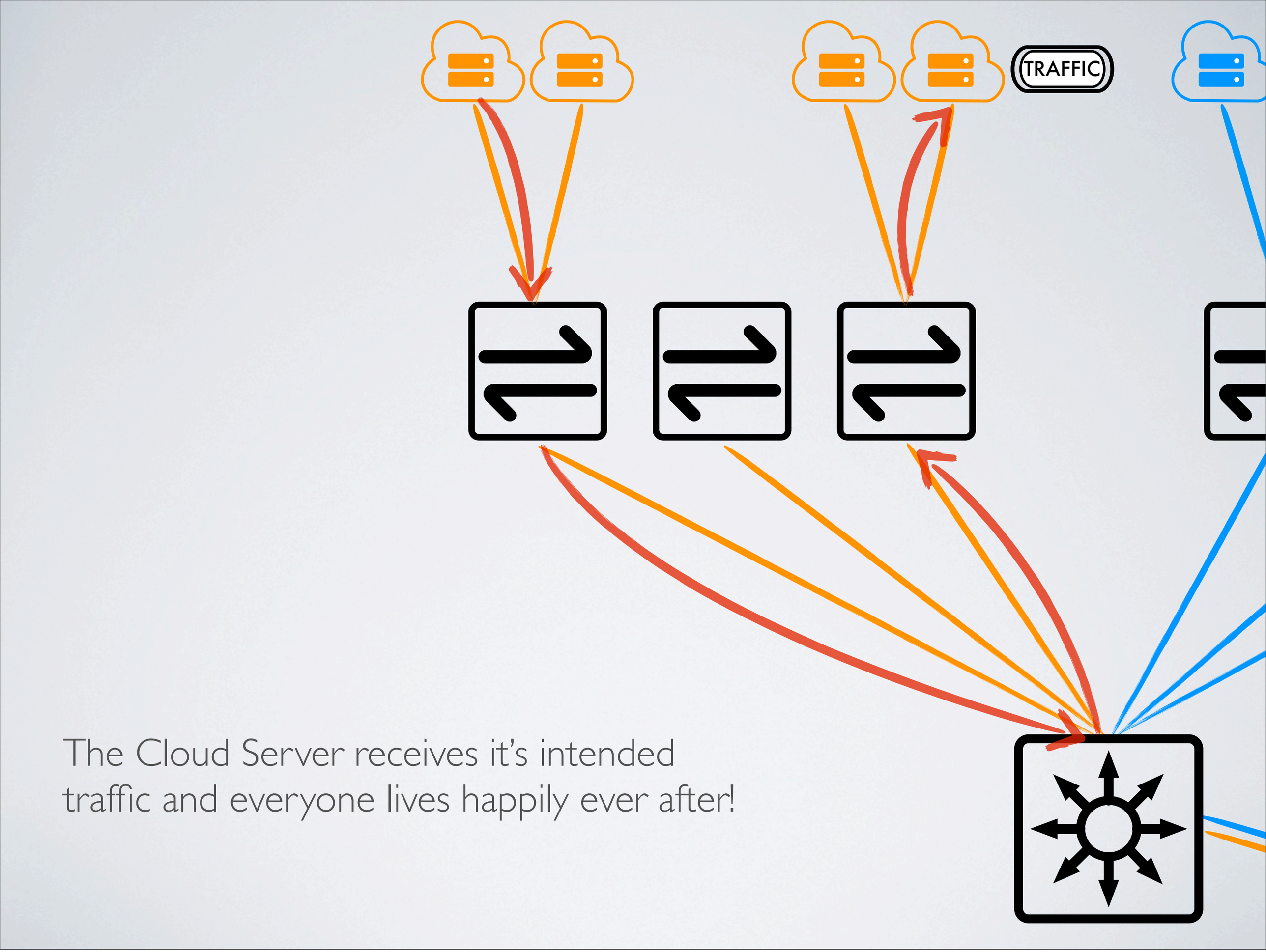

The **Forwarding Switch** checks its **MAC Address Table** for the **Destination MAC**, and sees that it needs to forward the traffic **out the interface that goes to it's Aggregation Switch**.



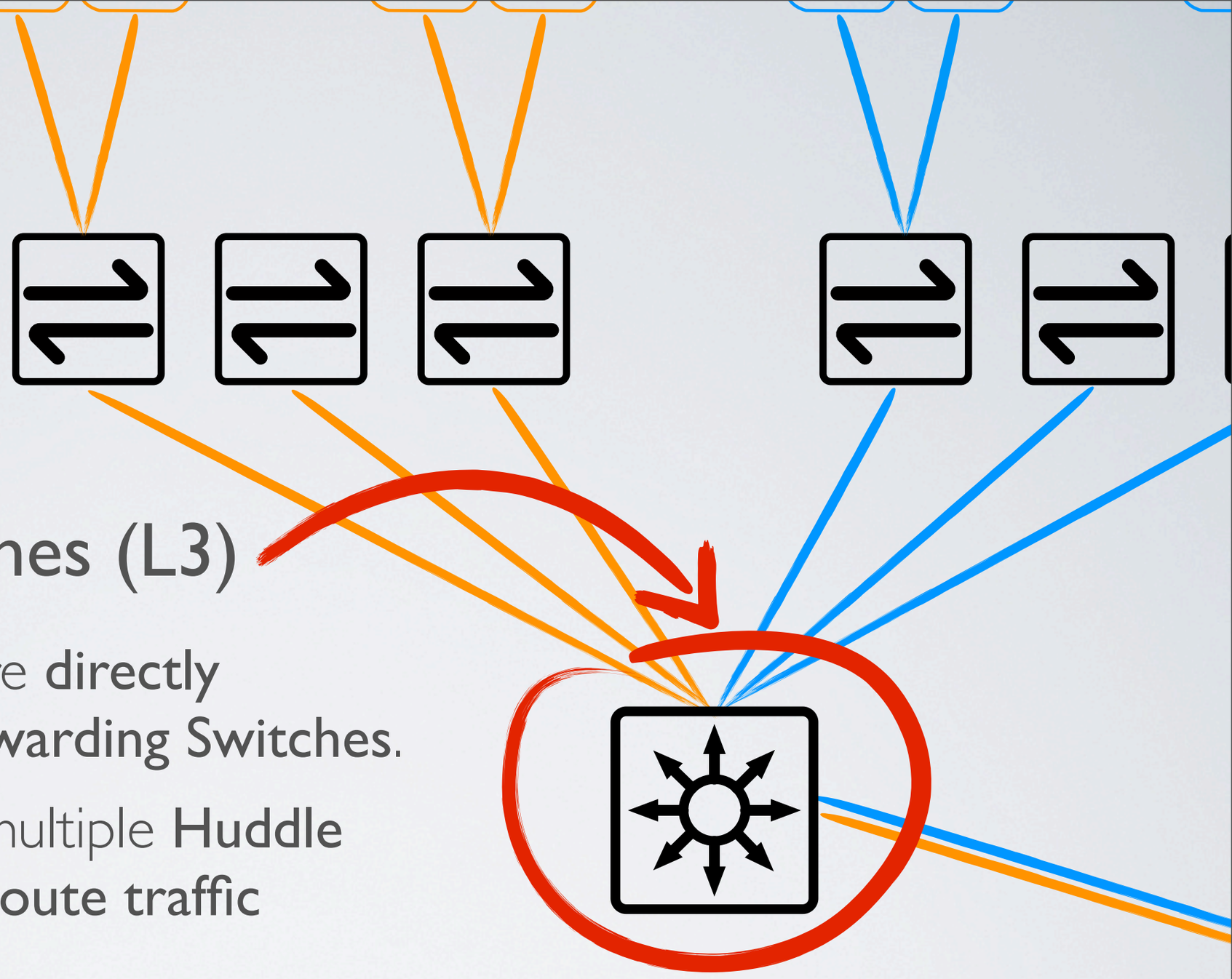

The **Aggregation Switch forwards** the **traffic** out the interface connected to the **Forwarding Switch** of the **destination** Cloud Server.




The **Forwarding Switch** receives the **traffic** and **forwards** it to the destination **Cloud Server**.




The Cloud Server receives it's intended traffic and everyone lives happily ever after!



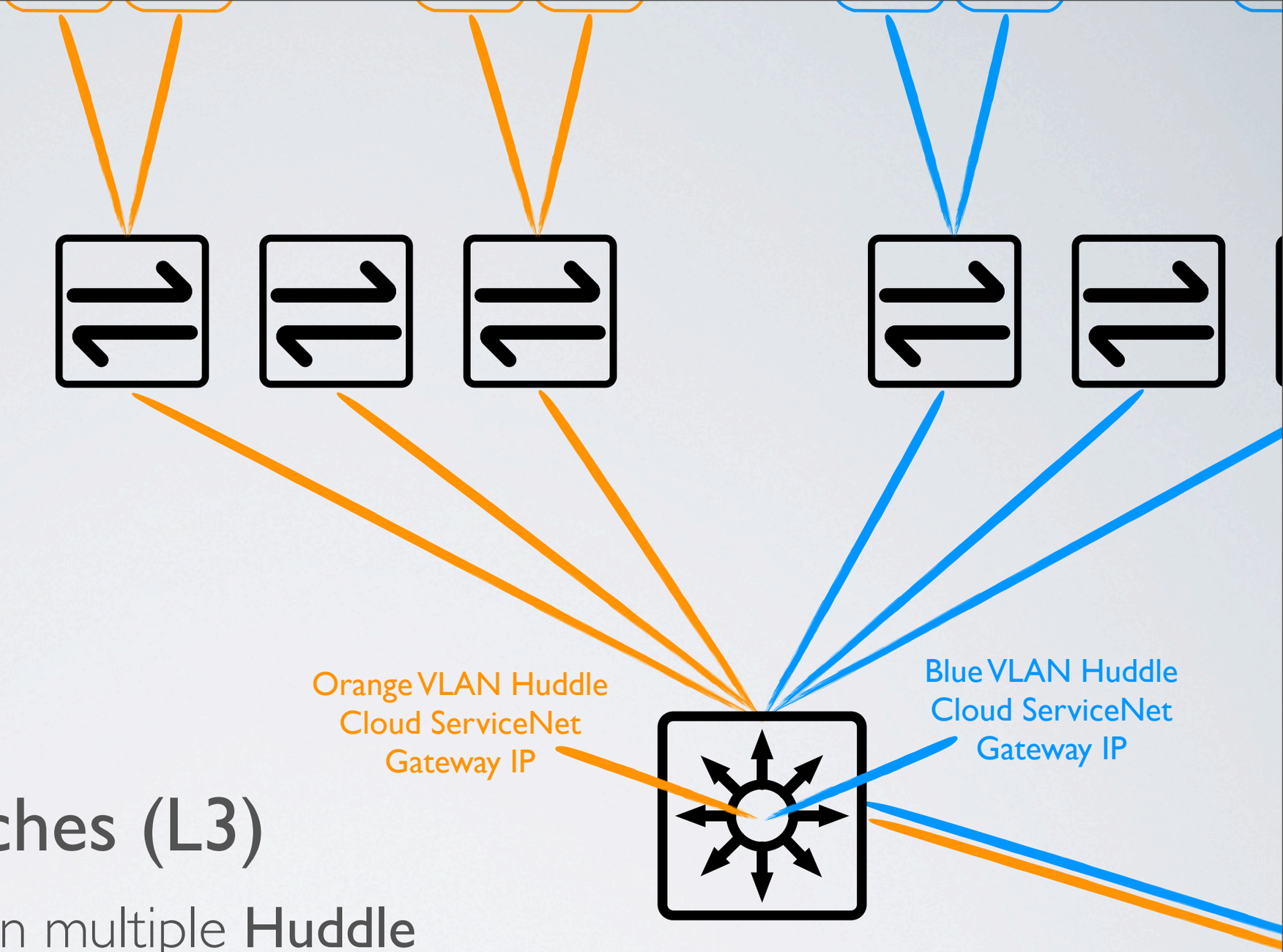
# Aggregation Switches (L3)

Aggregation Switches are **directly connected** to many **Forwarding Switches**.

These switches contain multiple **Huddle VLANs** and are able to **route traffic between Huddles**.

Each **Huddle VLAN** has it's own **Gateway IP.**

When a RackConnected **Cloud Server** makes it's **initial routing decision** for **Cloud to Cloud traffic**, because the **destination IP** is **within** the **Cloud ServiceNet IP space** (**10.176.0.0/12 or /13**), it will use the **next hop** of the **Huddle Gateway IP.**




# Aggregation Switches (L3)

These switches contain multiple **Huddle VLANs** and are able to **route traffic between Huddles**.

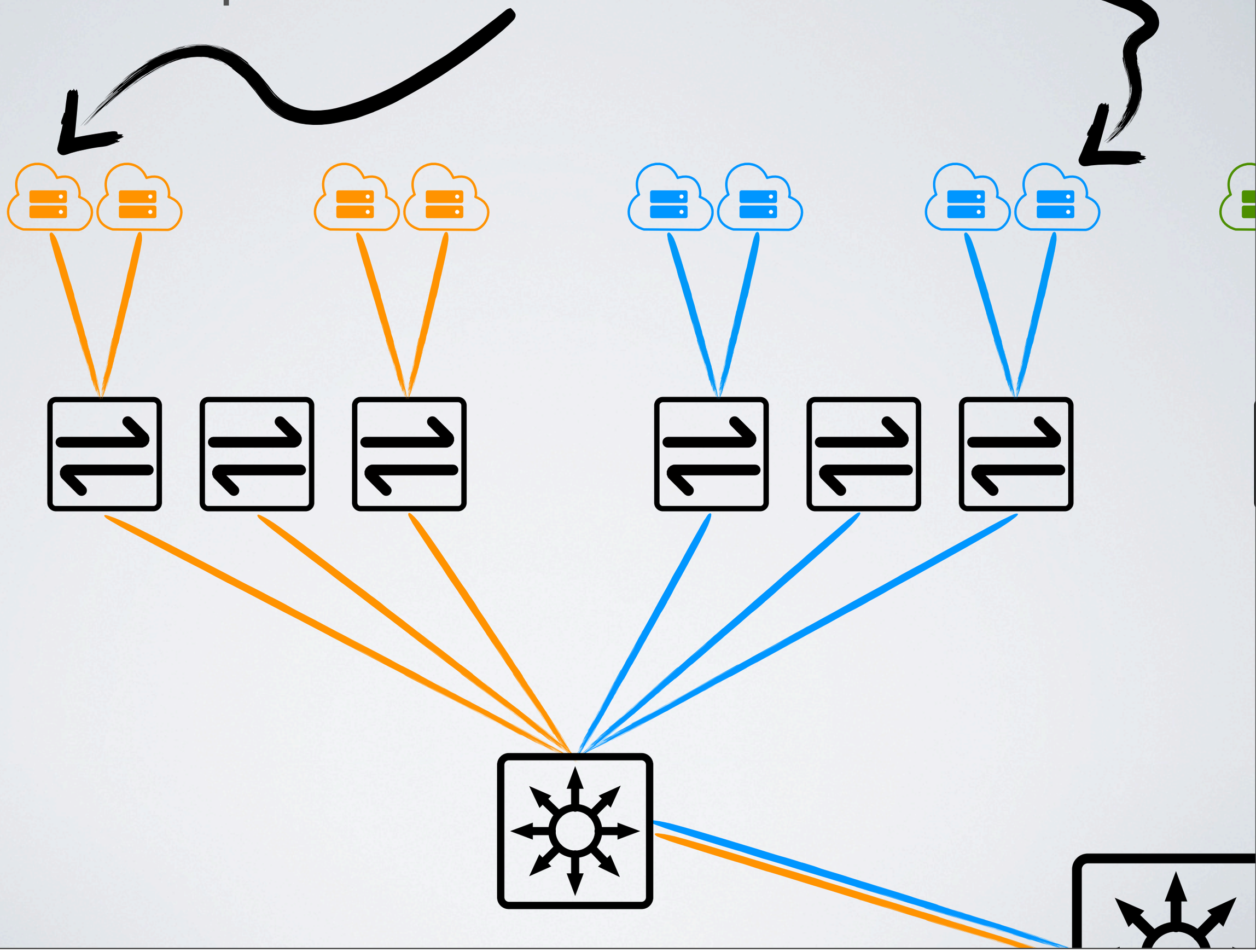
Each **Huddle VLAN** has it's own **Gateway IP.**

This **Gateway IP** acts as the **Huddle/Cell Cloud ServiceNet Gateway IP.**

(aka Orange 1)

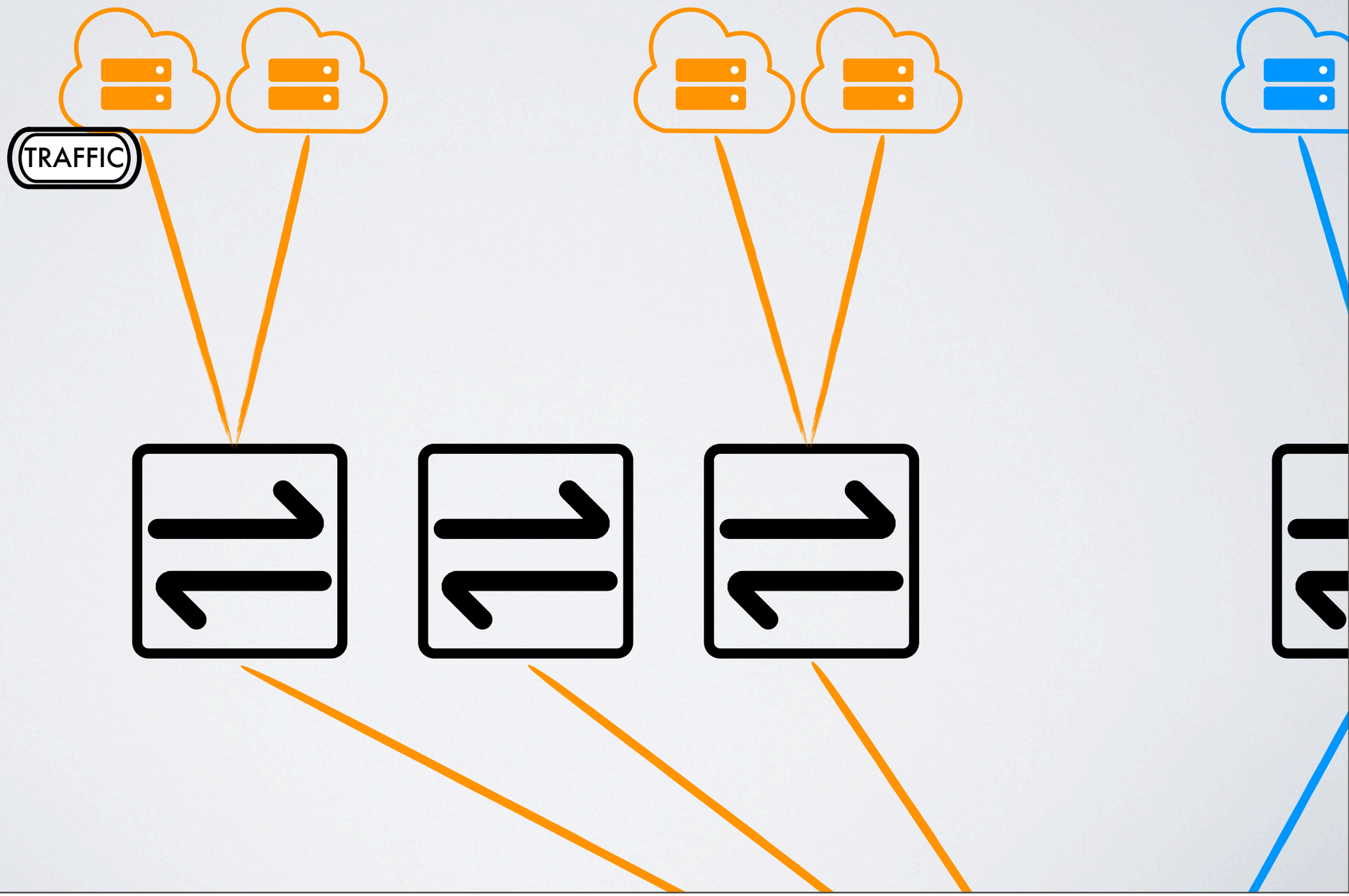
(aka Blue 4)

