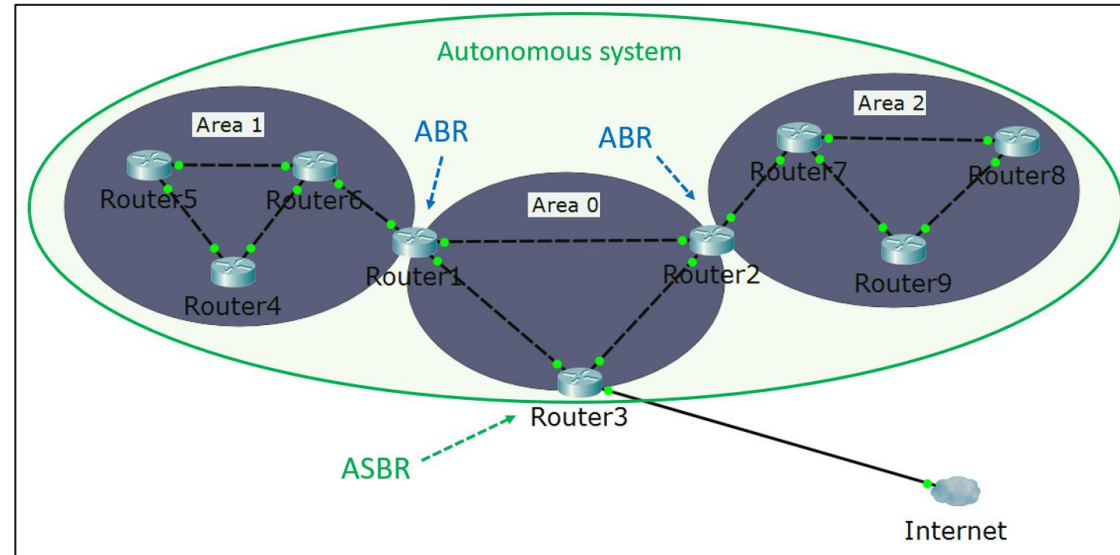


Dynamic routing with OSPF

Lecture 8



SoftUni Team
Technical Trainers



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A background network diagram featuring a central dark blue circle connected to several smaller white circles with gray outlines. These smaller circles are further connected to each other and to the edges of the frame by a web of thin gray lines, creating a complex network structure.

Introduction to dynamic routing

- **Static routing:**

- Routes to destination networks configured manually
- Routing tables **not updated** if there is better route or lost network
- Big **administrative overhead**, hard to manage

- **Dynamic routing:**

- Routers dynamically exchange the networks they know about
- Routing tables are created with **the best routes** to destinations
- Routing tables **dynamically create or remove entries**

- **Distance-vector protocols**

- Designed for small networks
- Not scalable
- Examples: **RIP**, IGRP, BGP

- **Link-state protocols**

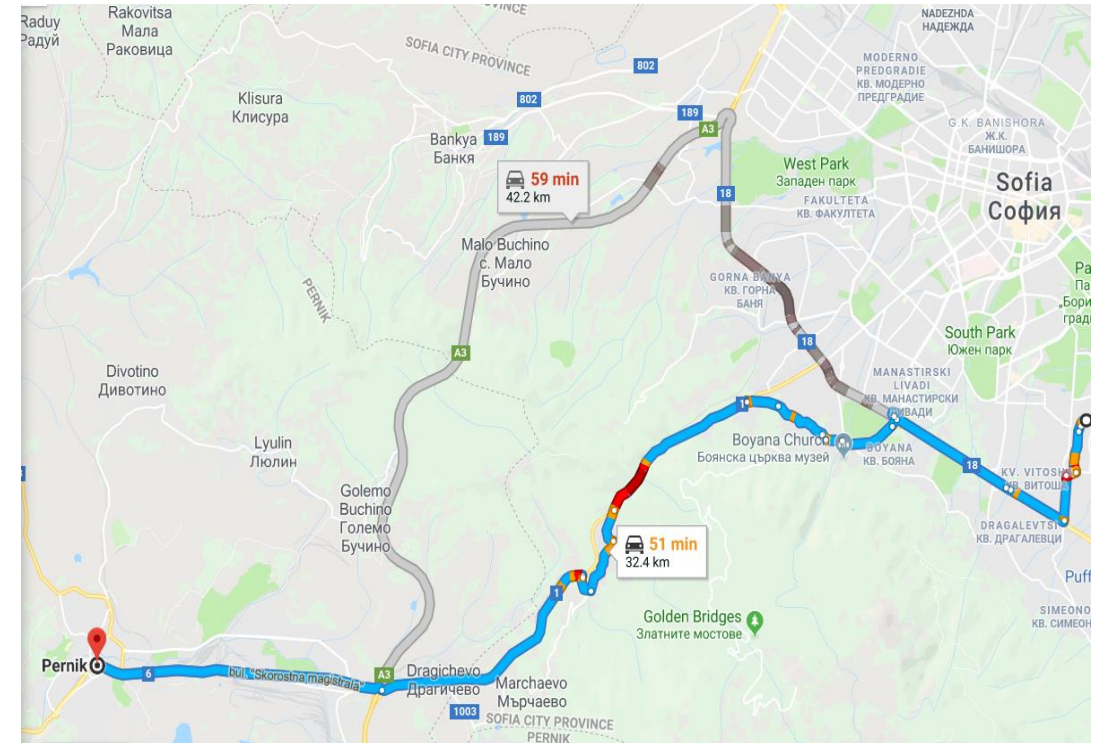
- Designed for small, medium and large networks
- Can scale
- Examples: **OSPF**, IS-IS

