Peering Network Design

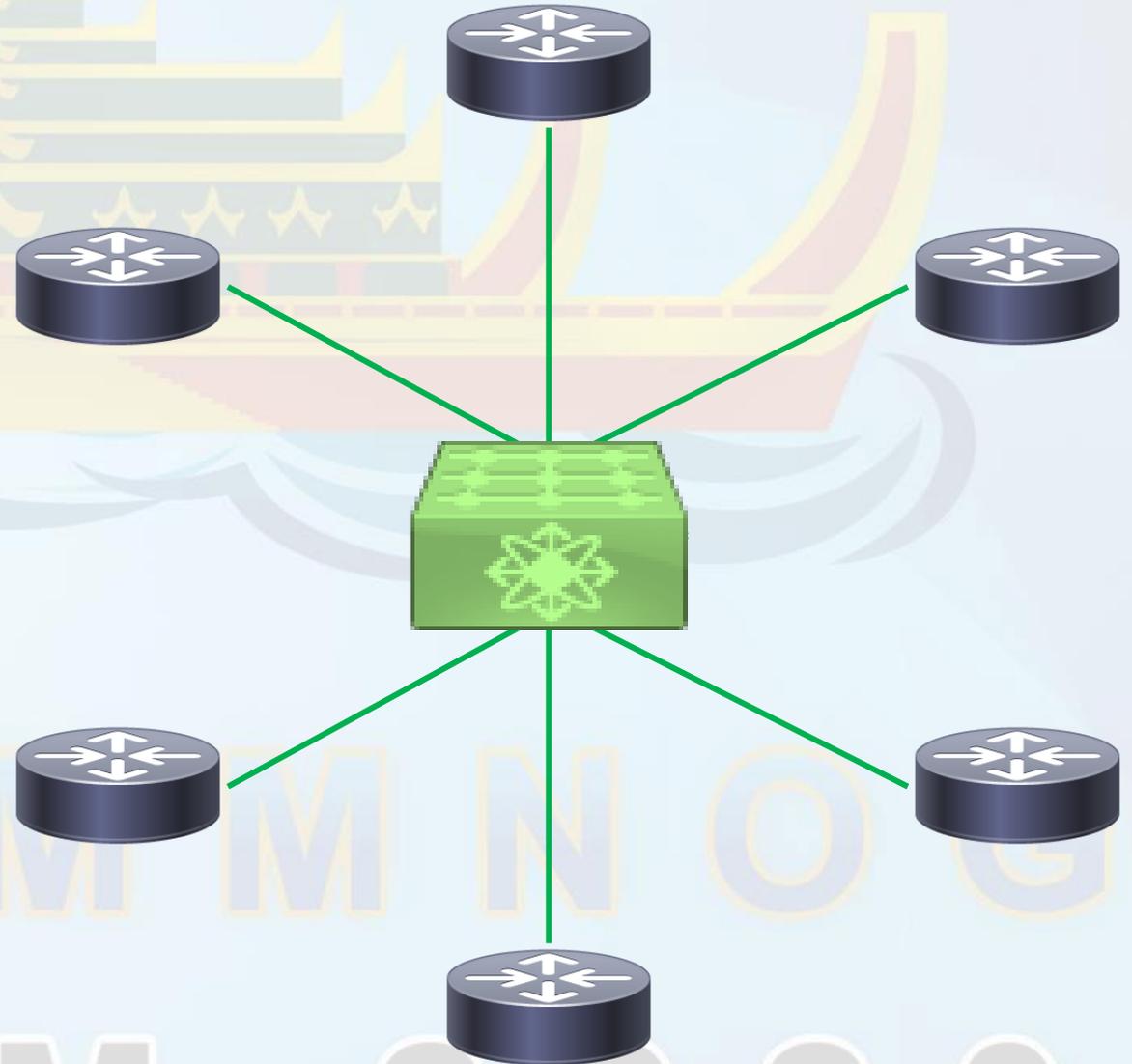| Version:	0.1