**For Example:** This Cloud Server wants to reach this one.



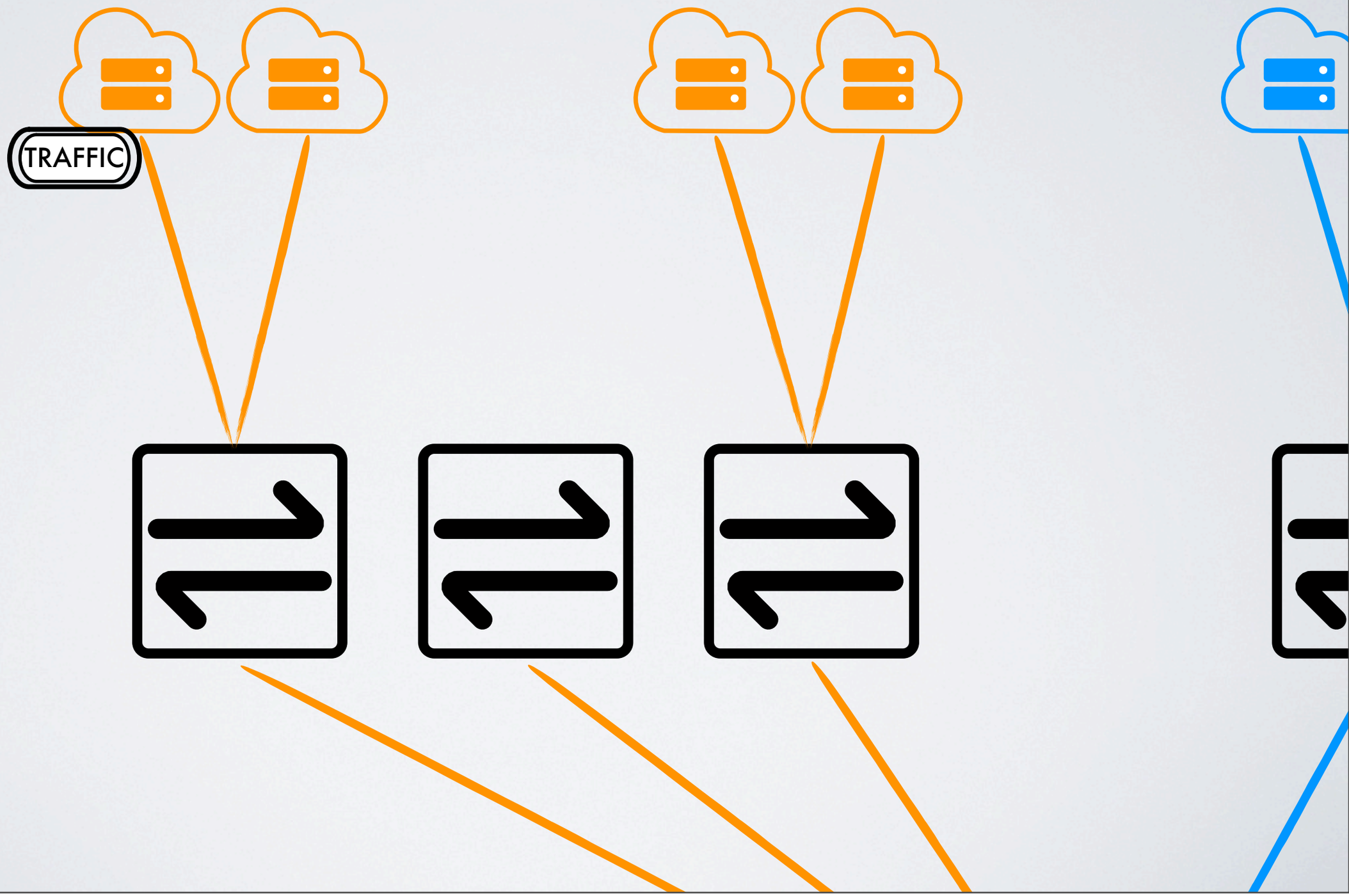
Has the Cloud Server made an **IP routing decision** (L3) or will it **forward based on MAC Address** (L2)?

The Cloud Server made an **IP routing decision** (L3)!

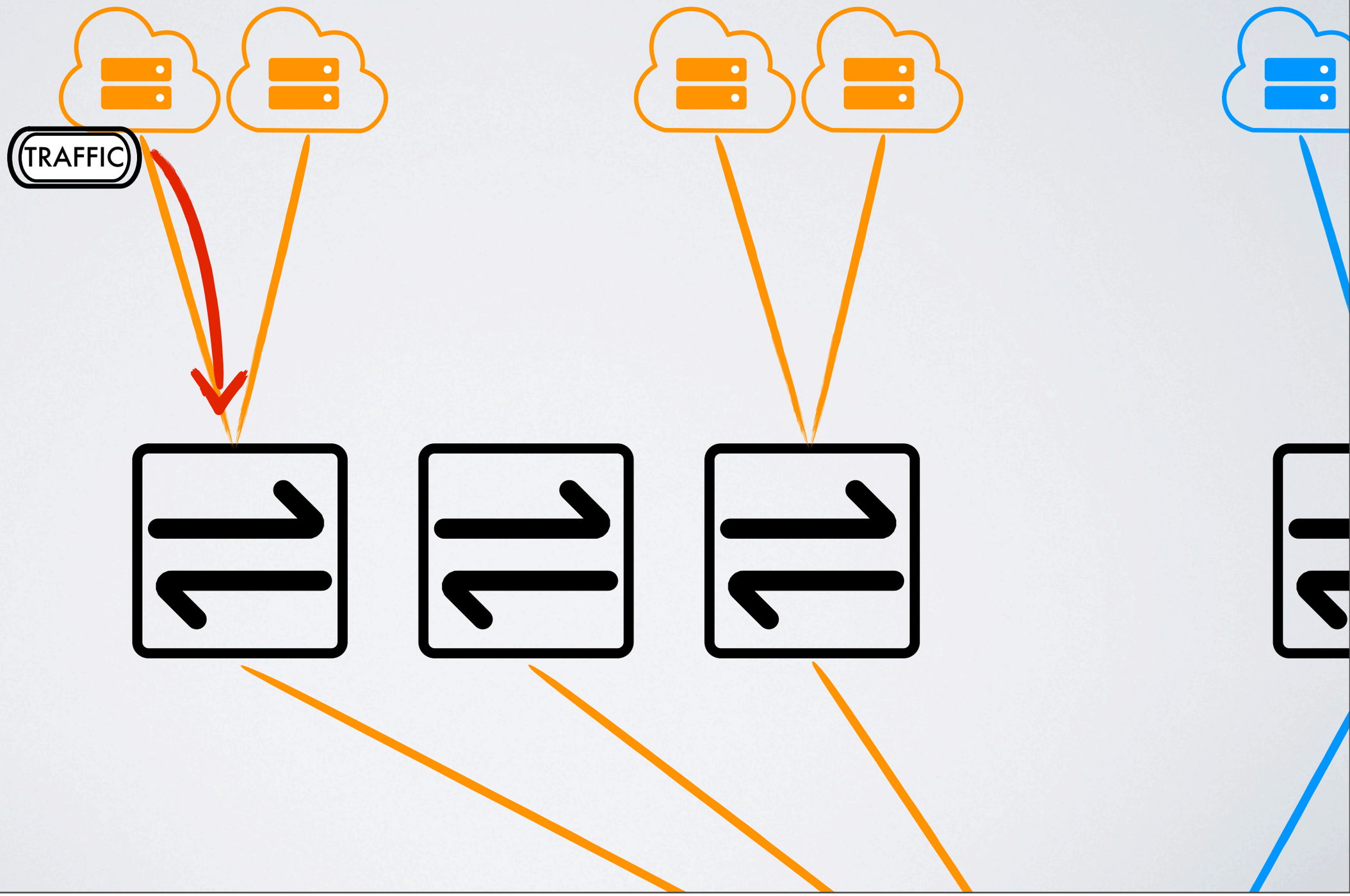


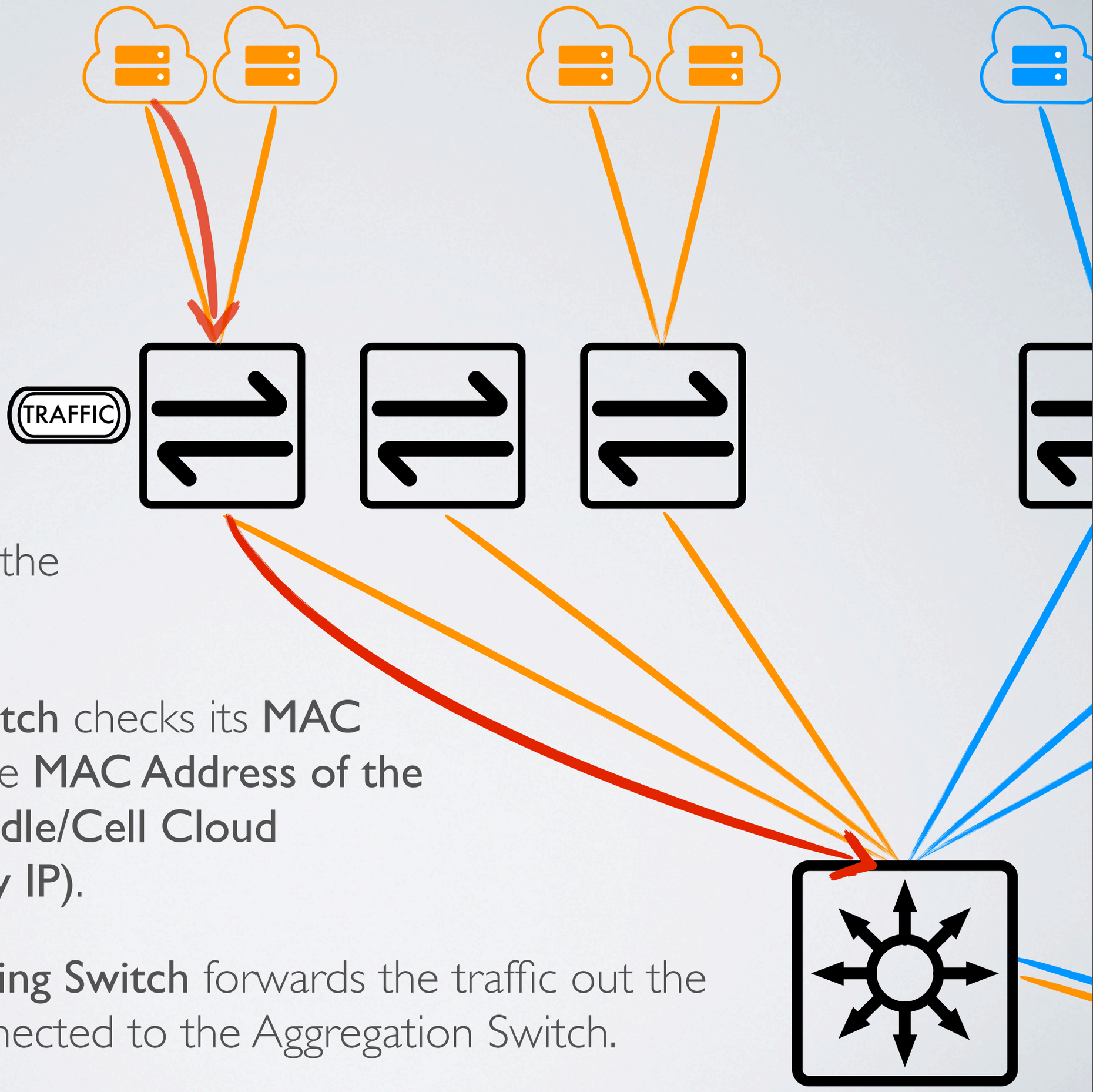
(aka Blue 4)

Traffic is destined for an IP outside of Orange VLAN's subnet and it will forward traffic to the Next-Hop IP Address of it's local subnet's **Cloud ServiceNet Gateway IP.**



**Traffic** must be forwarded to the Huddle/Cell (local subnet) **Cloud ServiceNet Gateway IP**, and is passed from the **Cloud Server** to the **Forwarding Switch.**

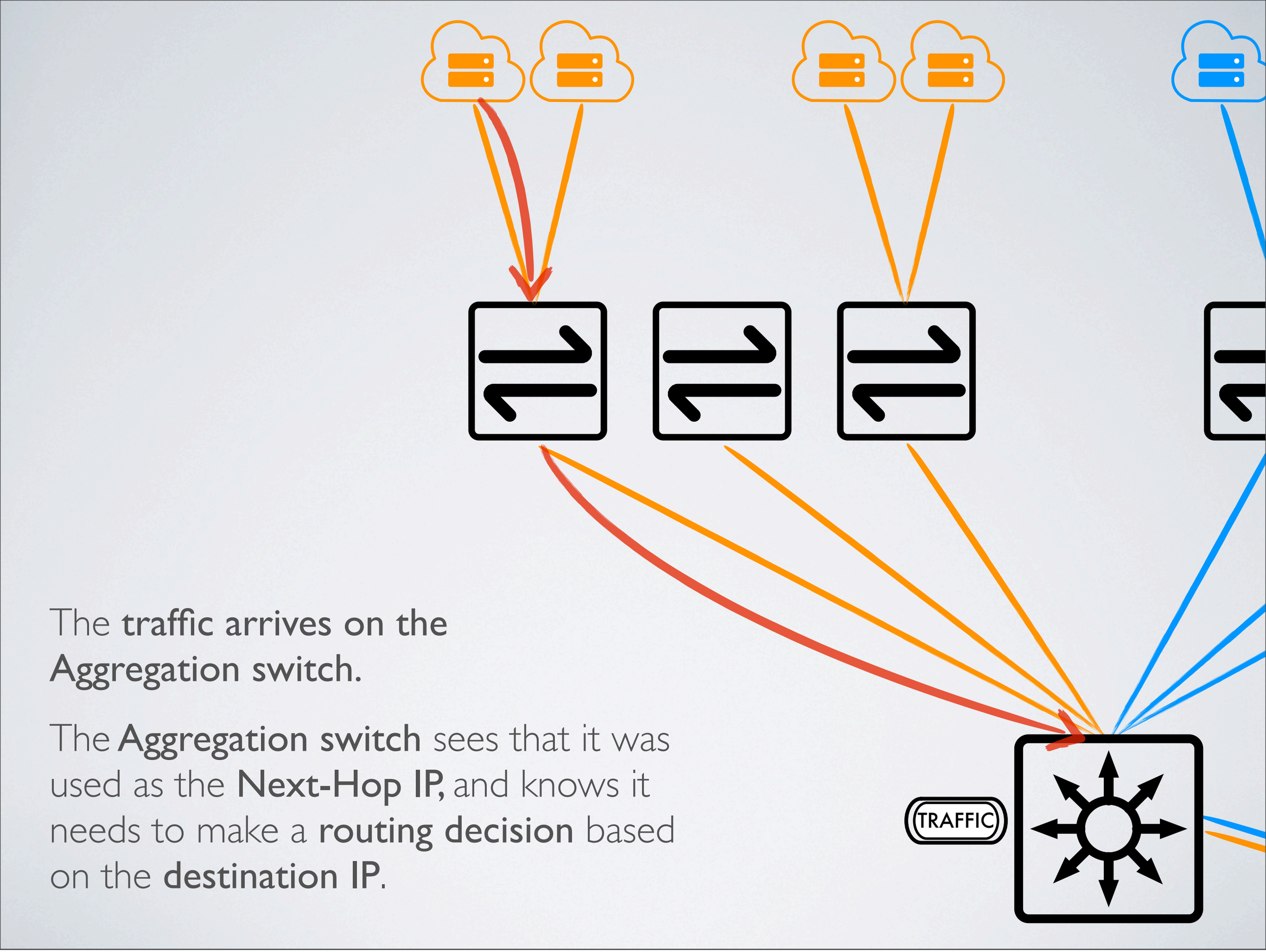





Traffic is received at the Forwarding Switch.

The **Forwarding Switch** checks its **MAC Address Table** for the **MAC Address of the Next-Hop** (the **Huddle/Cell Cloud ServiceNet Gateway IP**).

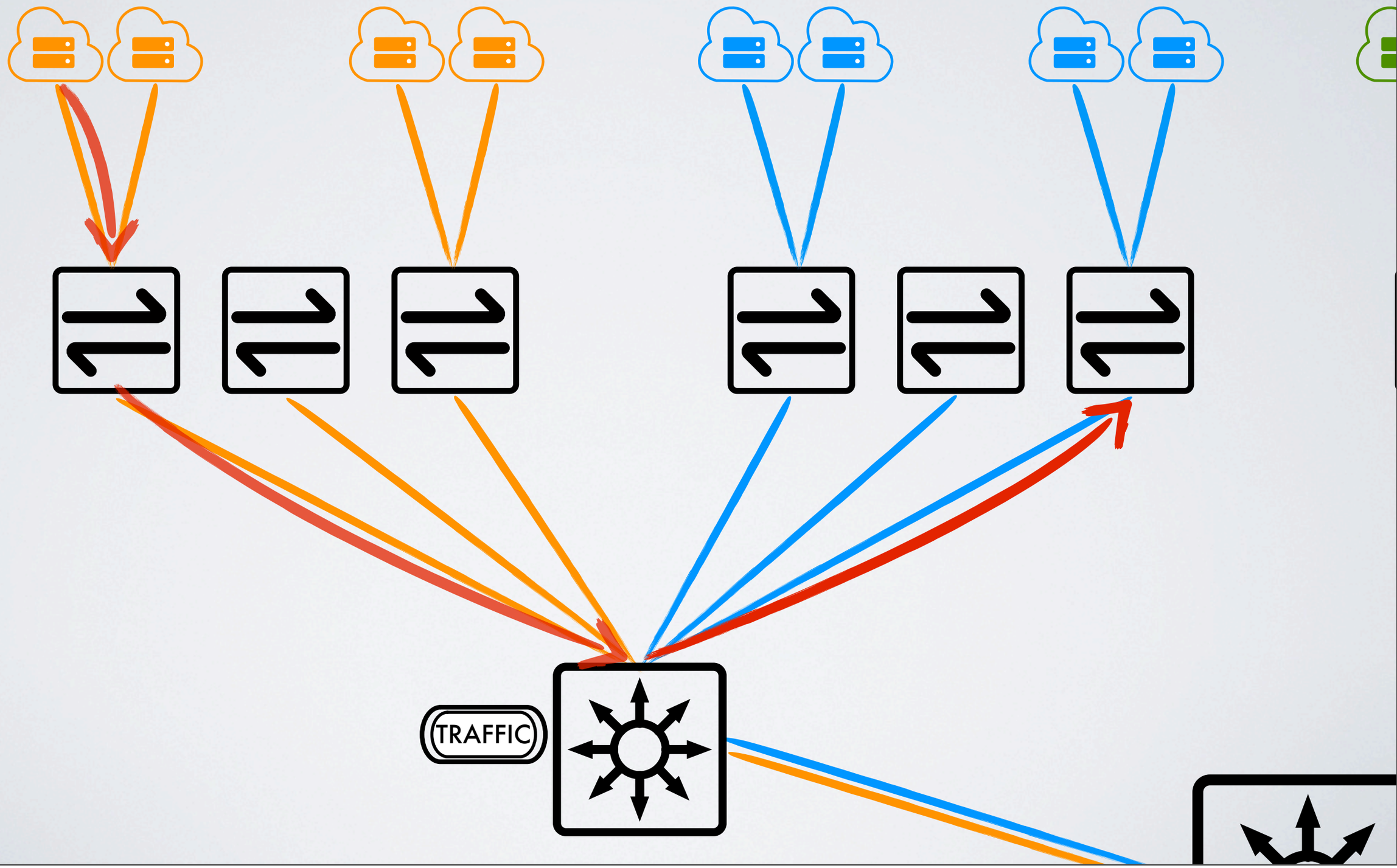
The **Forwarding Switch** forwards the traffic out the interface connected to the Aggregation Switch.