Distance-vector vs link-state protocols (2)

- Distance-vector protocols

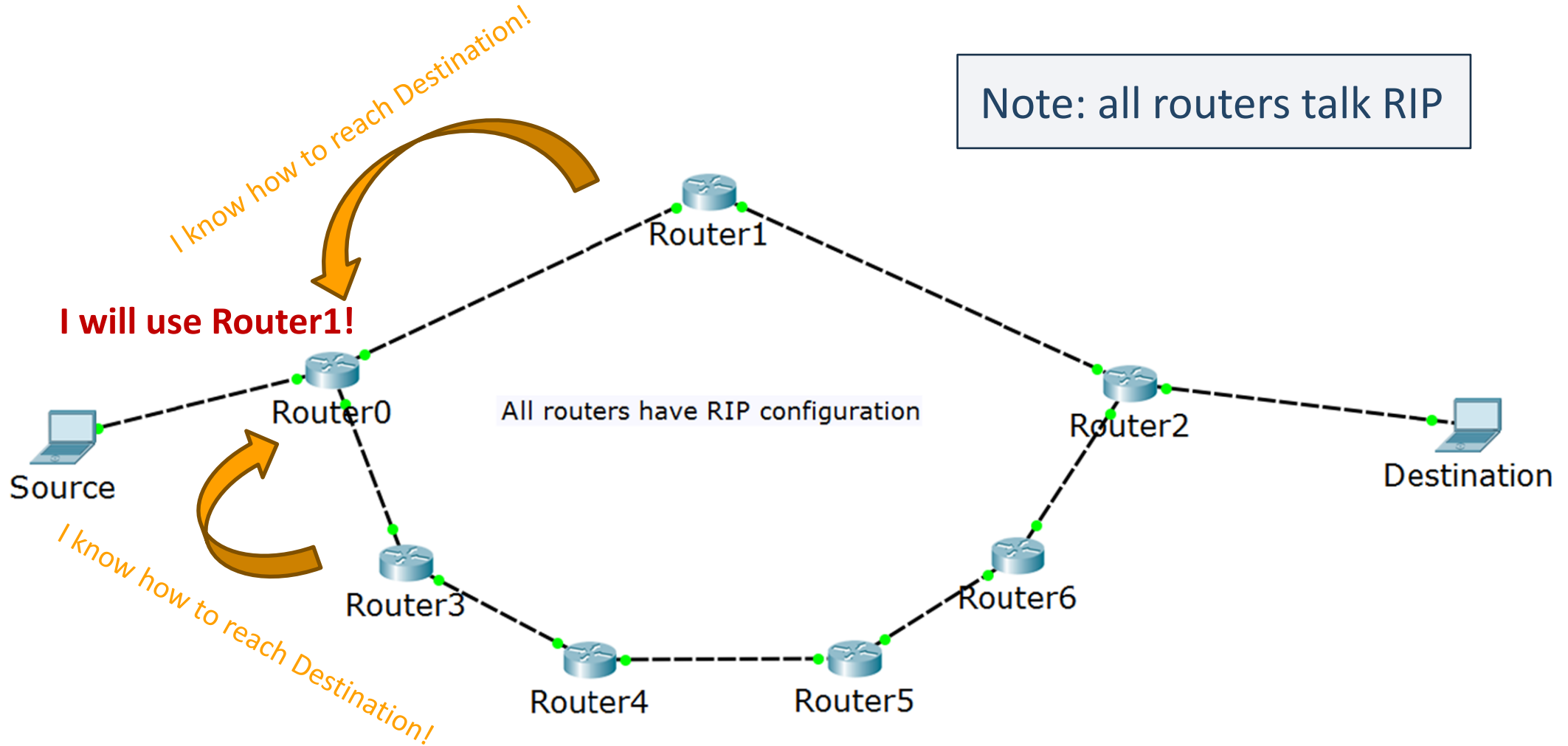


- Link-state protocols



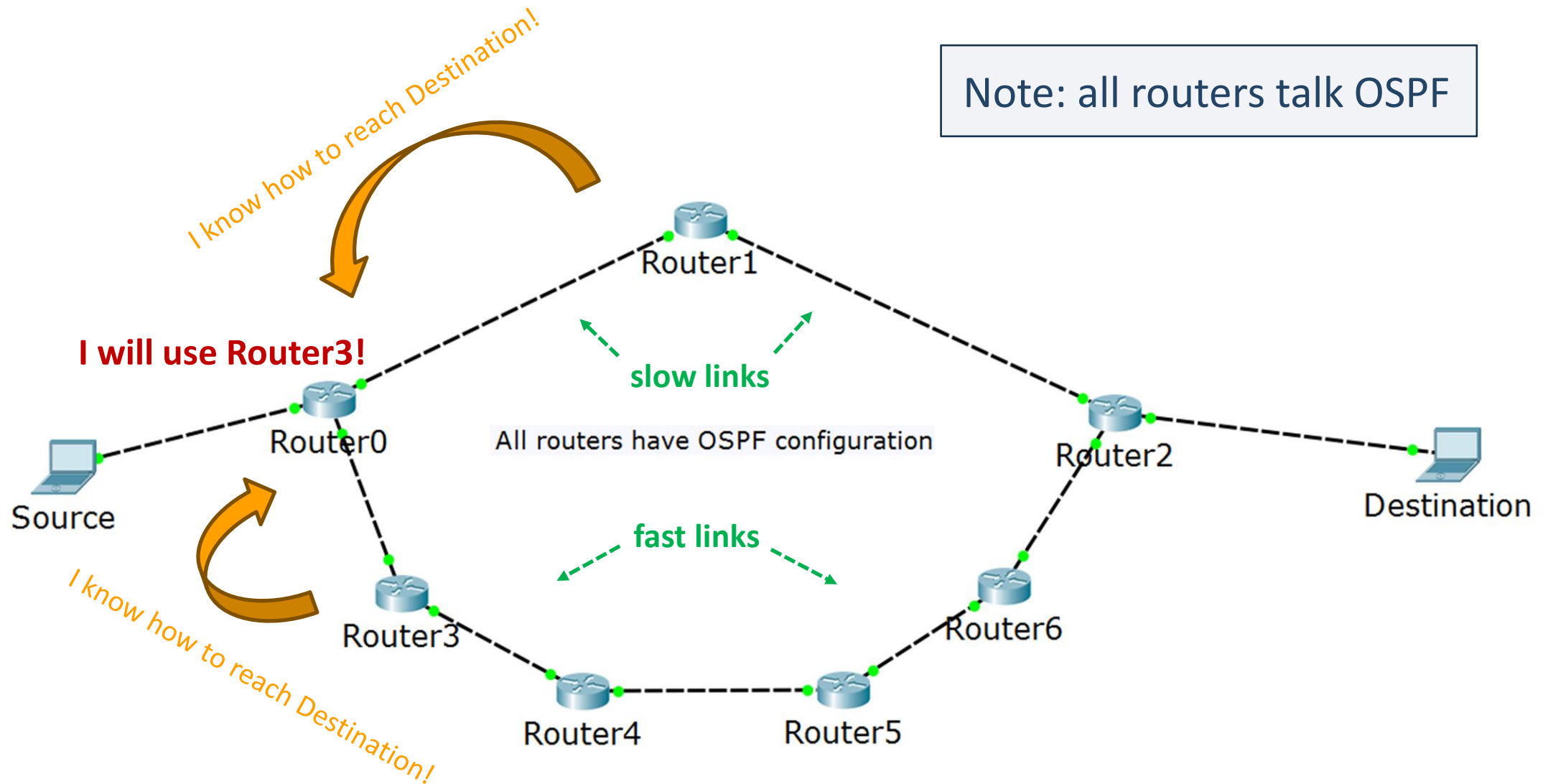
- RIP: Routing Information Protocol
 - Not efficient in the communication
(uses broadcast, sends only periodic updates in v1)
 - Classful protocol (by default)
 - Uses **hop count** as a metric
- OSPF: Open Shortest Path First
 - Very efficient (uses multicast, sends triggered updates)
 - Classless protocol (but can summarize)
 - Uses **cost** as a metric