Last Update:	18-Oct-2019

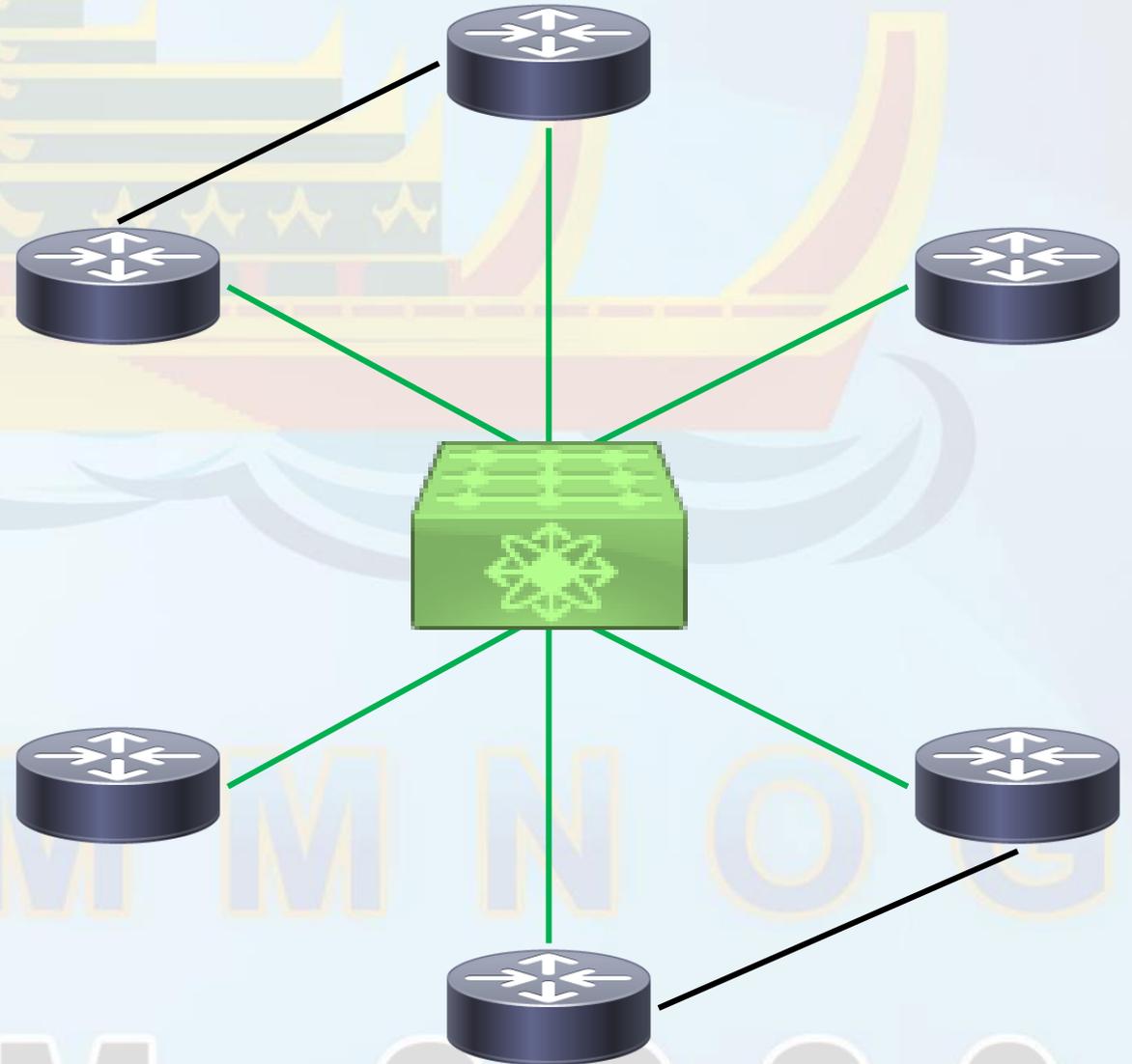# Direct Peering

Full Mesh:
Highly transmission cost
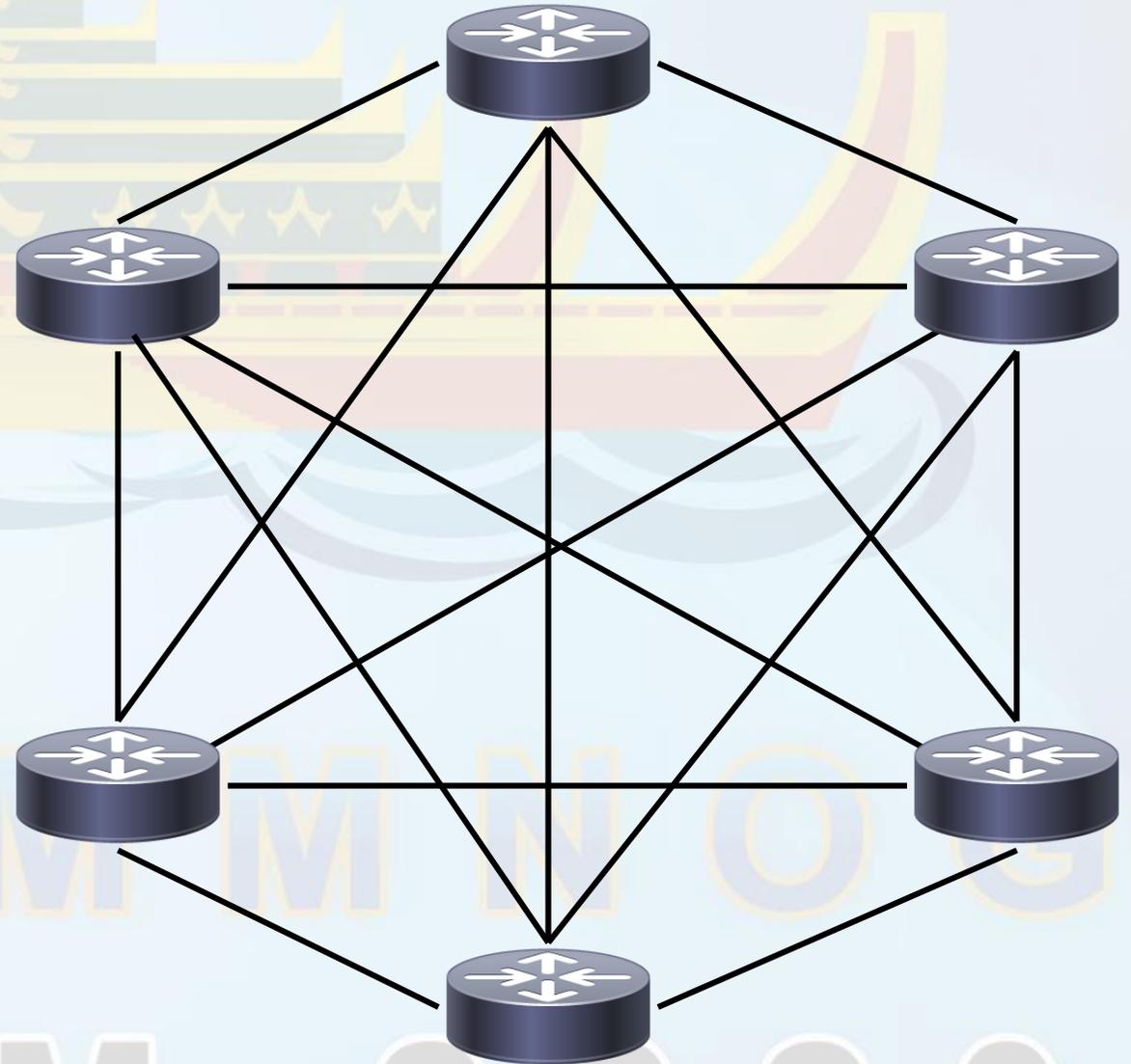
Peer with an IXP