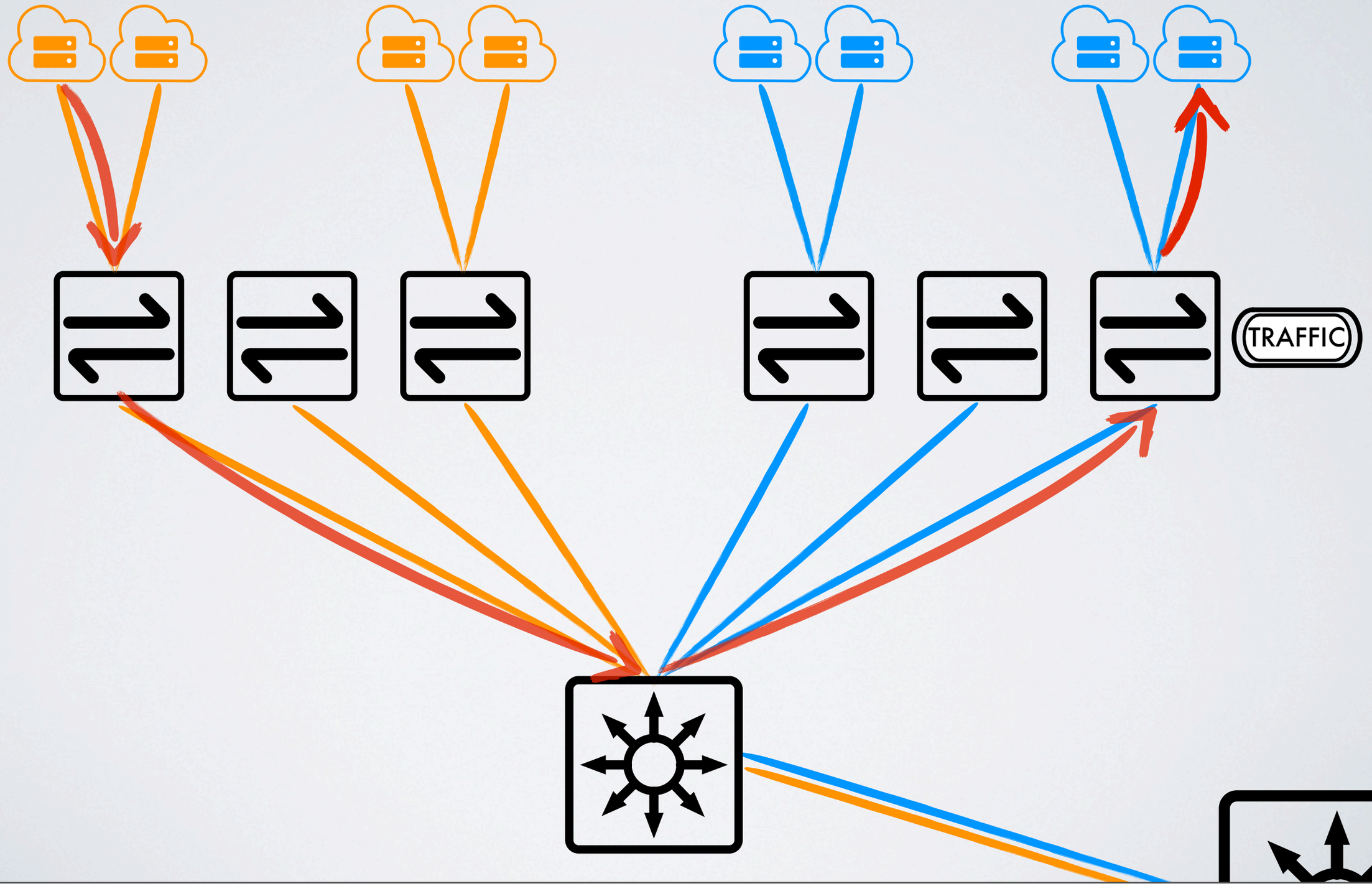

The **traffic arrives on the Aggregation switch.**

The **Aggregation switch** sees that it was used as the **Next-Hop IP,** and knows it needs to make a **routing decision** based on the **destination IP**.

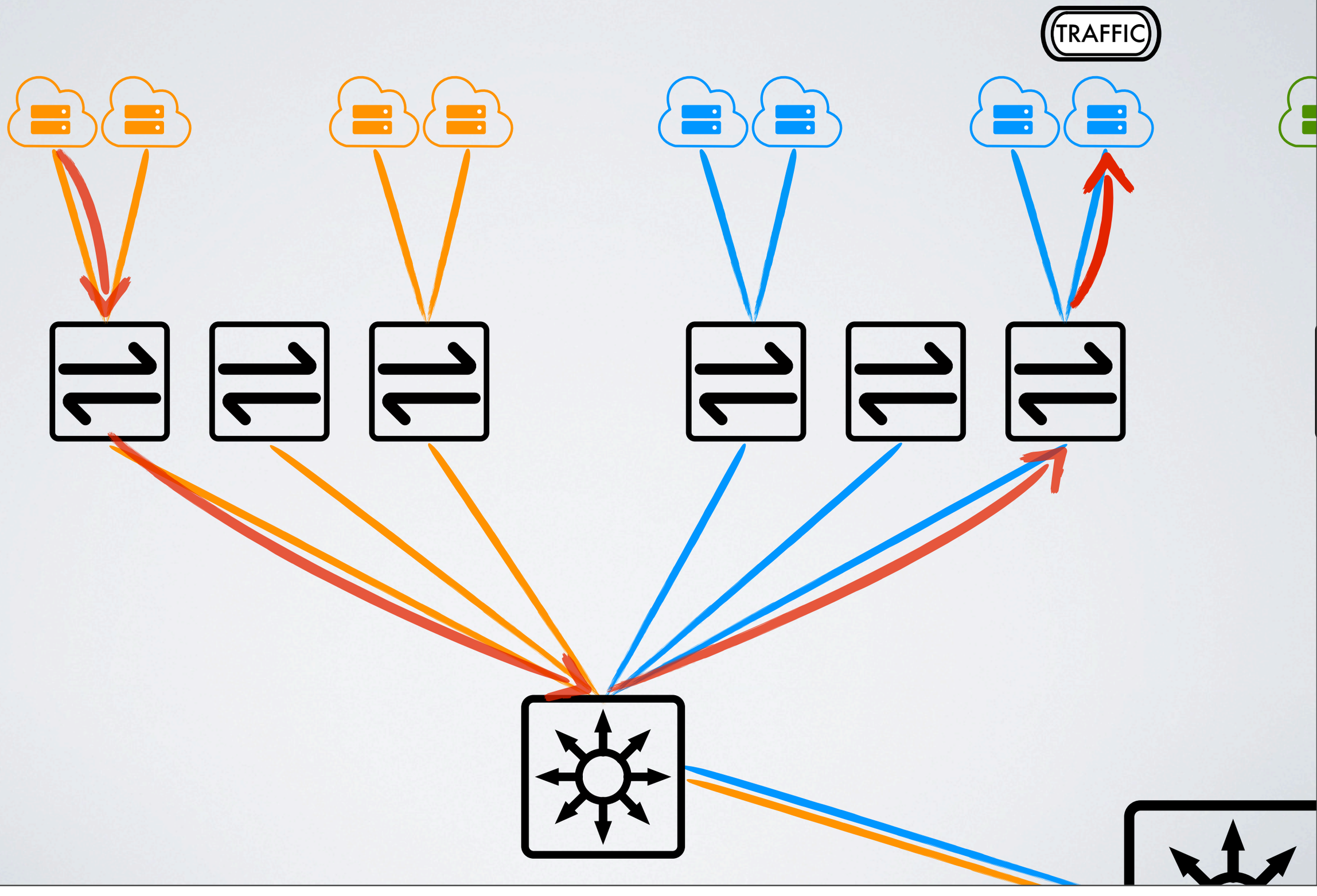
Based on existing routes, the **Aggregation Switch** places the traffic onto the Destination **(Blue) VLAN**, and forwards the traffic to the **Forwarding Switch** of the destination **Cloud Server**.

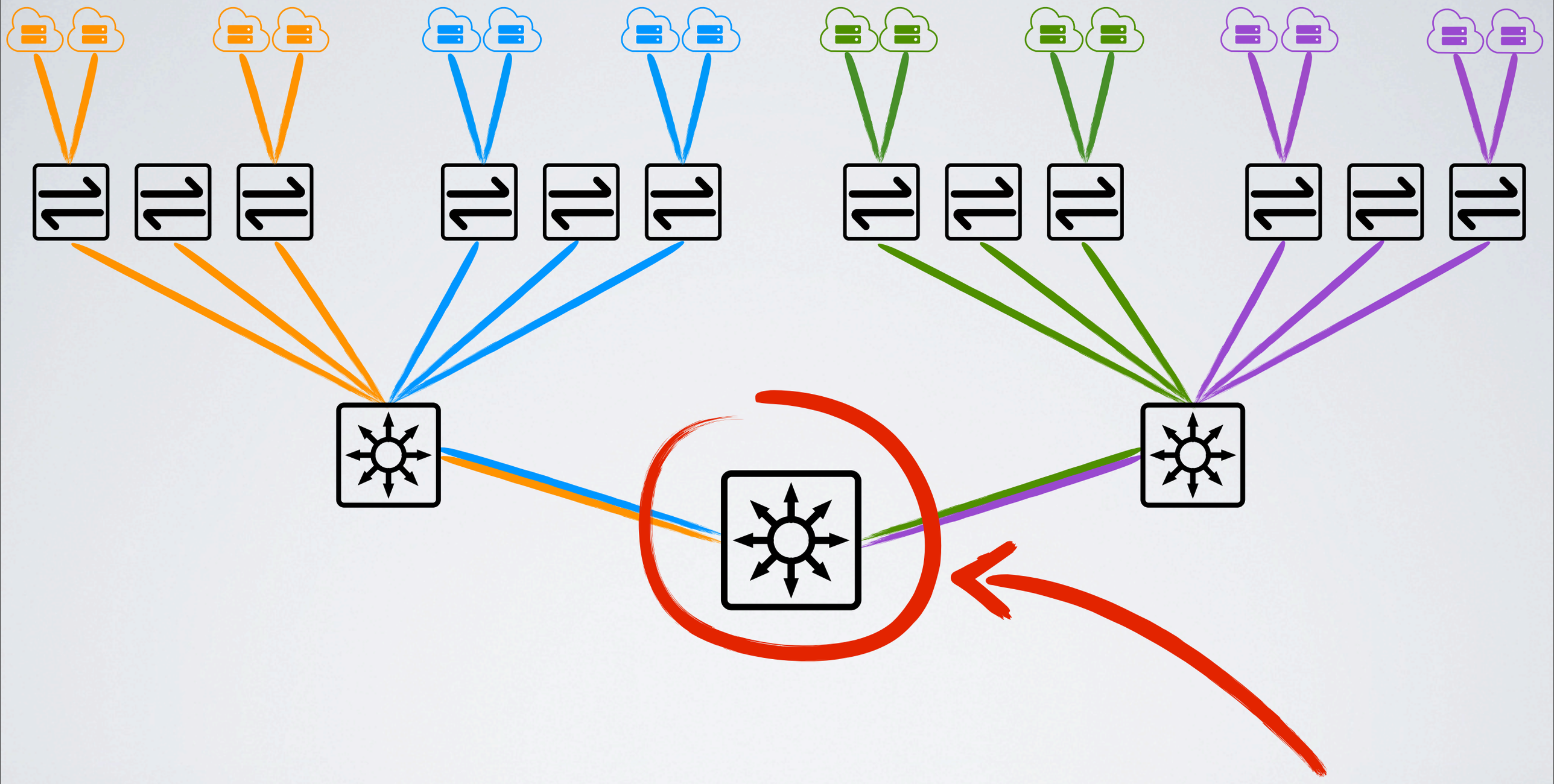


The **Forwarding Switch** receives the **traffic** and **forwards** it to the destination **Cloud Server**.



The traffic is received at the destination **Cloud Server**, and everyone lives happily ever after!



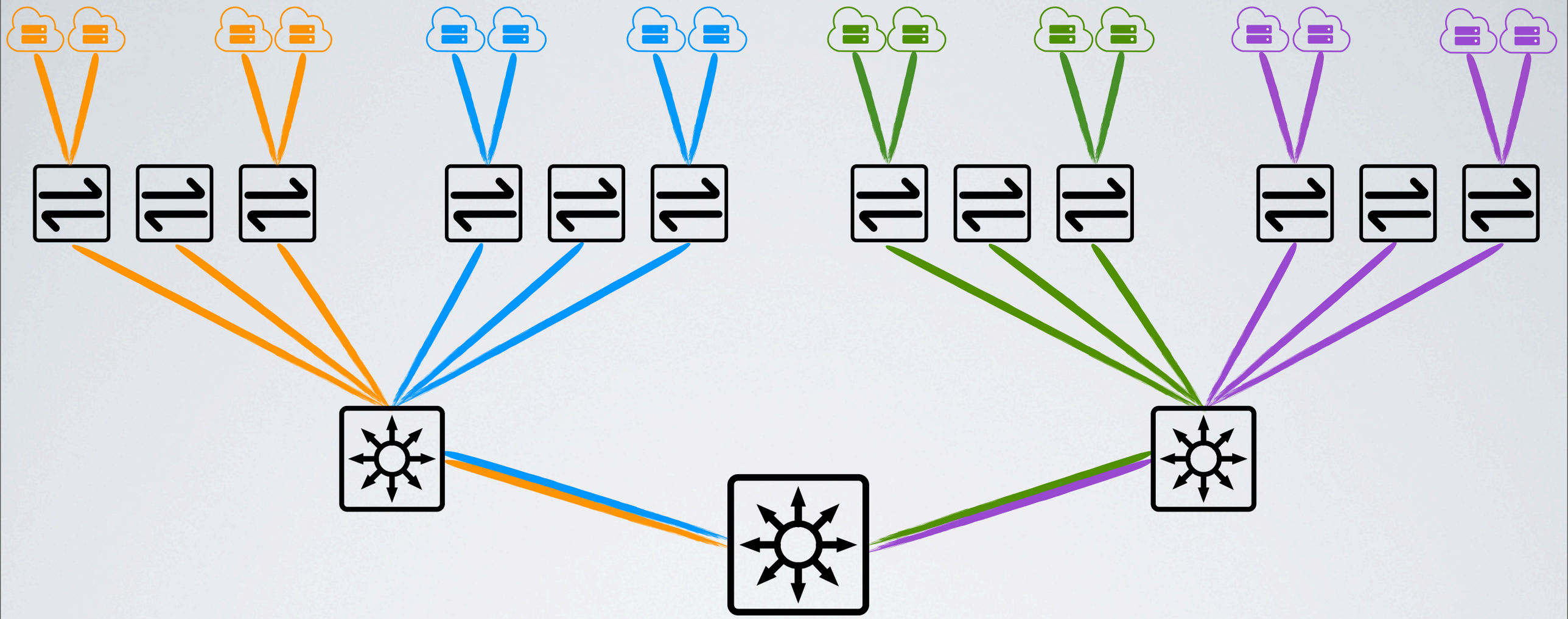


All **Aggregation Switches** connect to the same **Core ServiceNet Router**.

The **Core ServiceNet Router** is capable of both Forwarding and IP routing.

**ALL Huddle VLANs reside on** the **Core ServiceNet Router**.

**Aggregation Switches** only have a portion of the total **Huddle VLANs** for Cloud ServiceNet (in order to split up the work!).

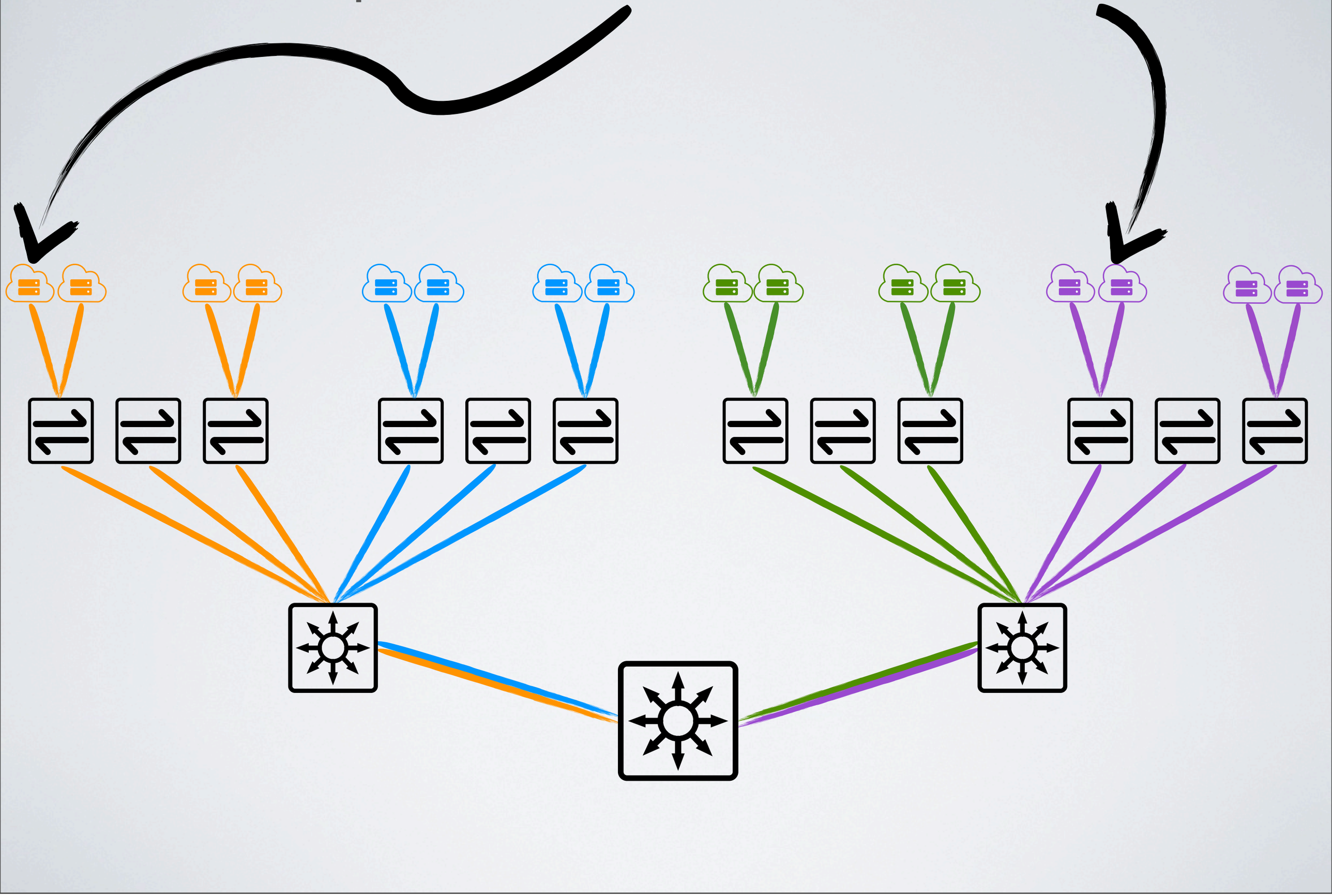


If a **Cloud Server** sends traffic to a **destination Cloud Server** that resides on a different **Huddle VLAN** that **does NOT reside** on its **Aggregation Switch**, the **traffic** will be **forwarded** to the **Core ServiceNet Router**.

(aka Orange 1)

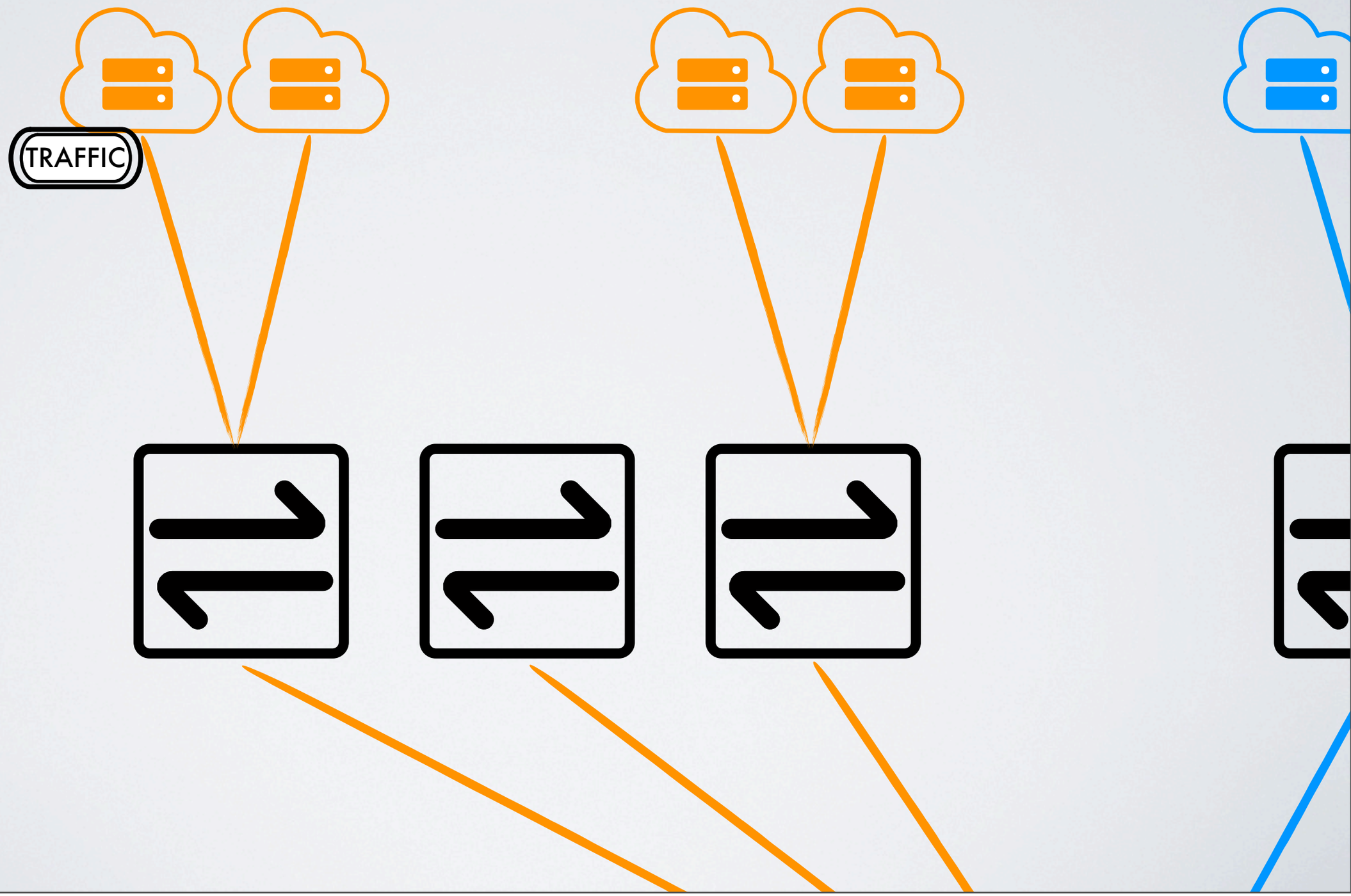
(aka Purple 2)