RIP Metric: hop count



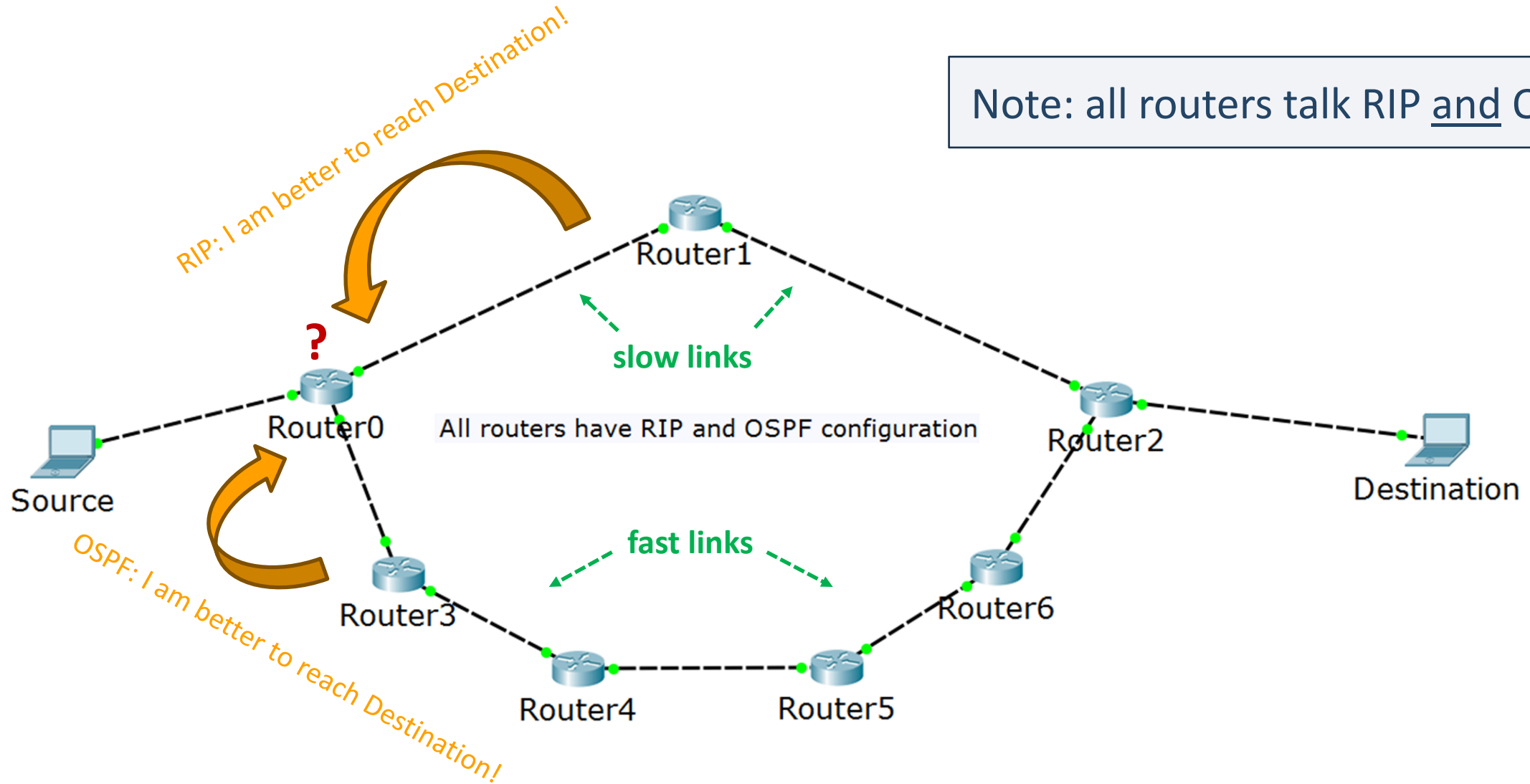
OSPF Metric: cost

Note: all routers talk OSPF



Multiple protocols in the same network

Note: all routers talk RIP and OSPF



Administrative distance

Route Source	Default Distance	Routing Table Entry
Connected interface	0	C
Static route out an interface	0	S
Static route to a next-hop address	1	S
EIGRP summary route	5	D
External BGP	20	B
Internal EIGRP	90	D
IGRP	100	I
OSPF	110	O
IS-IS	115	i
RIPv1, RIPv2	120	R
Exterior Gateway Protocol (EGP)	140	E
ODR	160	O
External EIGRP	170	D EX
Internal BGP	200	B
Unknown	255	