Full Mesh with
Low transmission cost

Hybrid
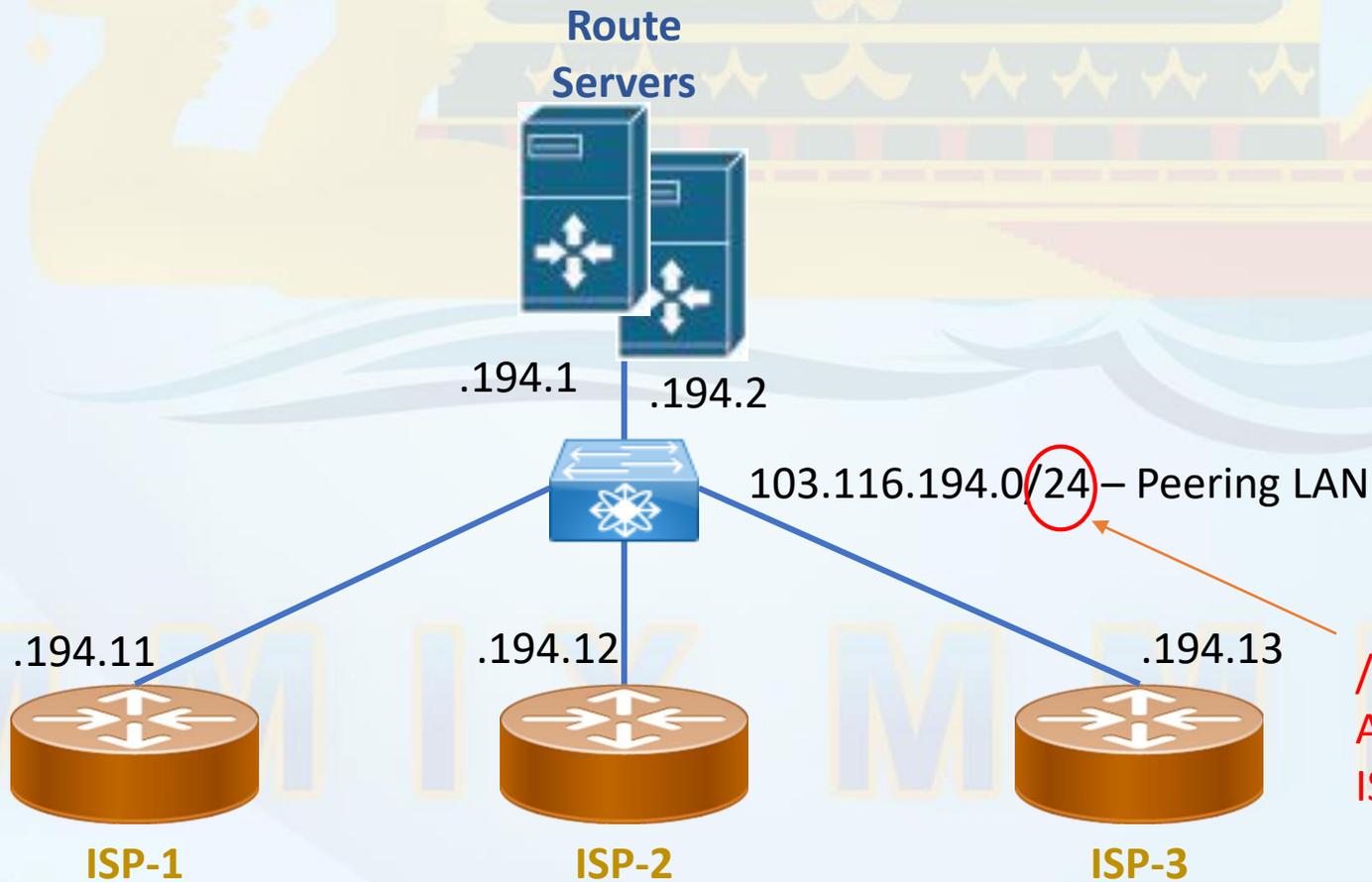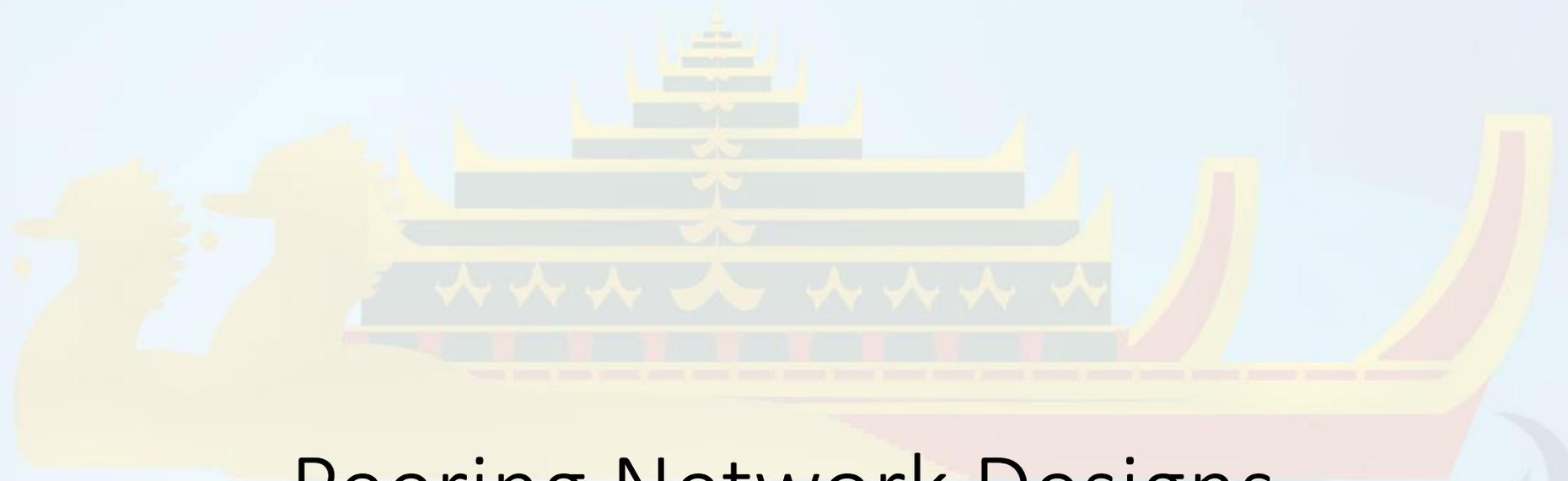
Use for highly critical data access over direct link while exchange link is for backup.