**For Example:** This Cloud Server wants to reach this one.



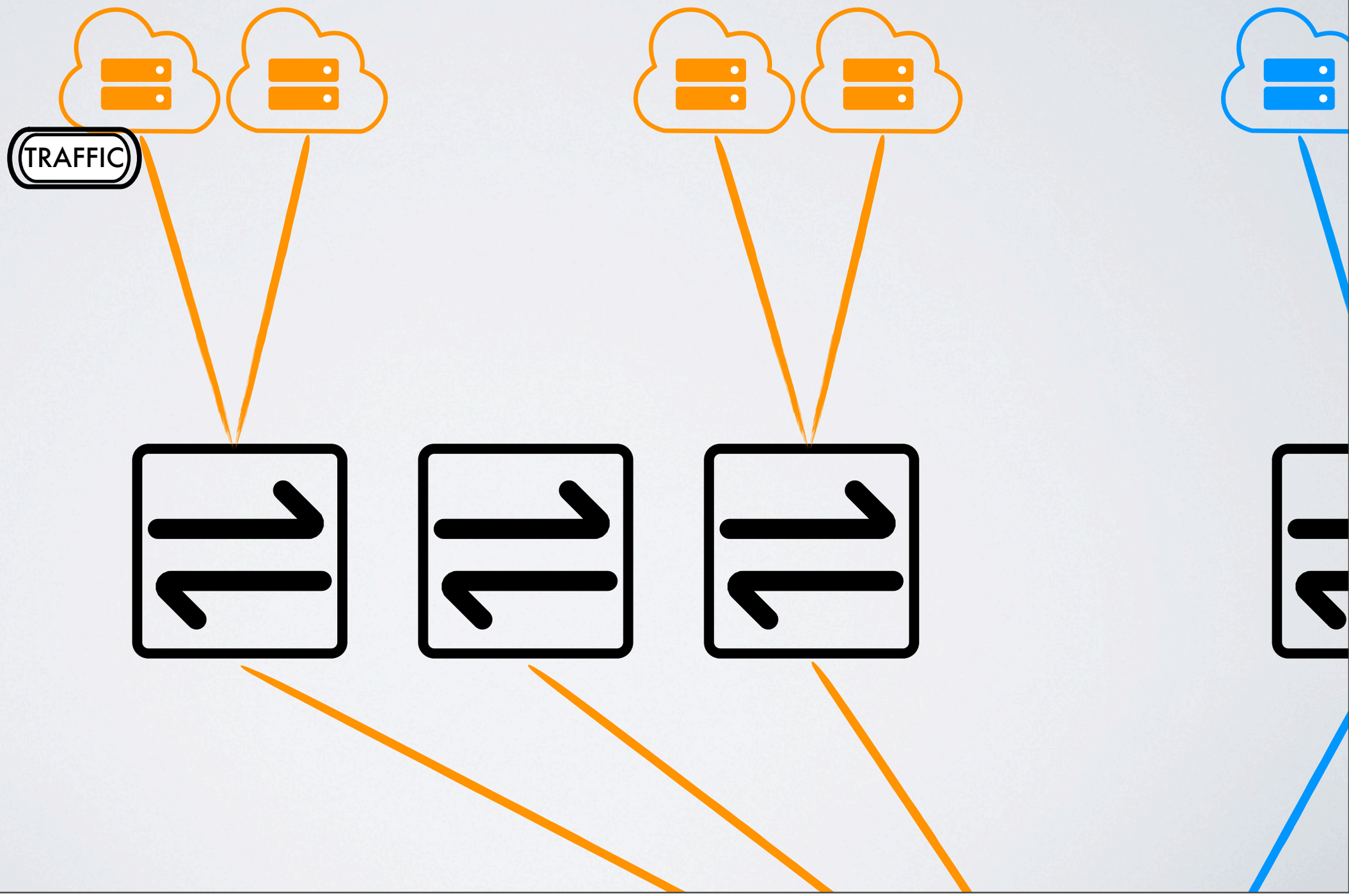
Has the Cloud Server made an **IP routing decision** (L3) or will it **forward based on MAC Address** (L2)?

The Cloud Server made an **IP routing decision** (L3)!

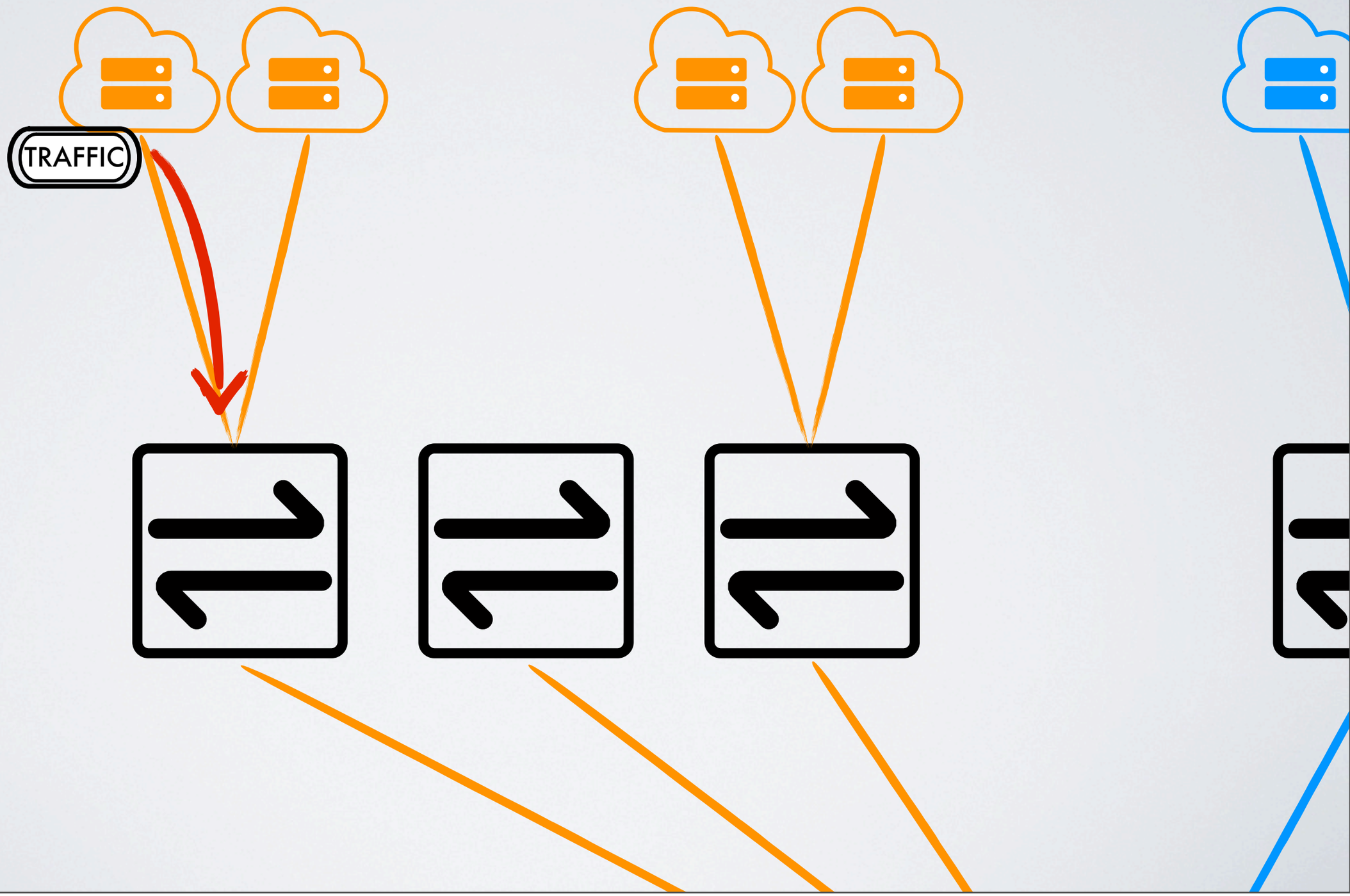


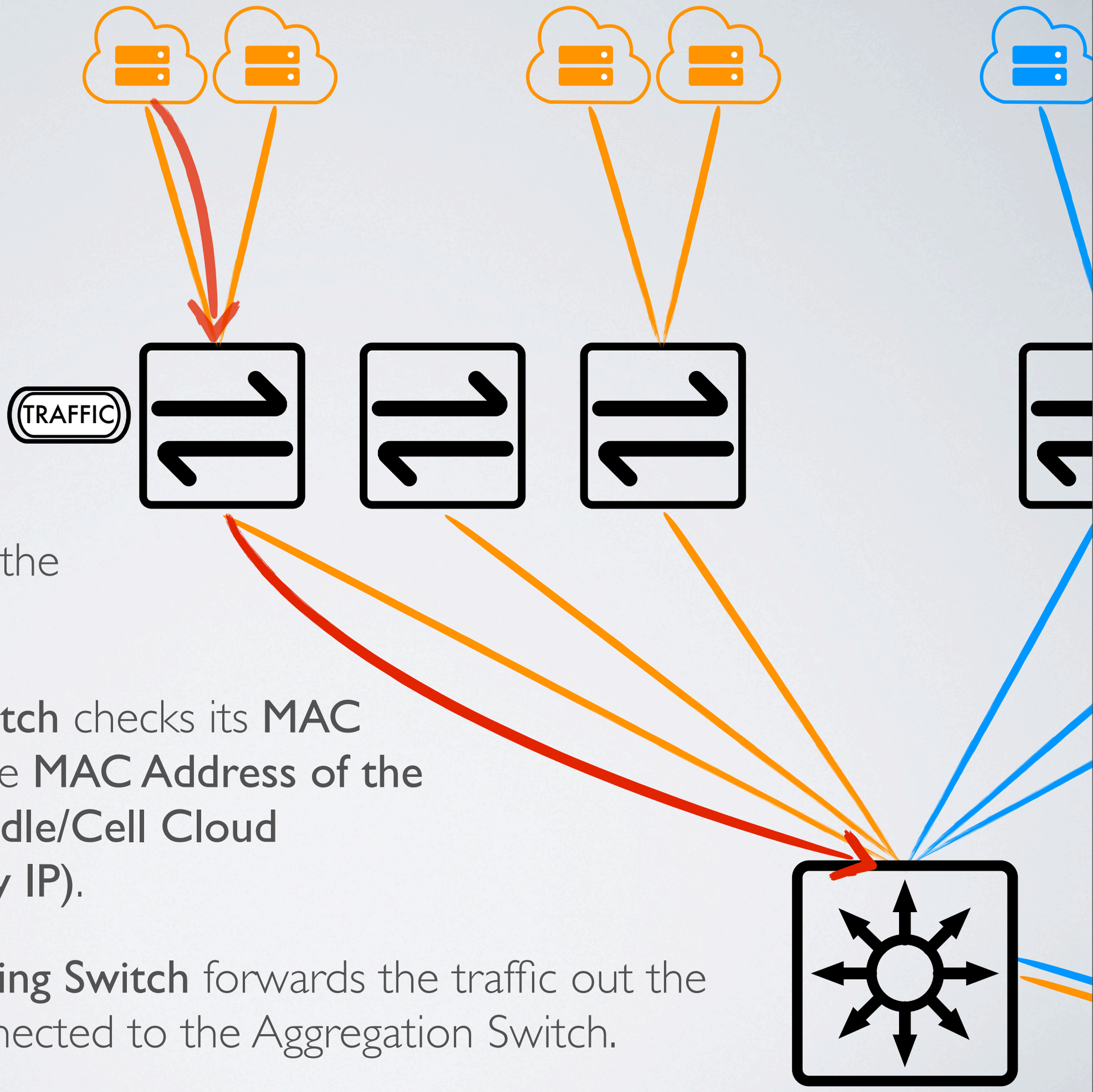
(aka Purple 2)

Traffic is destined for an IP outside of Orange VLAN's subnet and it will forward traffic to the Next-Hop IP Address of it's local subnet's **Cloud ServiceNet Gateway IP.**



**Traffic** must be forwarded to the Next-Hop IP (Huddle/Cell **Cloud ServiceNet Gateway IP)** and is passed from the **Cloud Server** to the **Forwarding Switch.**





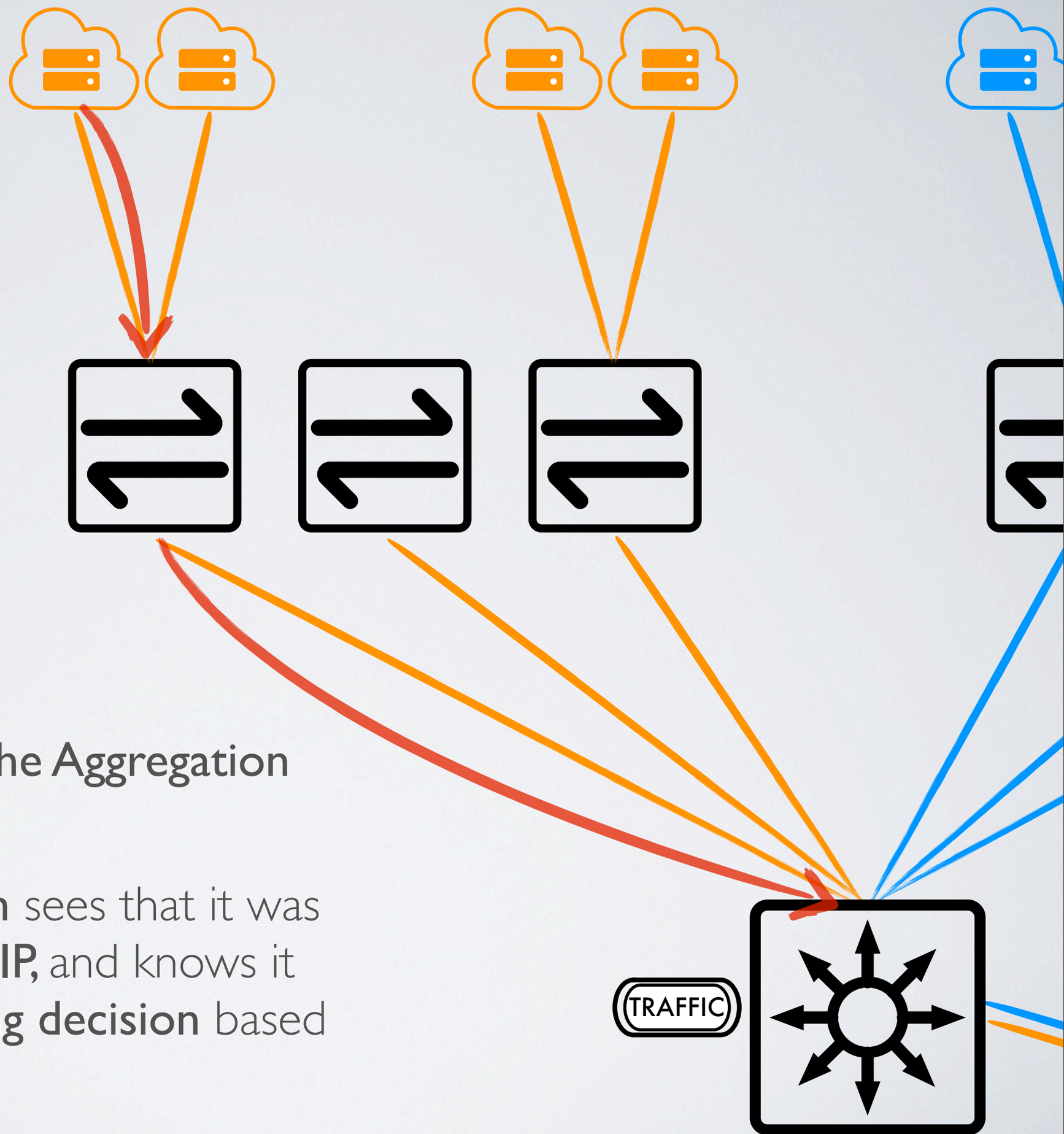

Traffic is received at the Forwarding Switch.

The **Forwarding Switch** checks its **MAC Address Table** for the **MAC Address of the Next-Hop** (the **Huddle/Cell Cloud ServiceNet Gateway IP**).

The **Forwarding Switch** forwards the traffic out the interface connected to the Aggregation Switch.

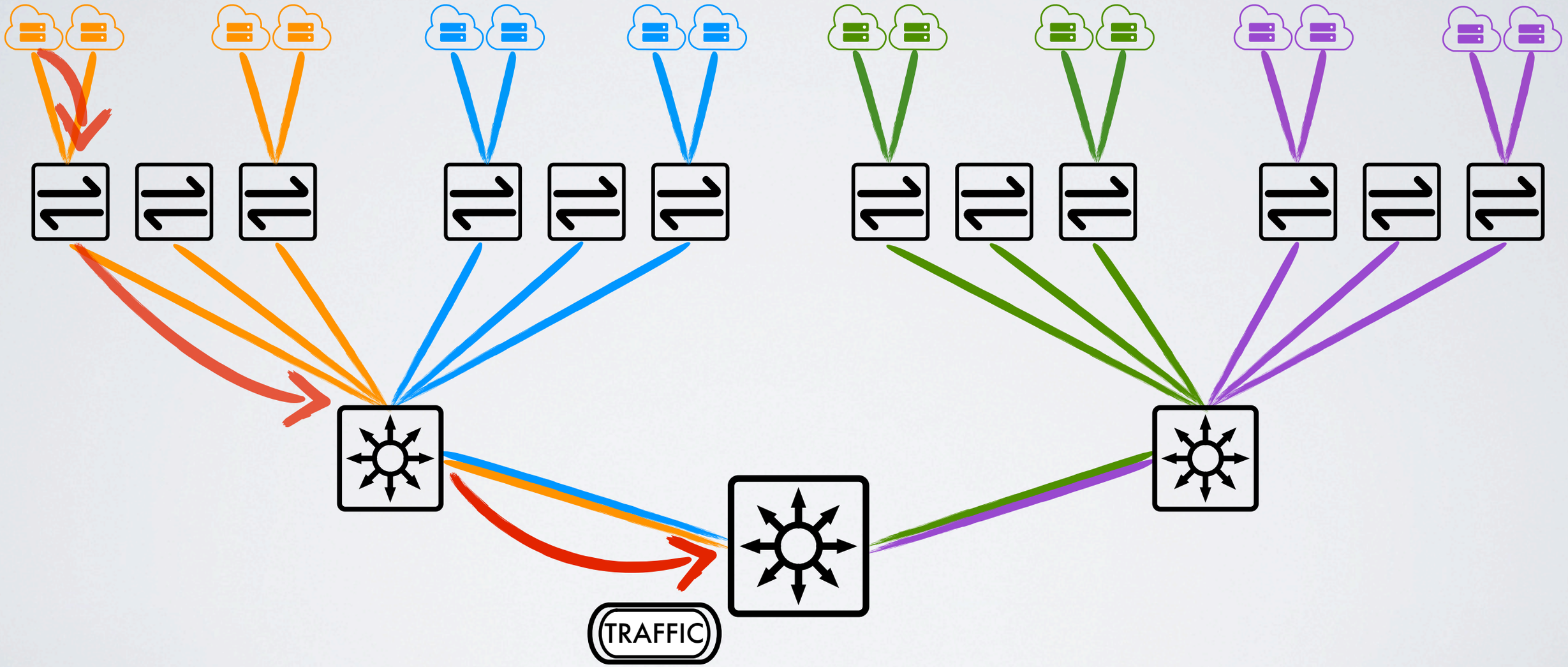
The **traffic arrives on the Aggregation switch.**

The **Aggregation switch** sees that it was used as the **Next-Hop IP,** and knows it needs to make a **routing decision** based on the **destination IP**.