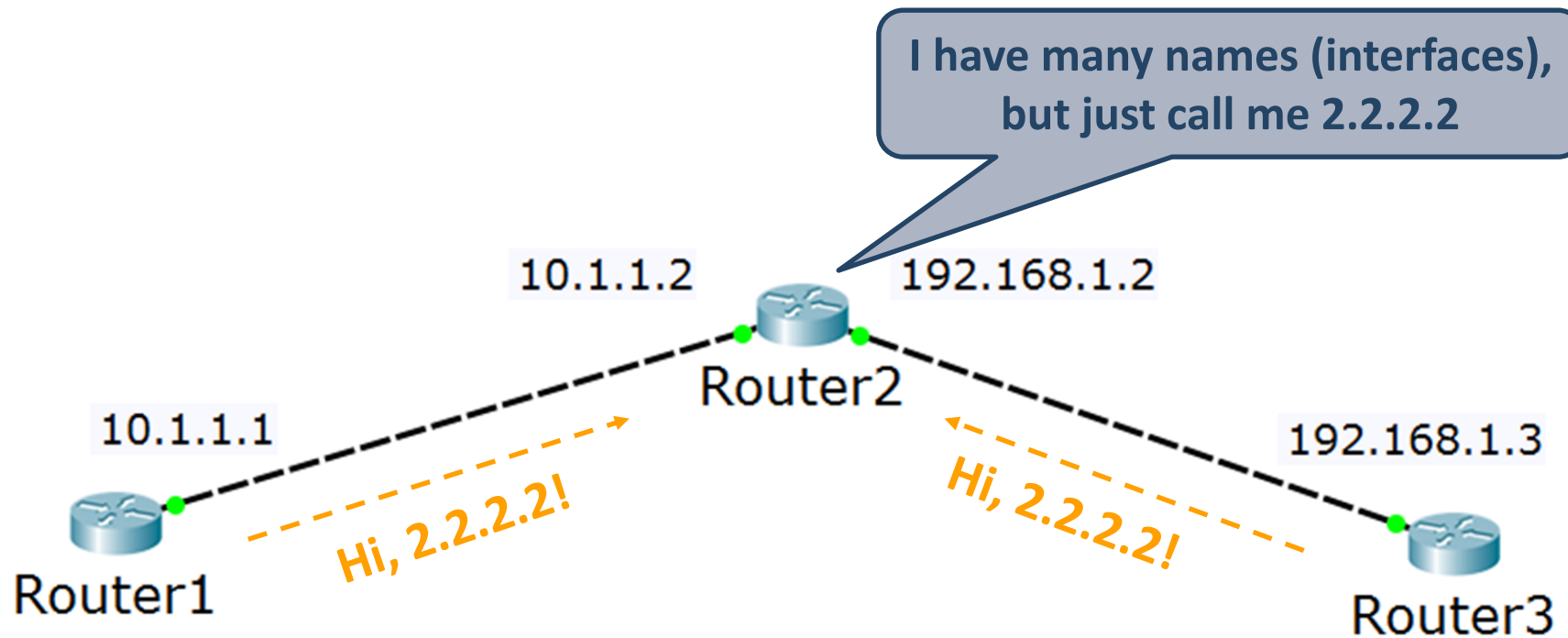
OSPF introduction

- Fast convergence with triggered updates
- Hierarchical structure (areas)
- VLSM support (classless protocol)
- Efficient communication with neighbors
- Uses intelligent metric (cost)
- Open standard