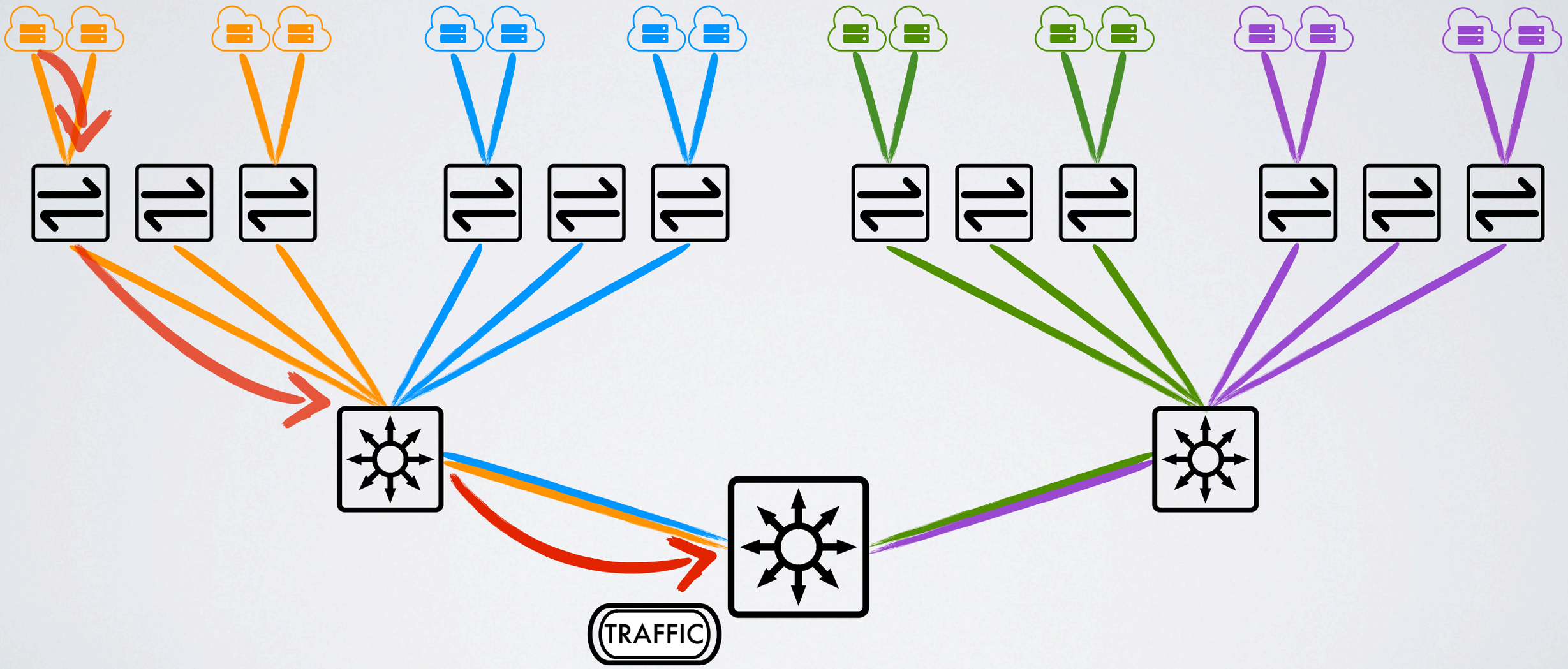


Based on existing routes, the **Aggregation Switch** forwards the traffic to the **Next-Hop IP** on the **Core ServiceNet Router**, which has a route for the **Destination (Purple VLAN) subnet**.

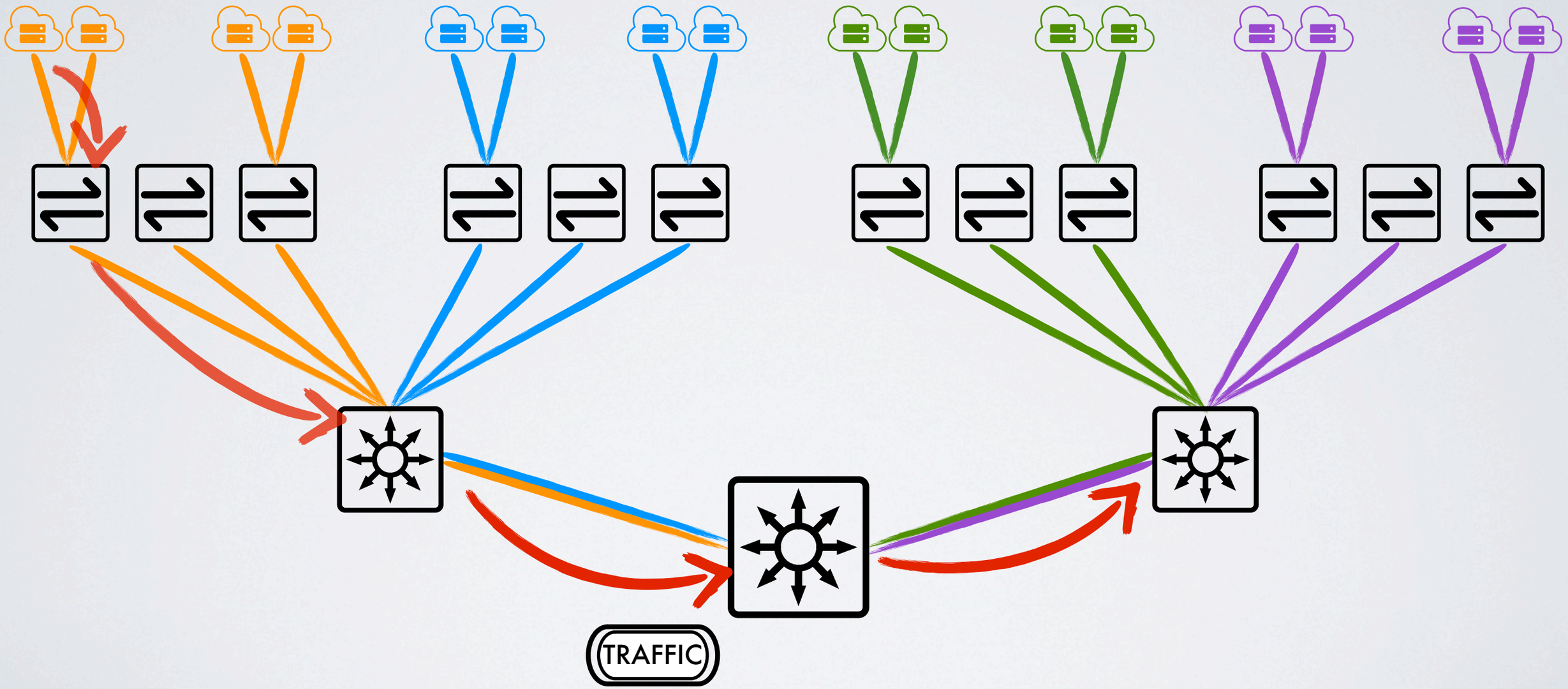
The **Next-Hop IP** on the **Core ServiceNet Router** will know where to forward the traffic to next!



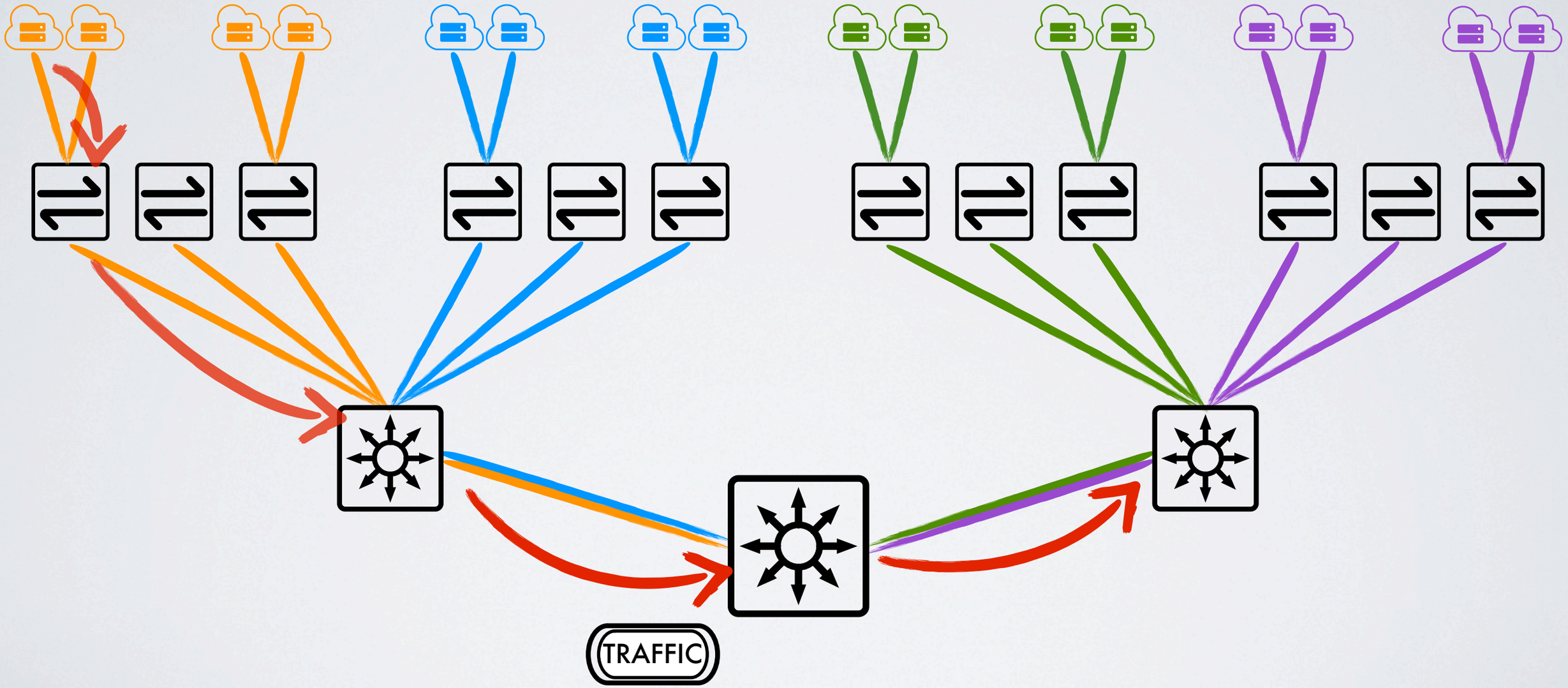
The **Aggregation Switch forwards** the **traffic** to the **Core ServiceNet Router**.

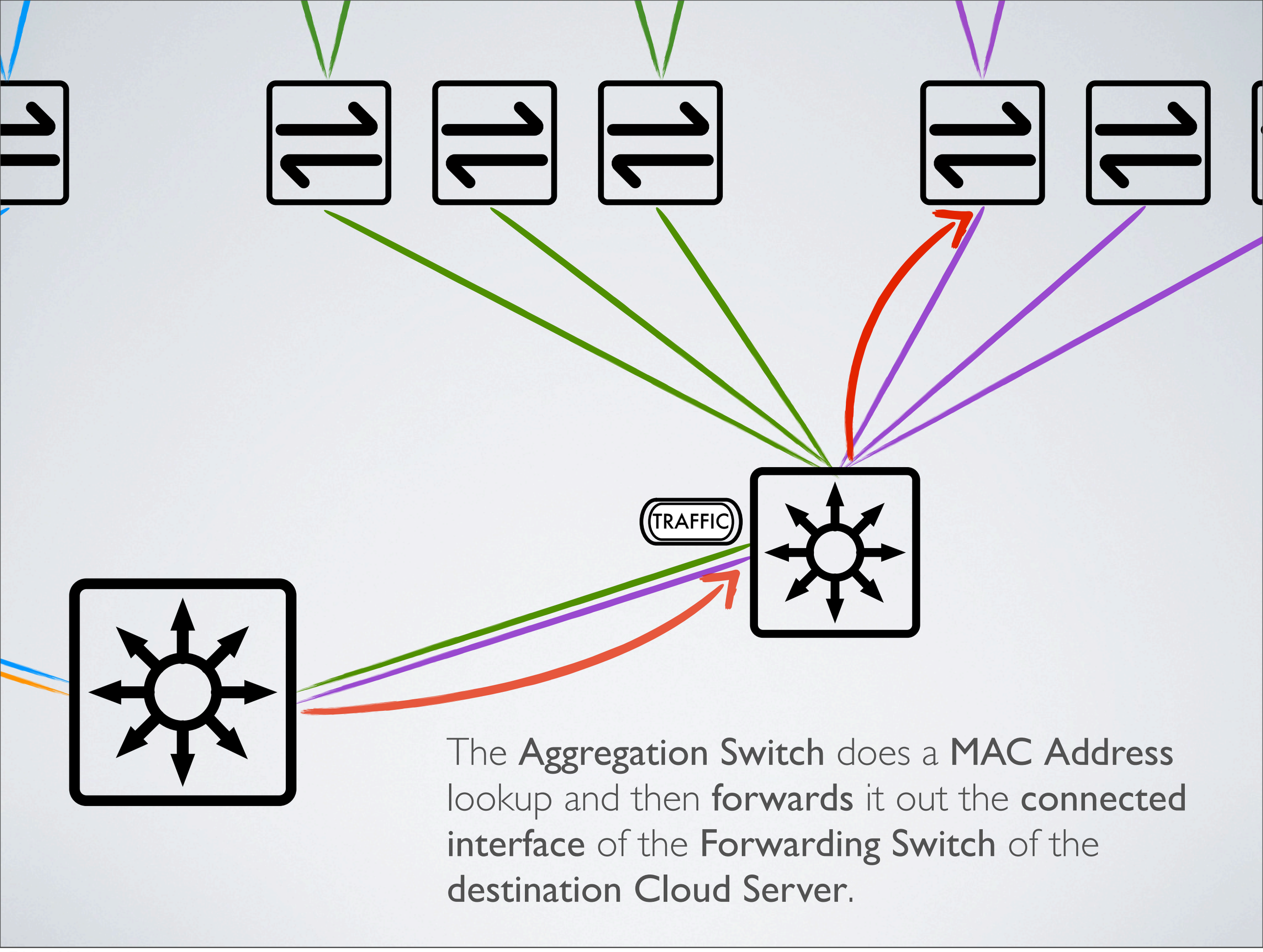


The **Core ServiceNet Router** sees that it was used as the **Next-Hop IP,** and knows it needs to make a **routing decision** based on the **destination IP**.

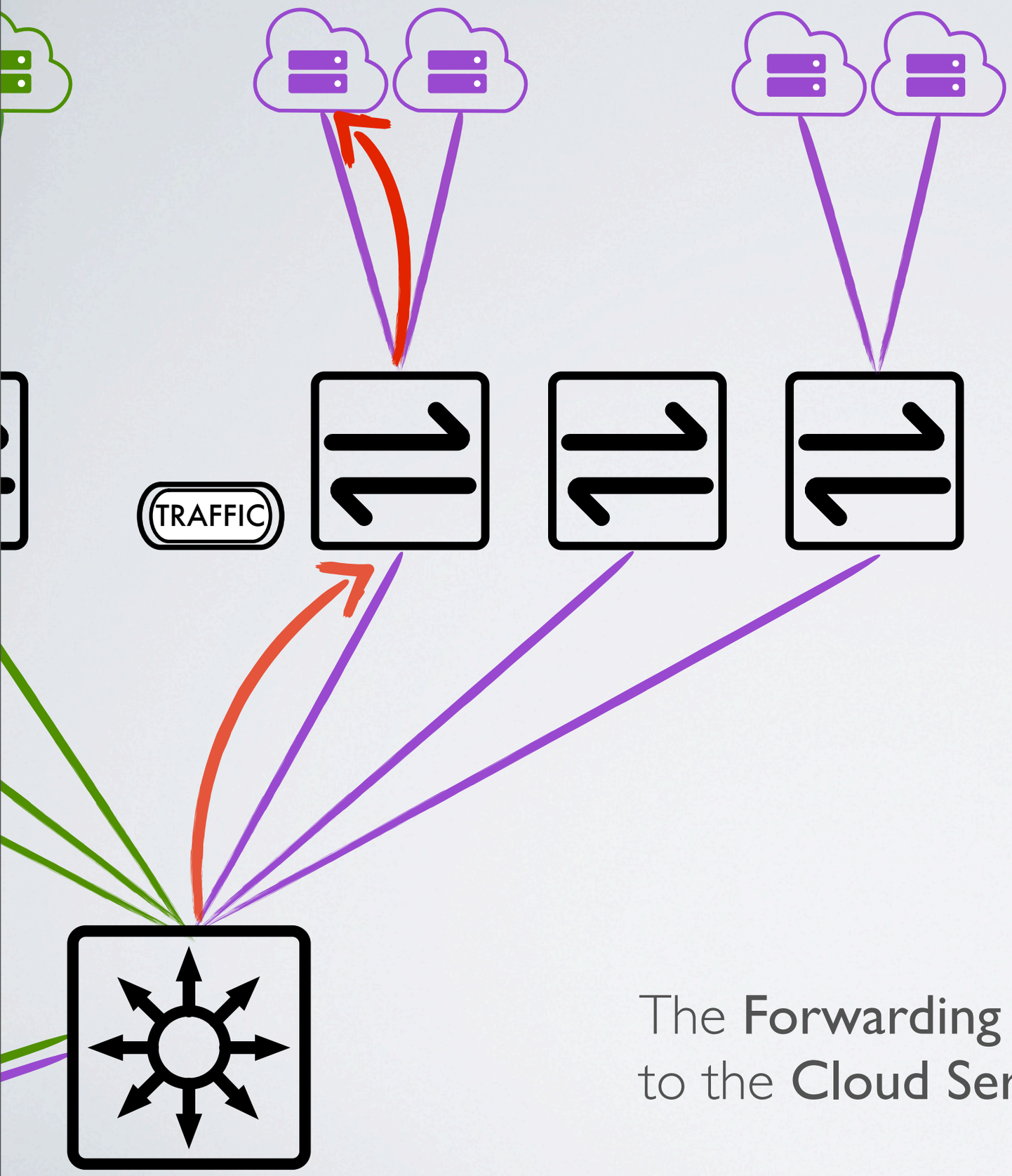


Based on existing routes, the **Core ServiceNet Router** places the traffic onto the Destination **(Purple) VLAN**, and forwards the traffic to the **Forwarding Switch** of the destination **Cloud Server**.

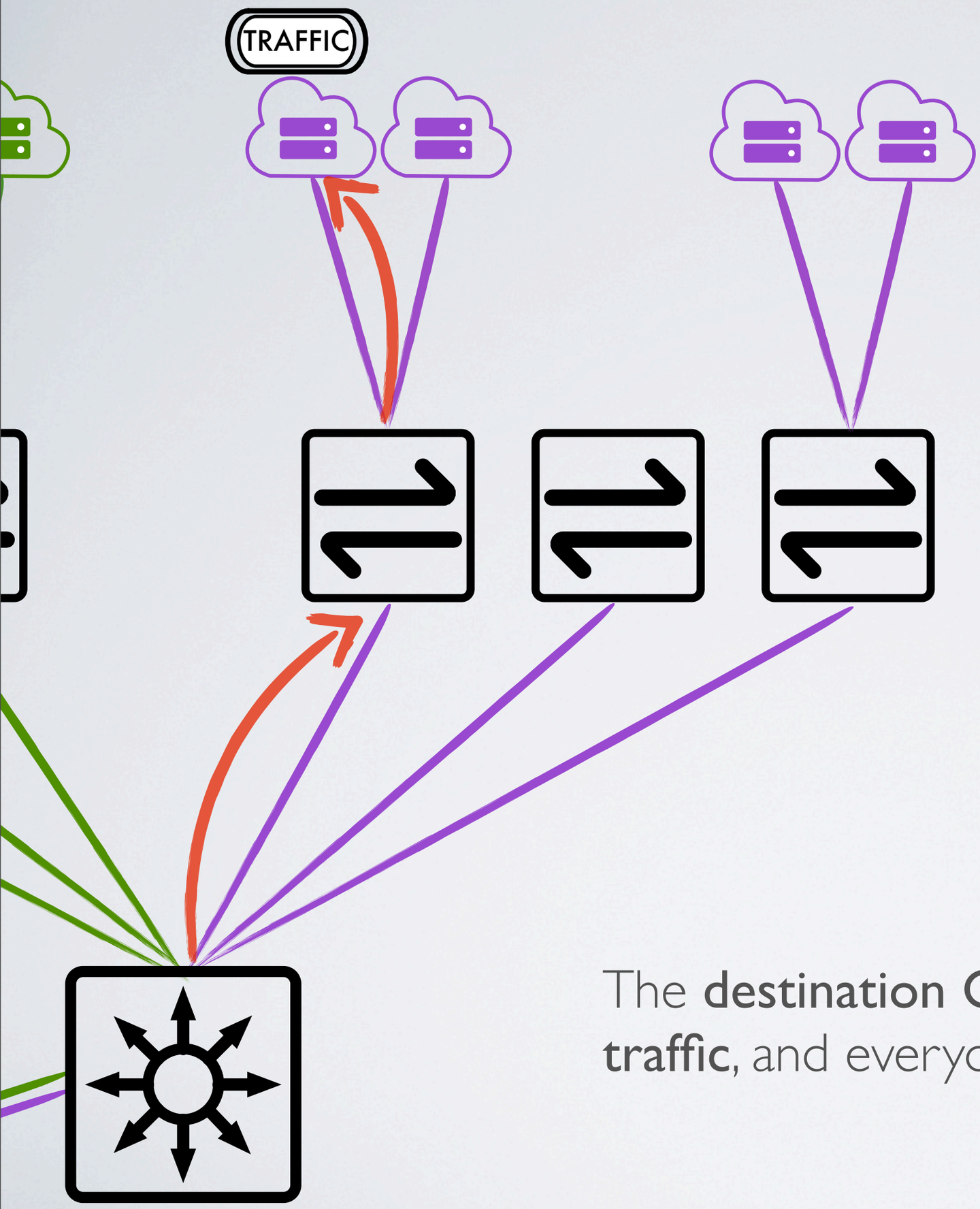





The **Aggregation Switch** does a **MAC Address** lookup and then **forwards** it out the **connected interface** of the **Forwarding Switch** of the **destination Cloud Server**.

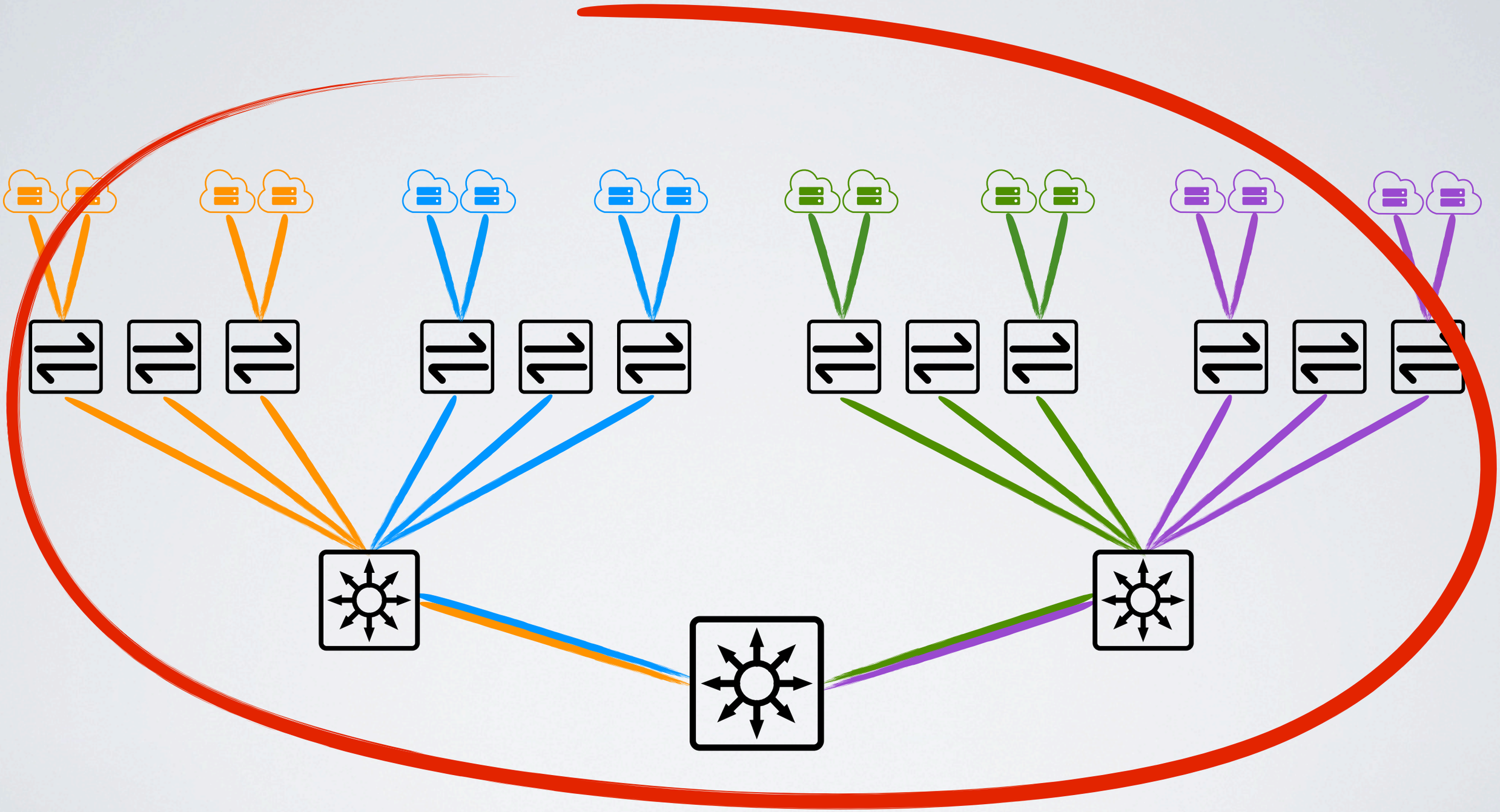



The **Forwarding Switch** then **forwards traffic** to the **Cloud Server**.




The **destination Cloud Server receives** its **traffic**, and everyone lives happily ever after!

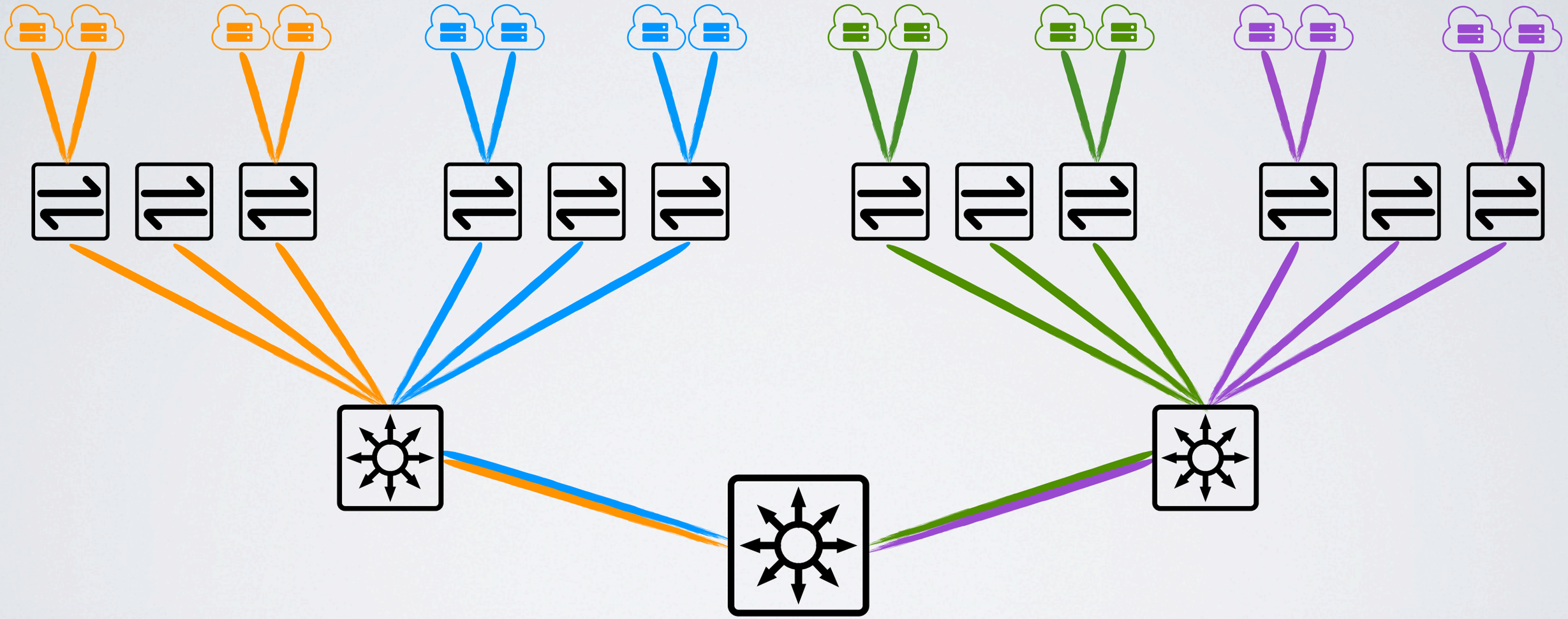
That's **Cloud ServiceNet** in a nut shell.



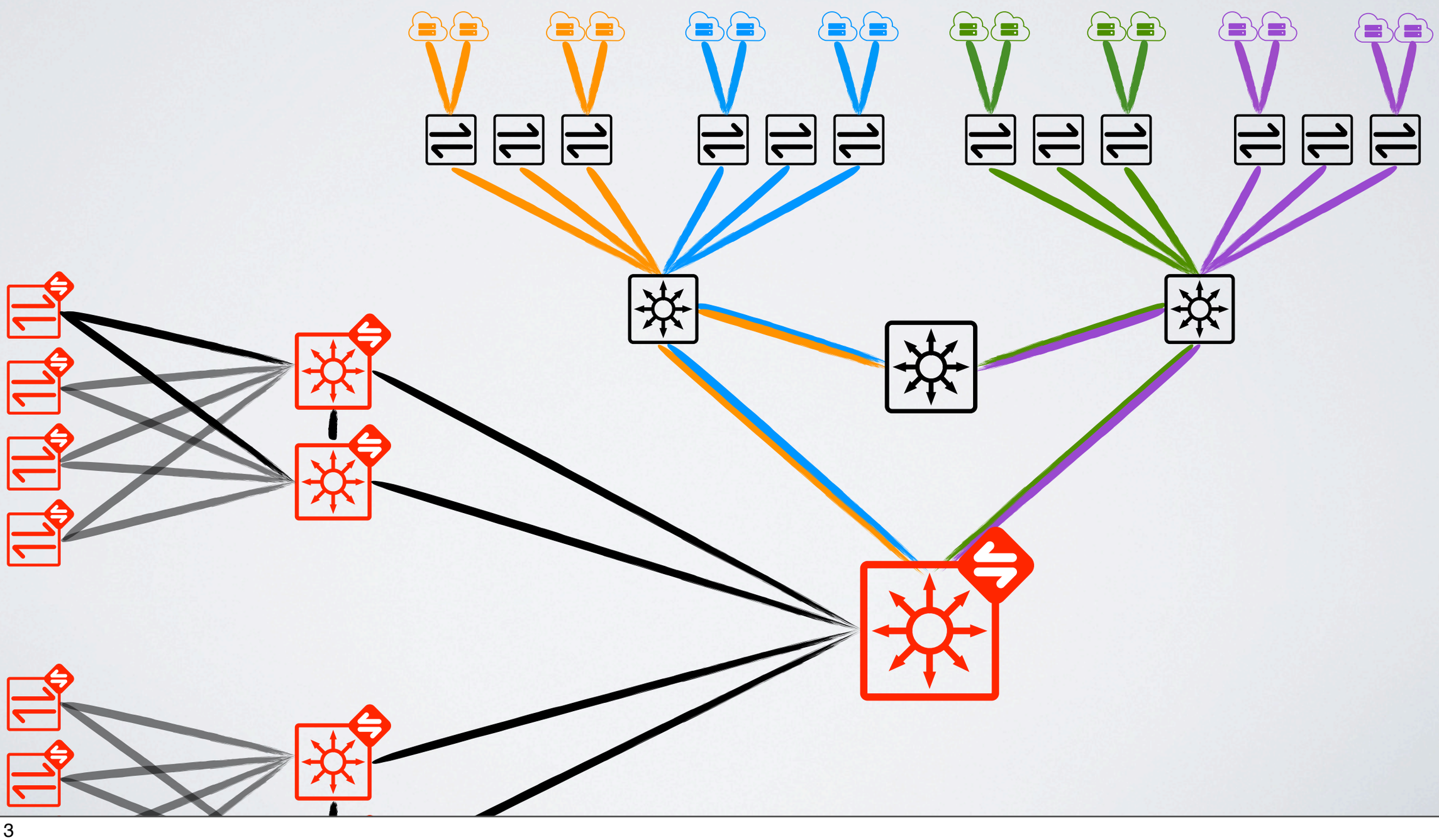
# Infrastructure Deep Dive

## RackConnect Infrastructure

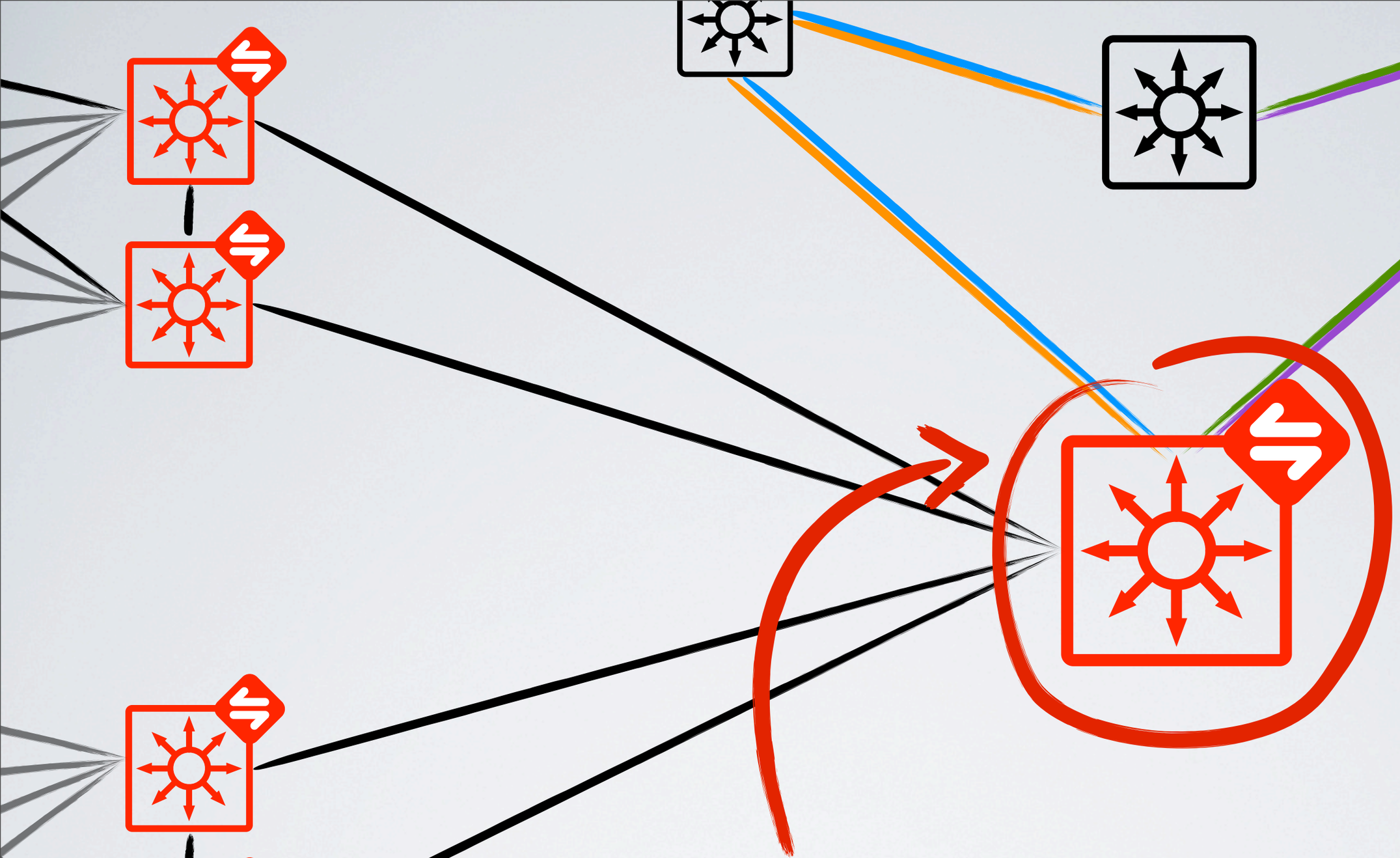
So how does RackConnect fit into this?



# So how does RackConnect fit into this?



All **ServiceNet Aggregation Switches** are directly connected to the **RackConnect Core Switch**, resulting in **all Huddle VLANs** being **trunked** to the **RackConnect Network Infrastructure**.

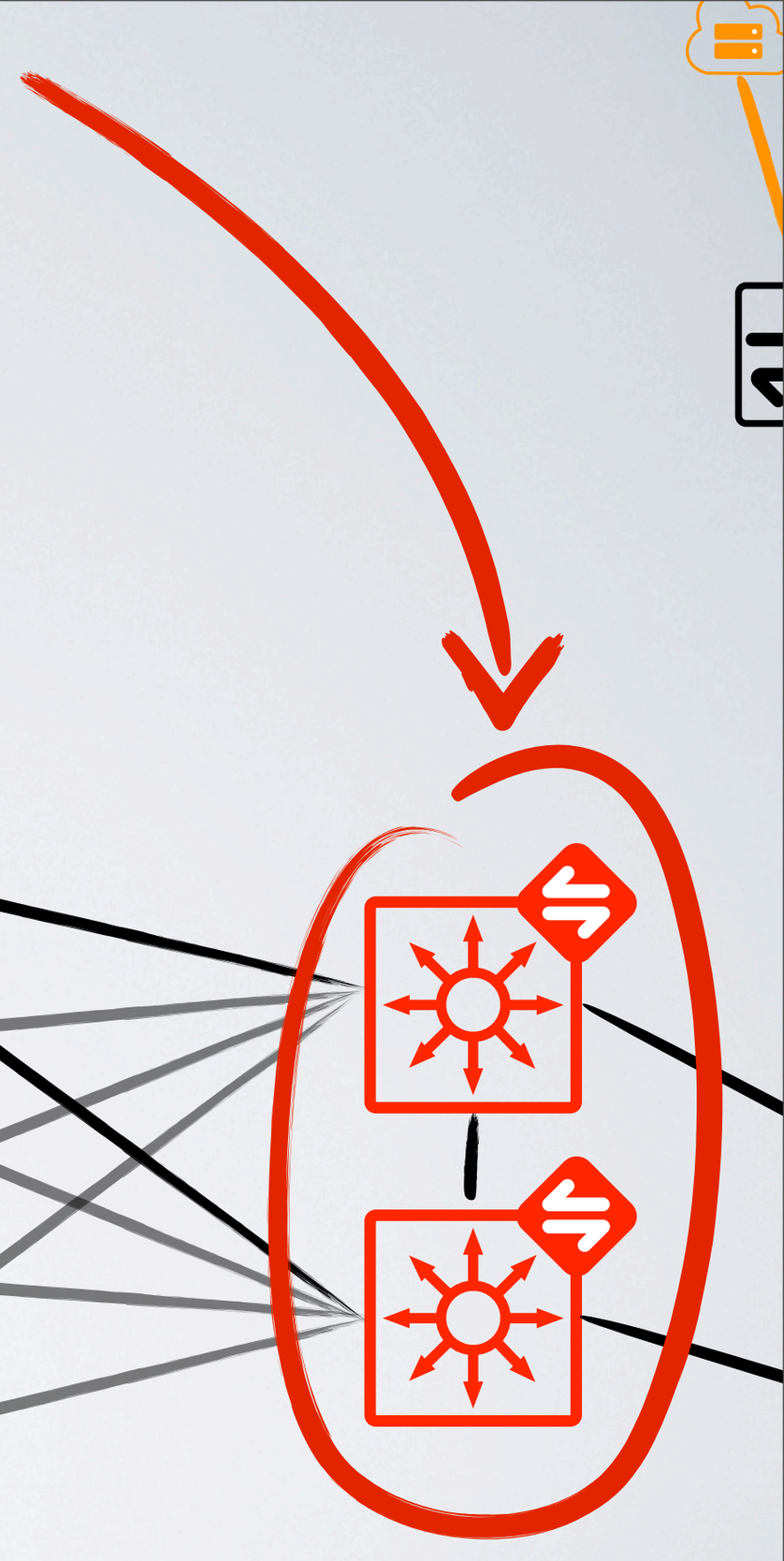


The **RackConnect Core Switch** is directly **connected** to ALL **RackConnect Aggregation Switches**.