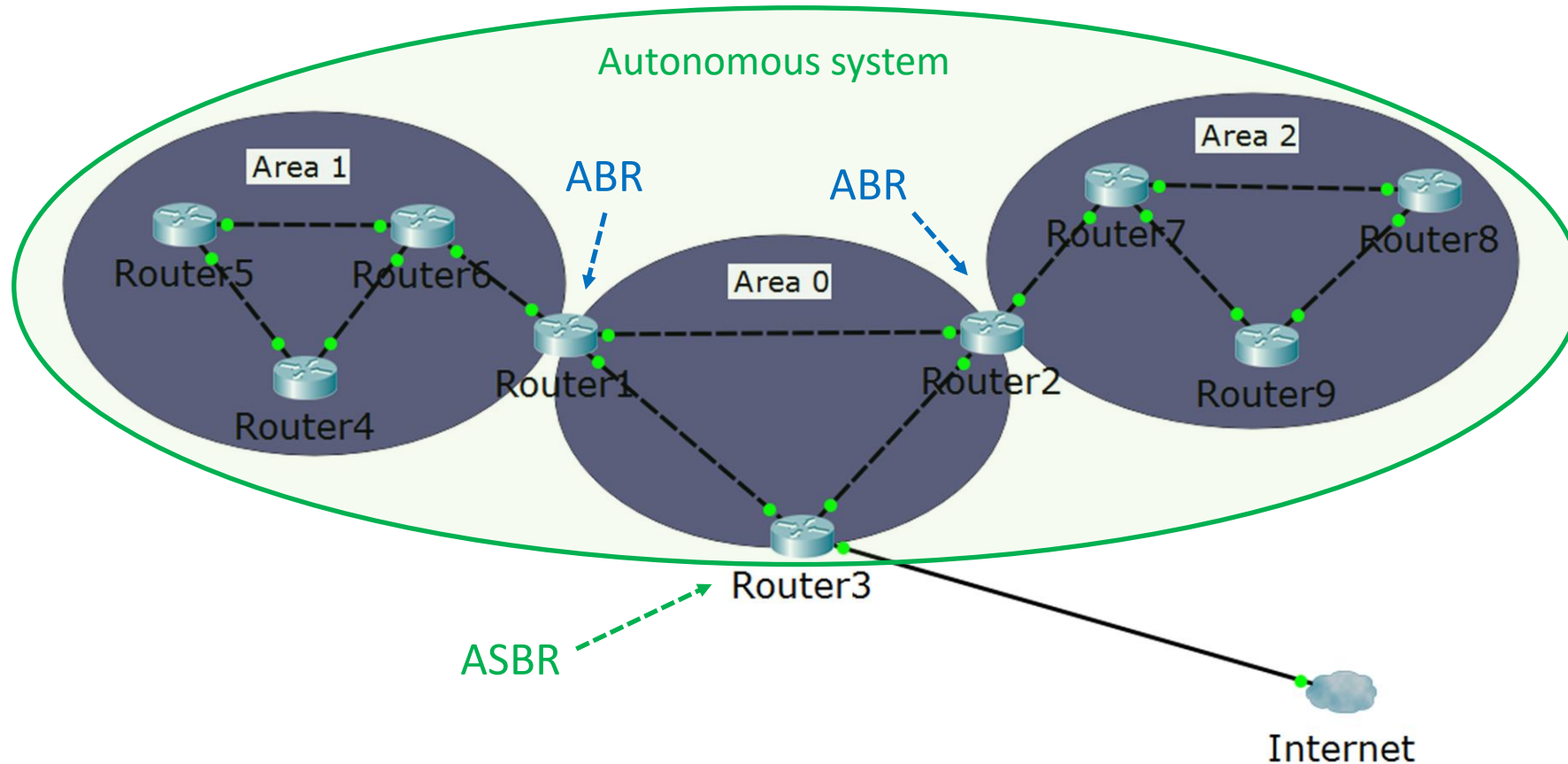
- Requires more RAM and CPU on the devices – maintains different tables (neighbor, topology, routing)
- Requires good and careful design when multiple areas are needed
- More complex to configure and troubleshoot

- LSA – Link State Advertisement
- Router ID
- Area
- ABR – Area Border Router
- Autonomous system
- ASBR – Autonomous System Boundary Router

OSPF terms: router ID



OSPF terms (2)



Area 0 = the backbone area

- In the **subnet masks**, 1 means “do care” and 0 means “don’t care”
- Examples:
 - 192.168.1.0 255.255.255.0 -> refers to 192.168.1.0 network
 - Loopback address: 10.1.1.1 255.255.255.255 -> exact IP address
- In the **wildcard masks**, 0 means “do care” and 1 means “don’t care”
- Examples:
 - 192.168.1.0 0.0.0.255 -> refers to 192.168.1.0 network
 - Loopback address: 10.1.1.1 0.0.0.0 -> exact IP address

- **router ospf *process-id***
- Has a local significance only – the numbers does not have to match between the routers
- Separates processes as they are different routing protocols
- It is rarely necessary to have more than 1 process on a router

The “network” command

- The network *A.B.C.D Wildcard_Mask* command makes two things:
 - It enables the interface (sends OSPF “Hello” messages)
 - It advertises the network (“I know about network A.B.C.D”) to all OSPF enabled interfaces

The “network” command (2)

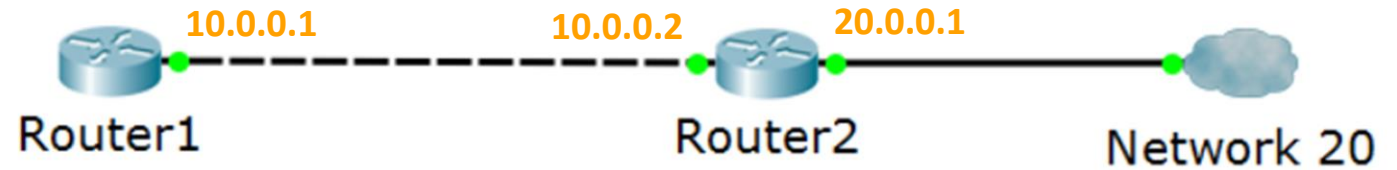
R1:

```
network 10.0.0.0 0.0.0.255
```

R2:

```
network 10.0.0.0 0.0.0.255
```

```
network 20.0.0.0 0.0.0.255
```



→ ①.