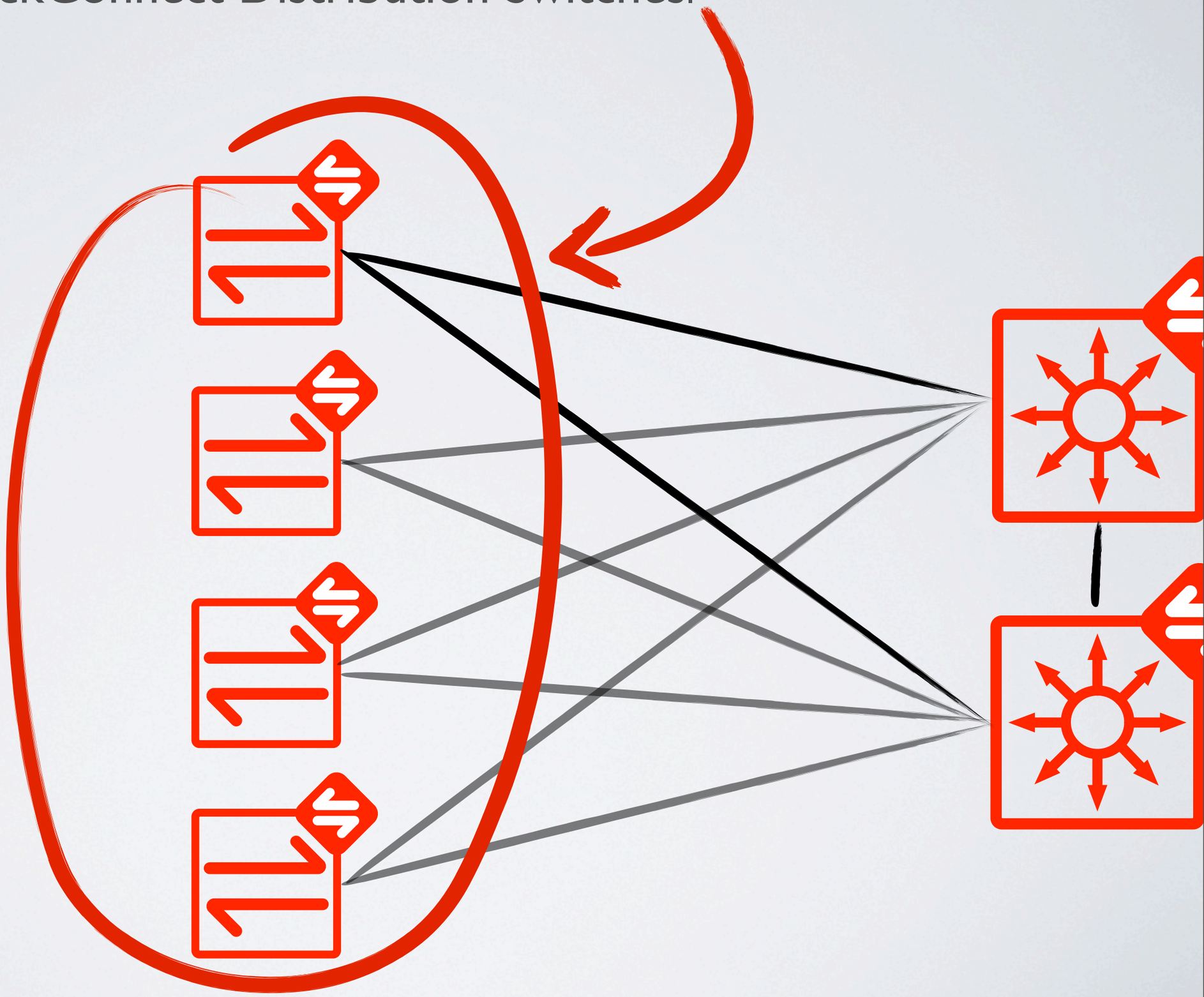
The **RackConnect Core Switch forwards** all **Cloud ServiceNet Huddle VLANs** to EVERY **RackConnect Aggregation Switch**.

The **RackConnect Aggregation Switches** are set up for **High Availability (HA)**, and come in **pairs**. Each **Aggregation Switch** is directly connected to its **HA partner**, as well as the **RackConnect Core Switch**.

Each **RackConnect Aggregation Switch** in the **HA pair** is also directly connected to each **RackConnect Distribution Switch**.

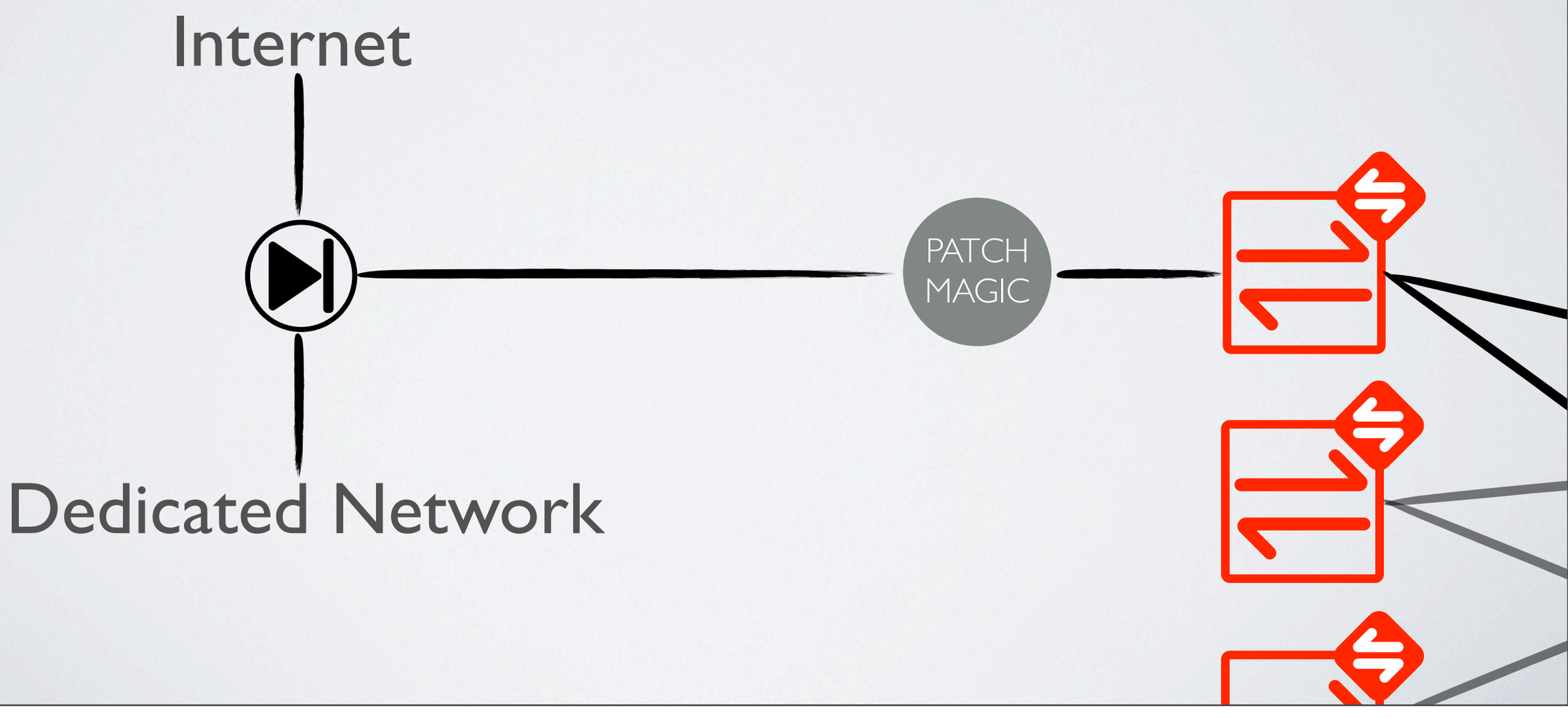


RackConnect Aggregation Switches forward all Huddle VLANs to all RackConnect Distribution Switches.



RackConnect Distribution Switches forward Huddle VLANs to the Connected Network Device.

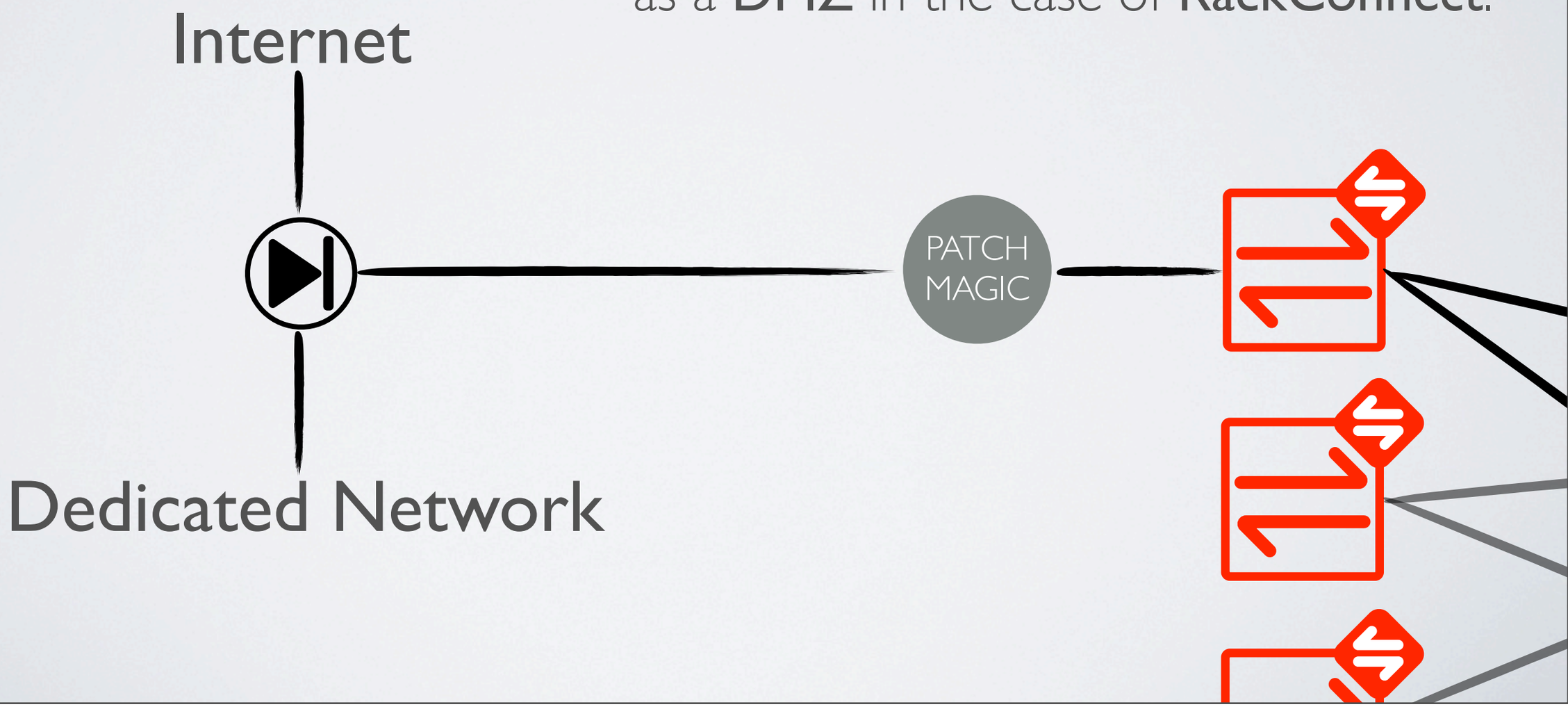
The Connected Network Device is configured with a sub-interface for each Huddle VLAN that contains one or more active Cloud Servers belonging to the customer.

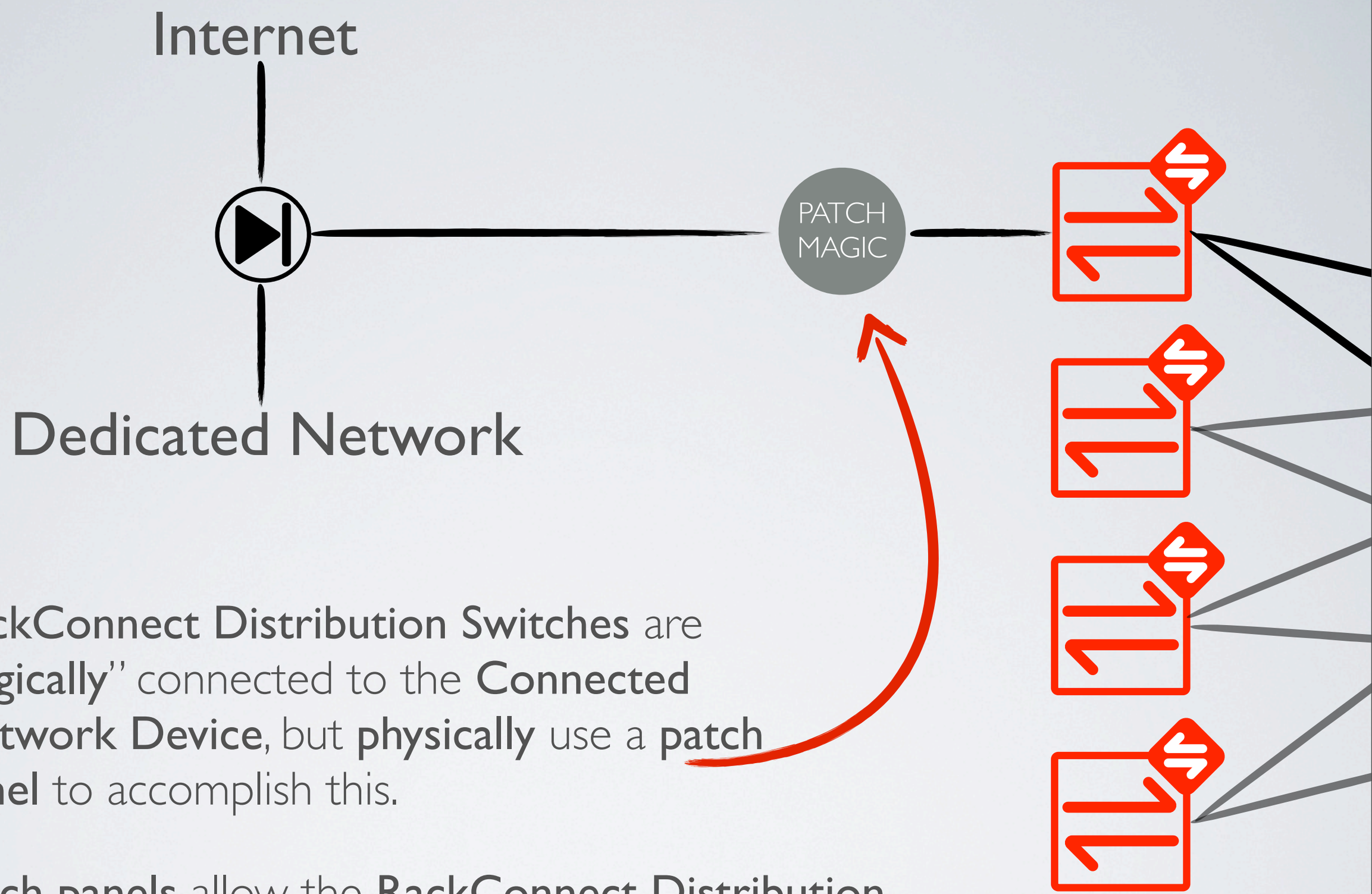


As far as **Network Devices** are concerned, **each** one of the **sub-interfaces** is just another **directly connected Network**.

With that in mind, as long as the **Network Device** has the **proper permissions** in place, traffic can be forwarded between the **Dedicated Network** and **Cloud Servers**.

You could think of **Cloud ServiceNet** as a **DMZ** in the case of **RackConnect**.

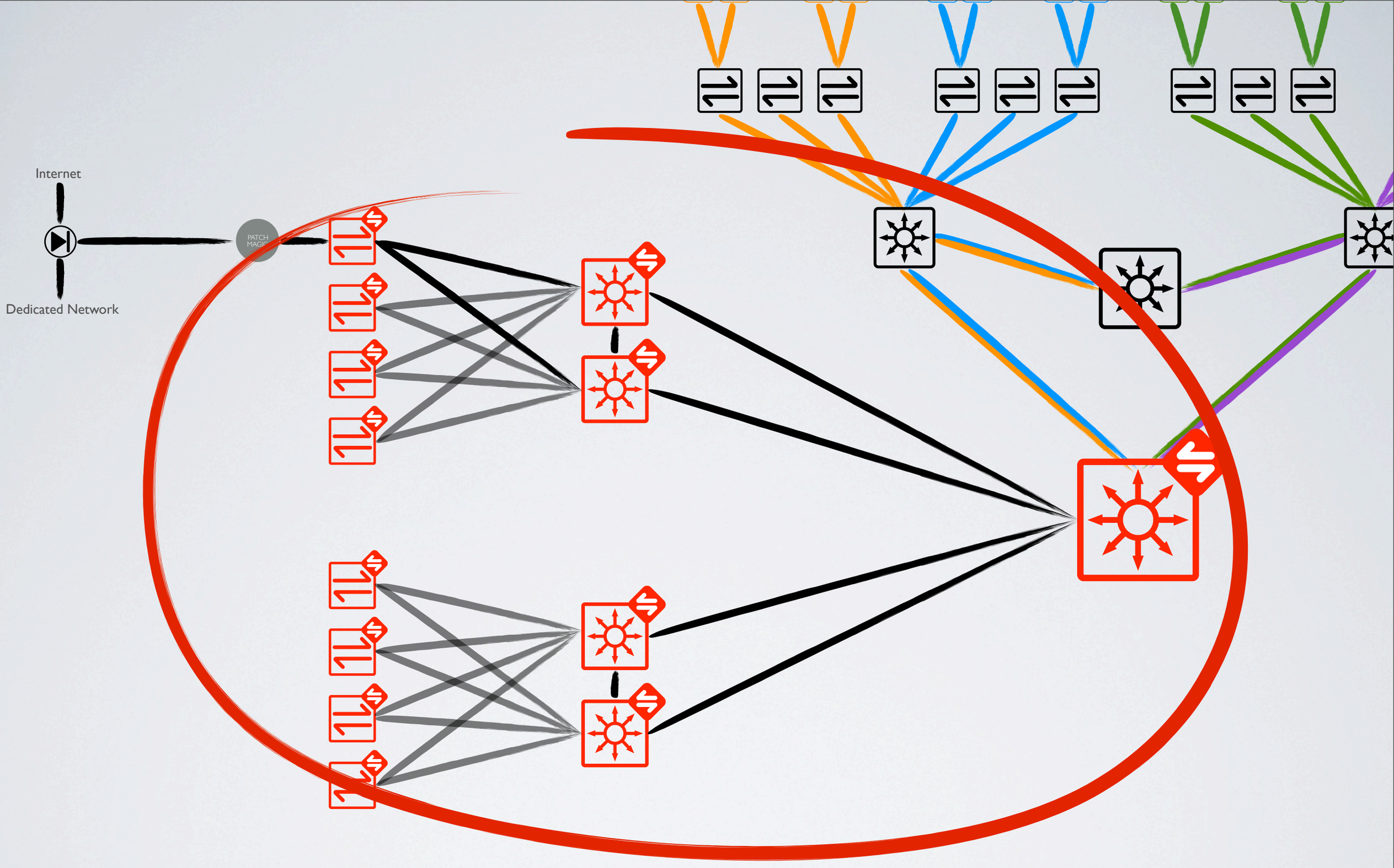




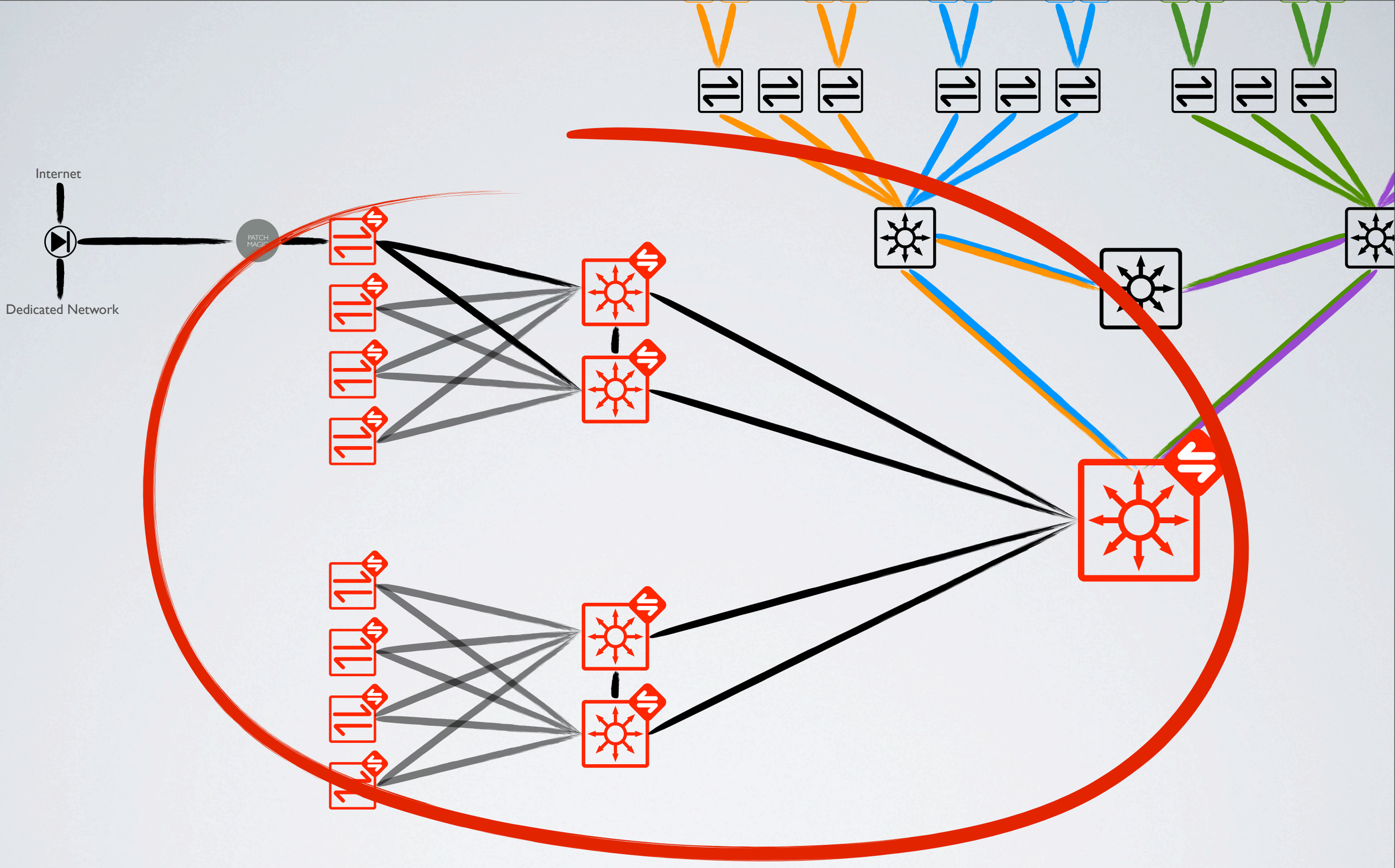

**RackConnect Distribution Switches** are "**logically**" connected to the **Connected Network Device**, but **physically** use a **patch panel** to accomplish this.

**Patch panels** allow the **RackConnect Distribution Switch** to be in one area of a Data Center while the **Connected Network Device** resides in another physical area, far away.

Ask me for an example of a patch panel! :)



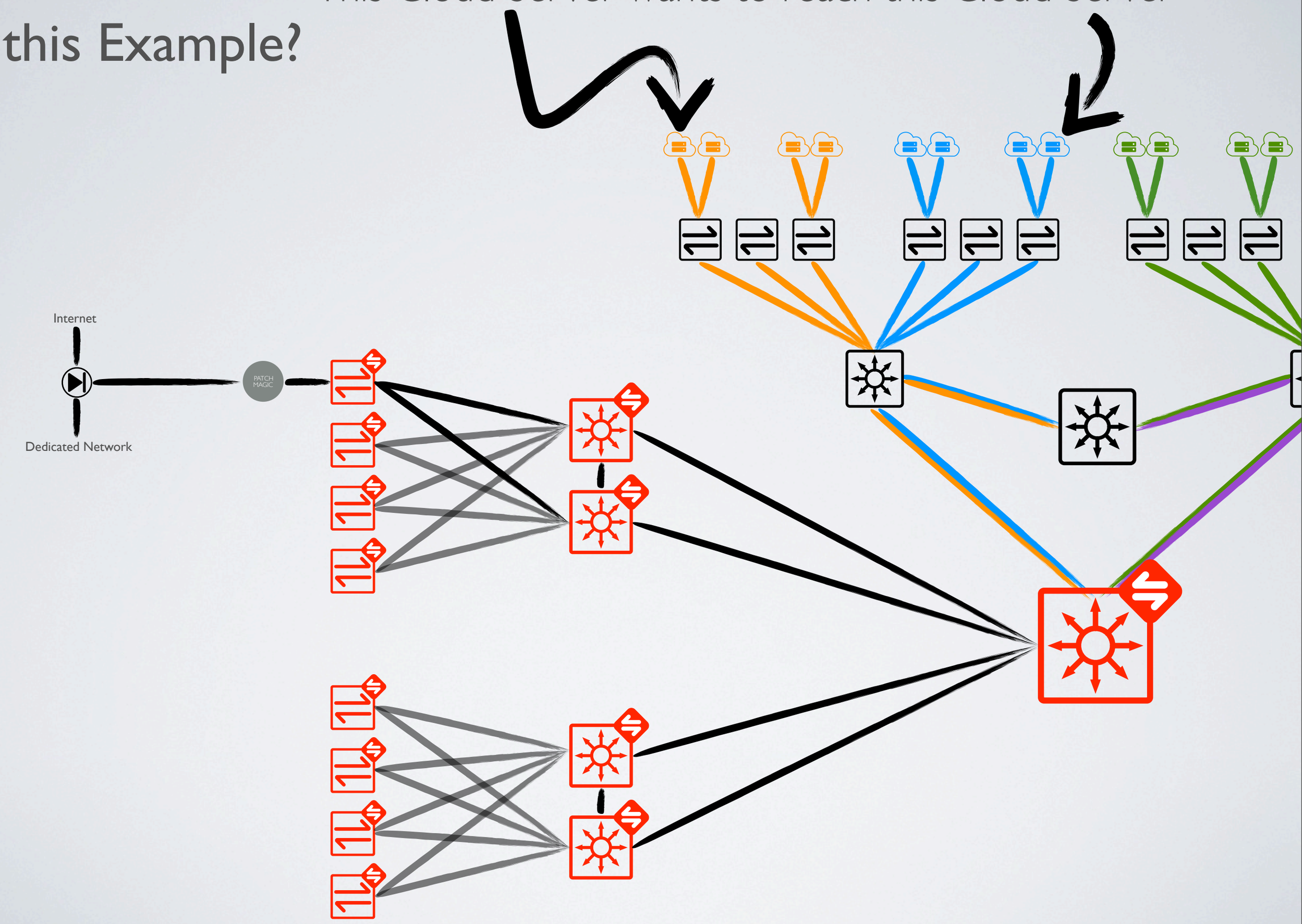

The **ENTIRE RackConnect Infrastructure** is simply acting as a **forwarding plane** for each **Cloud ServiceNet Huddle VLAN.**




This is referred to as a **Layer 2 Network** because **no IP routing ever takes place between the Cloud Server and the Connected Network Device.**

# Remember this Example?

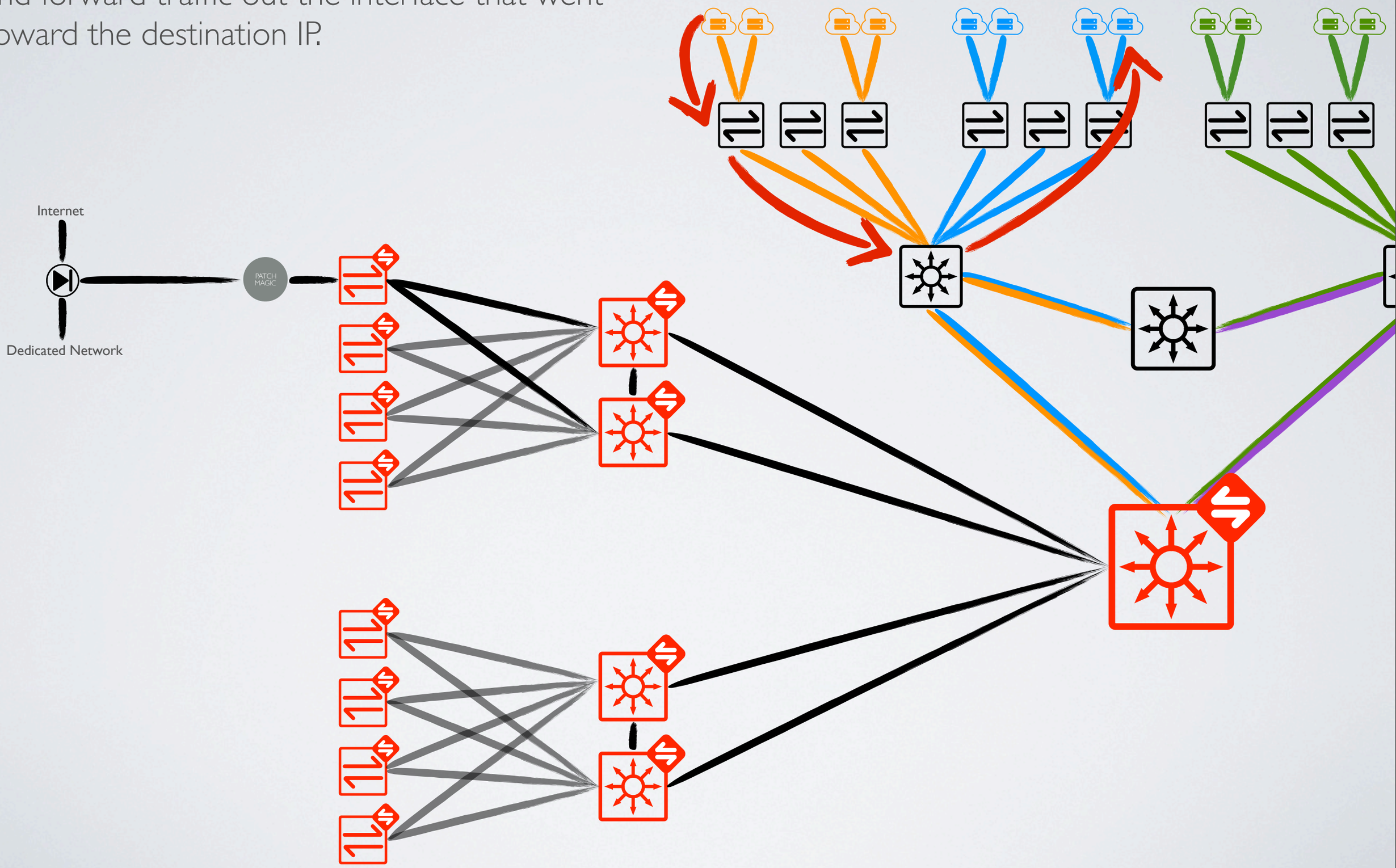
This Cloud Server wants to reach this Cloud Server



The Cloud Server routed traffic to the Next-Hop of it's Cloud ServiceNet Gateway IP.

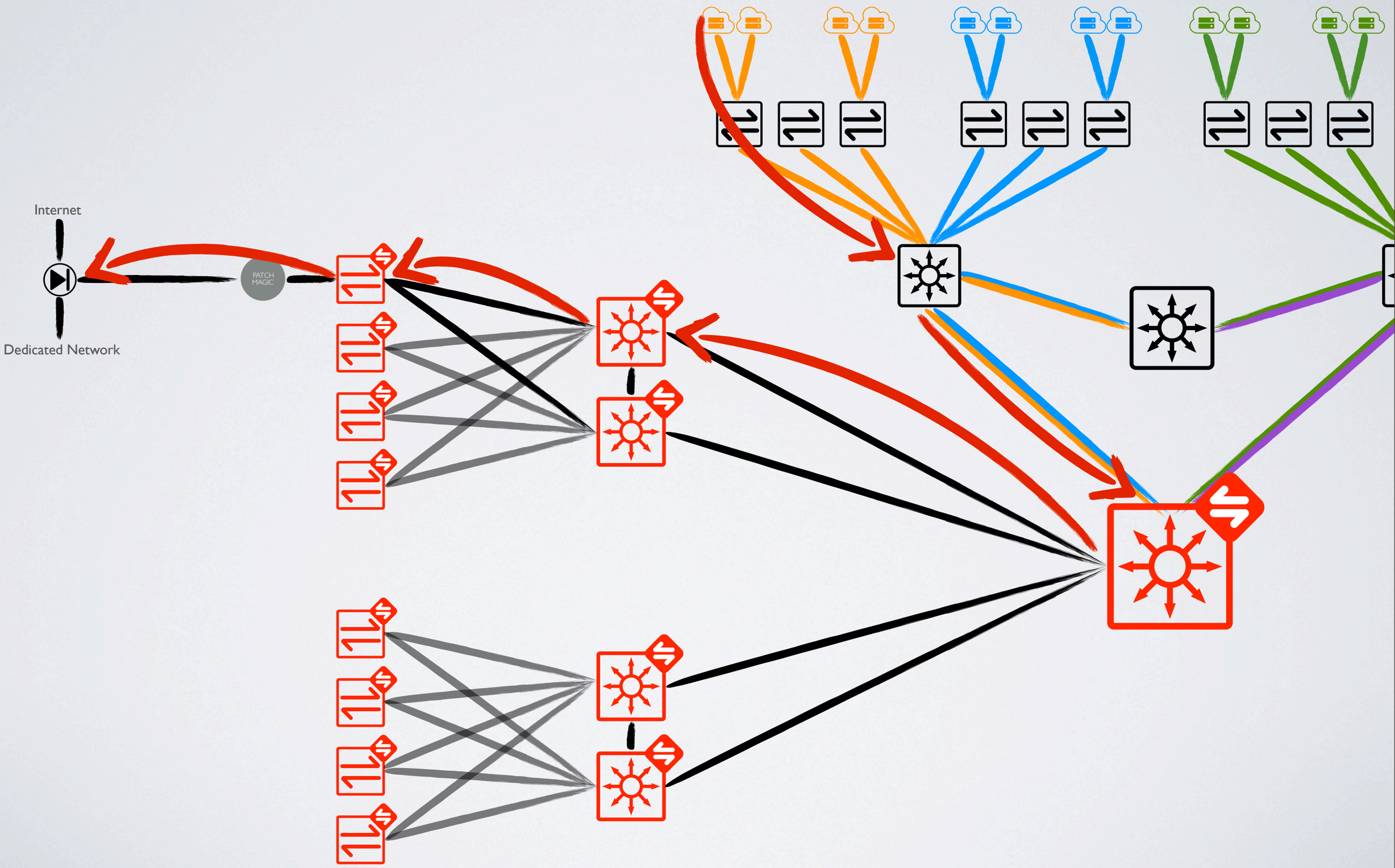
The Forwarding Switch forwarded the traffic out the interface that went toward the Next-Hop IP.

The Aggregation Switch made a routing decision and forward traffic out the interface that went toward the destination IP.



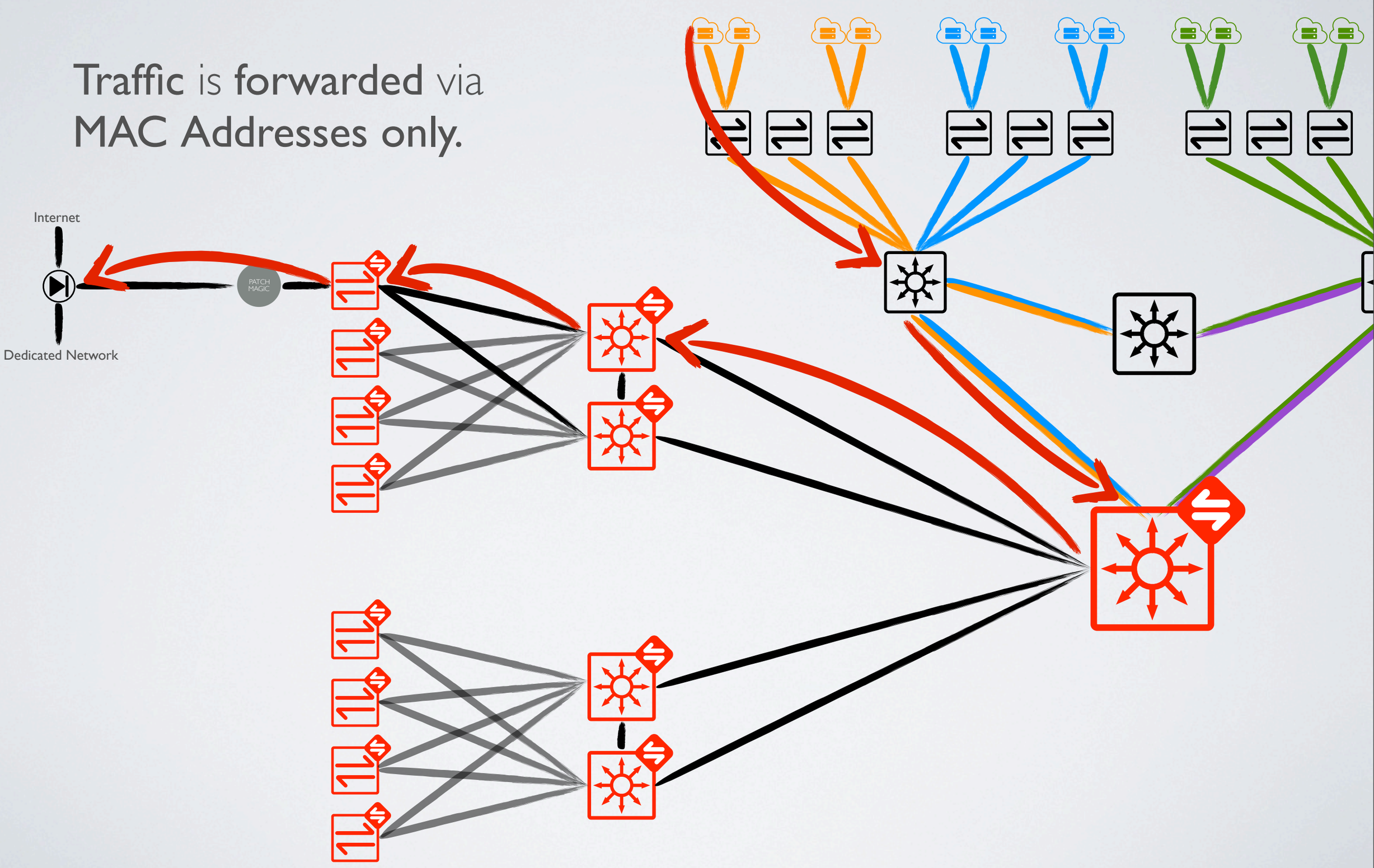
No joke, **that's how RackConnect works.**

Theres just a lot **more hopping between switches** and **MAC Address lookups** to get to the Next-Hop IP (**RC GW IP**).

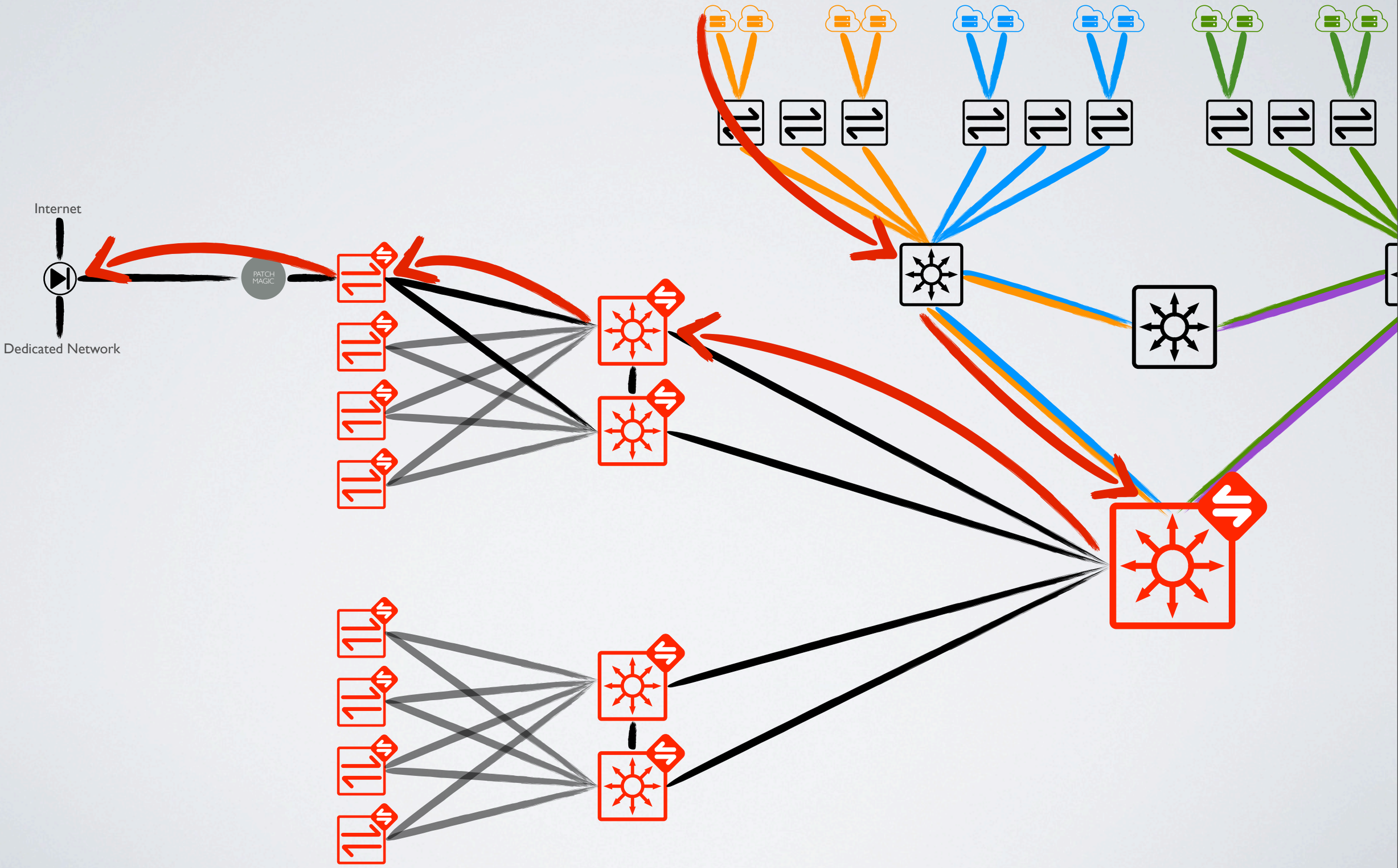


Since the **Huddle VLAN sub-interface** on the **Network Device** has an **IP within** the **same subnet as the Cloud Server**, **NO IP ROUTING** ever occurs.

**Traffic** is **forwarded** via **MAC Addresses only.**



Once the traffic has arrived on the **Connected Network Device**, as long as the traffic is allowed through, the traffic can be routed to either the **Dedicated Network(s)** or the outside Internet.



# RACKCONNECT

Infrastructure Walkthrough

## THE END

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