Hello!

I have network 10! ②.

← ①.

Hello!

I have network 10! ...and 20! ②. ②.

→ ①.

Hello!

I have network 10 and 20! ②.

A background network diagram featuring a central dark blue circle and several smaller white circles connected by thin grey lines, forming a mesh-like structure.

Single area OSPF configuration

Single area OSPF configuration

- Minimum configuration:
 - **router ospf *process_id***
 - **router-id *number*** (optional)
 - **network A.B.C.D *wildcard_mask* area *number***
- Example:
 - **router ospf 1**
 - **router-id 1.1.1.1** (optional)
 - **network 192.168.1.0 0.0.0.255 area 0**
 - **network 10.0.0.0 0.0.0.255 area 0**

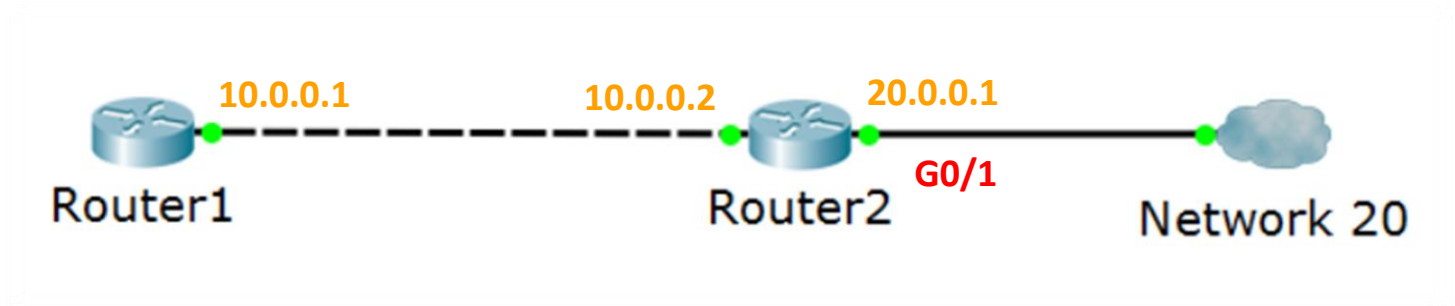
- The “network” command advertises the network AND sends hello messages out of the interface
- What if there is non-OSPF device on the other end of the link?
 - The Hello packets will be useless
 - Represents security issues
- One solution: use **passive interfaces**

OSPF passive interface (2)

R1:
network 10.0.0.0 0.0.0.255

R2:
network 10.0.0.0 0.0.0.255
network 20.0.0.0 0.0.0.255

passive-interface G0/1



→ ①.
Hello!
I have network 10! ②.

← ①.
Hello!
I have network 10! ...and 20! ②. ②.

~~→ ①.
Hello!
I have network 10 and 20! ②.~~

- `show ip ospf interface`
- `show ip ospf neighbor`
- `show run | begin ospf`
- `show ip route [ospf]`

- Some tips to check which path a packet will take in a multi-path L3 network:
 - show ip route – to check a router's routing table
 - tracert A.B.C.D (from Windows)
 - traceroute A.B.C.D (from Cisco, Linux, etc.)
 - *Use the Packet Tracer simulation mode

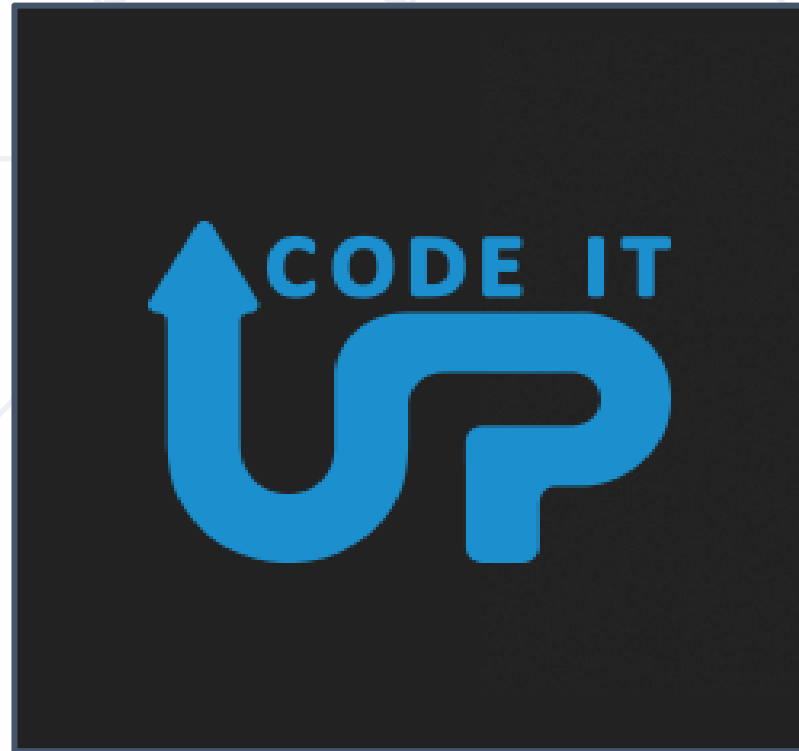
* not applicable in real networks



Demonstration

1. Introduction to dynamic routing
2. OSPF introduction
3. Single area OSPF configuration





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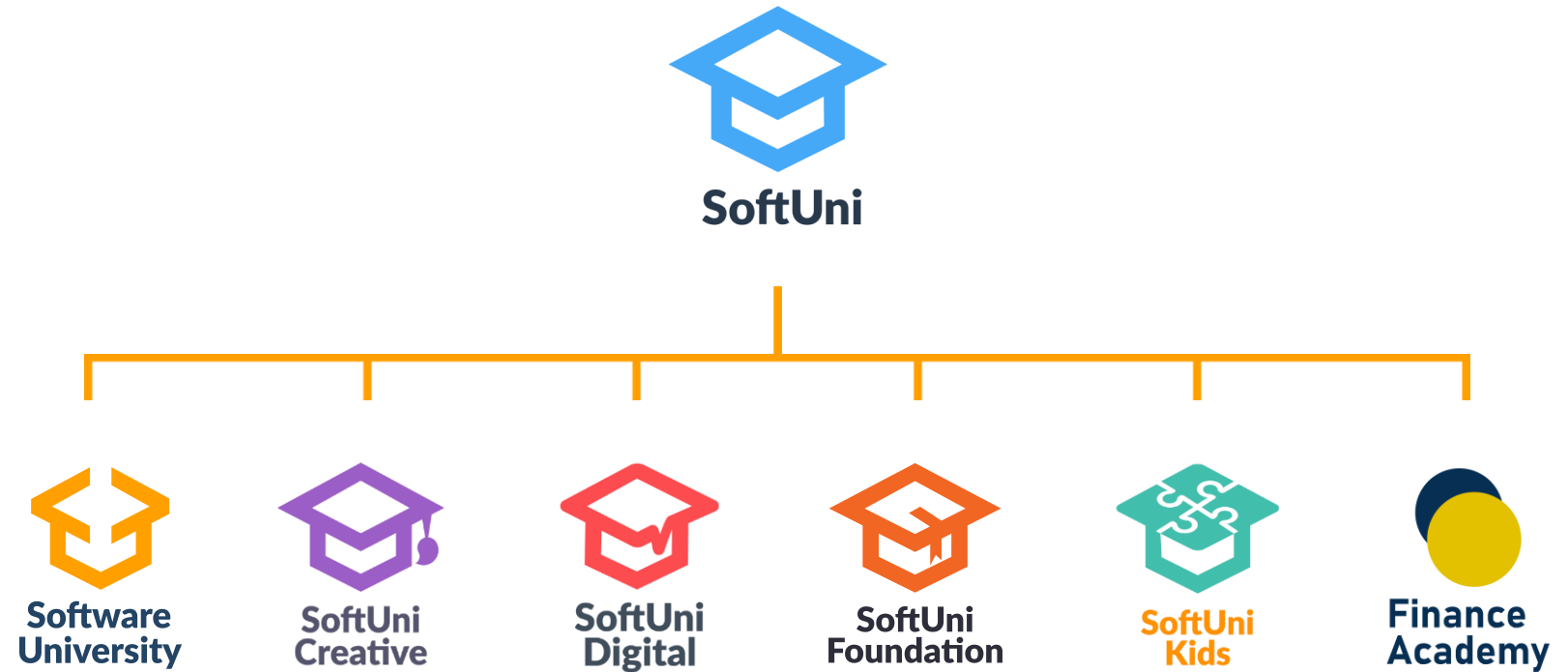


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