Layer 2 Transparent Internet Exchange

Route Servers

.194.1   .194.2

103.116.194.0/24 – Peering LAN

.194.11   .194.12   .194.13

ISP-1   **ISP-2**   **ISP-3**

/24
All peers are on the same layer 2 network
ISP to ISP is BGP one hop away only.

Peering Network Designs Connecting to an IXP

Typology 1: Simple ISP

This Topology is for

- Small ISP or Enterprise

- Who doesn't sell IP Transit

- Who doesn't have dedicated Peer Router.

Possible Problem(s)

- Outbound traffic of other Peers can pass through your IP Transit.

Single router connects both Internet and IXP

Edge/Transit
Router

**ISP-1
Core**

Internet

IXP

Prefixes announcement

ISP-1 Core

Local Routes →

← Peer Routes
Default GW
Partial Routes

Local Routes →

← Default GW
Partial Routes

Internet

Local Routes ↓   Peer Routes ↑

IXP

Traffic Flow – seems fine but

ISP-1 Core

Internet

IXP

IX Traffic Flow

IP Transit Traffic Flow

Problem : Peer's outbound

ISP-1 Core

Internet

Other Peer(s)' outbound can pass your network

IX Traffic Flow

IP Transit Traffic Flow

Peer's outbound

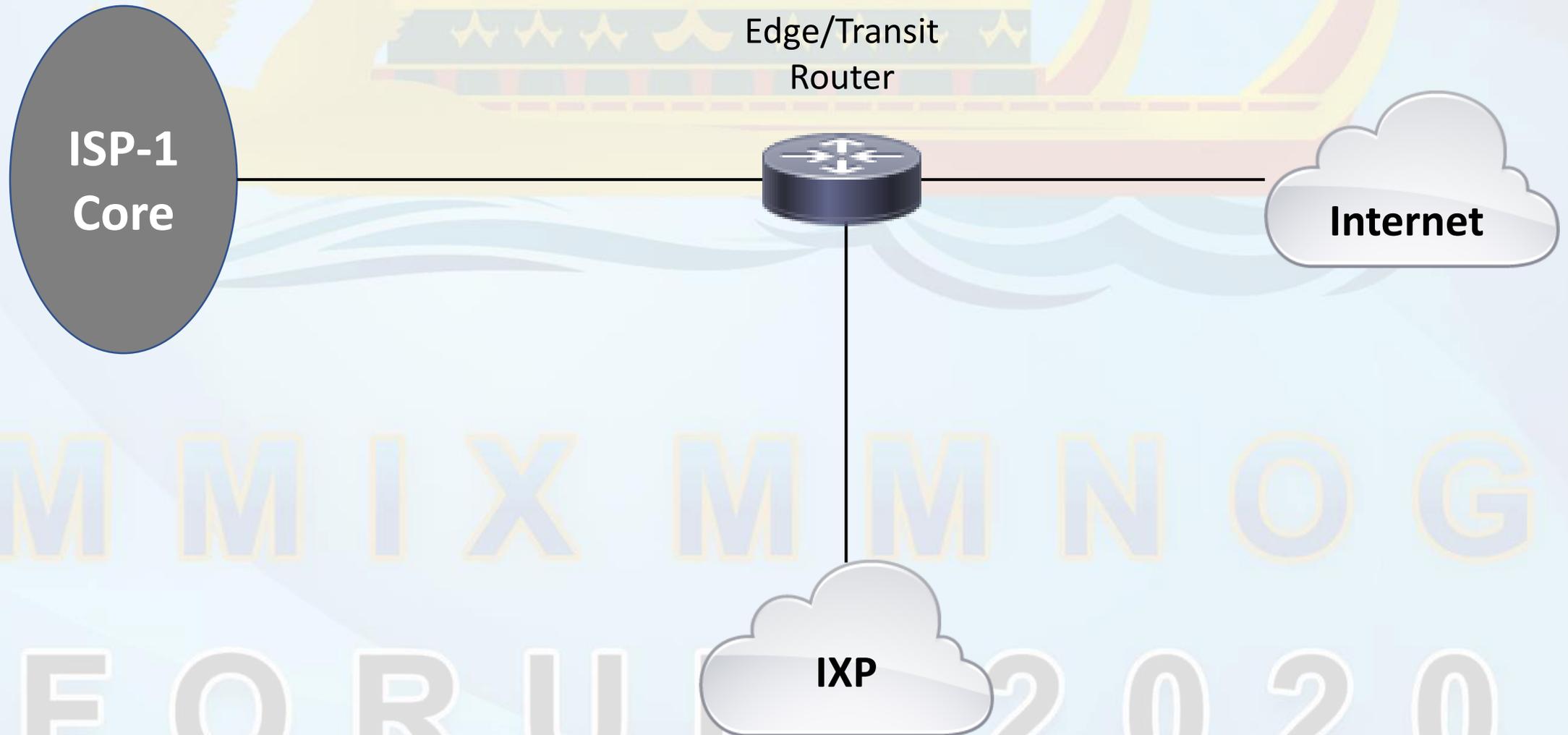**PEER-1** **To Internet using default-gw**

IXP
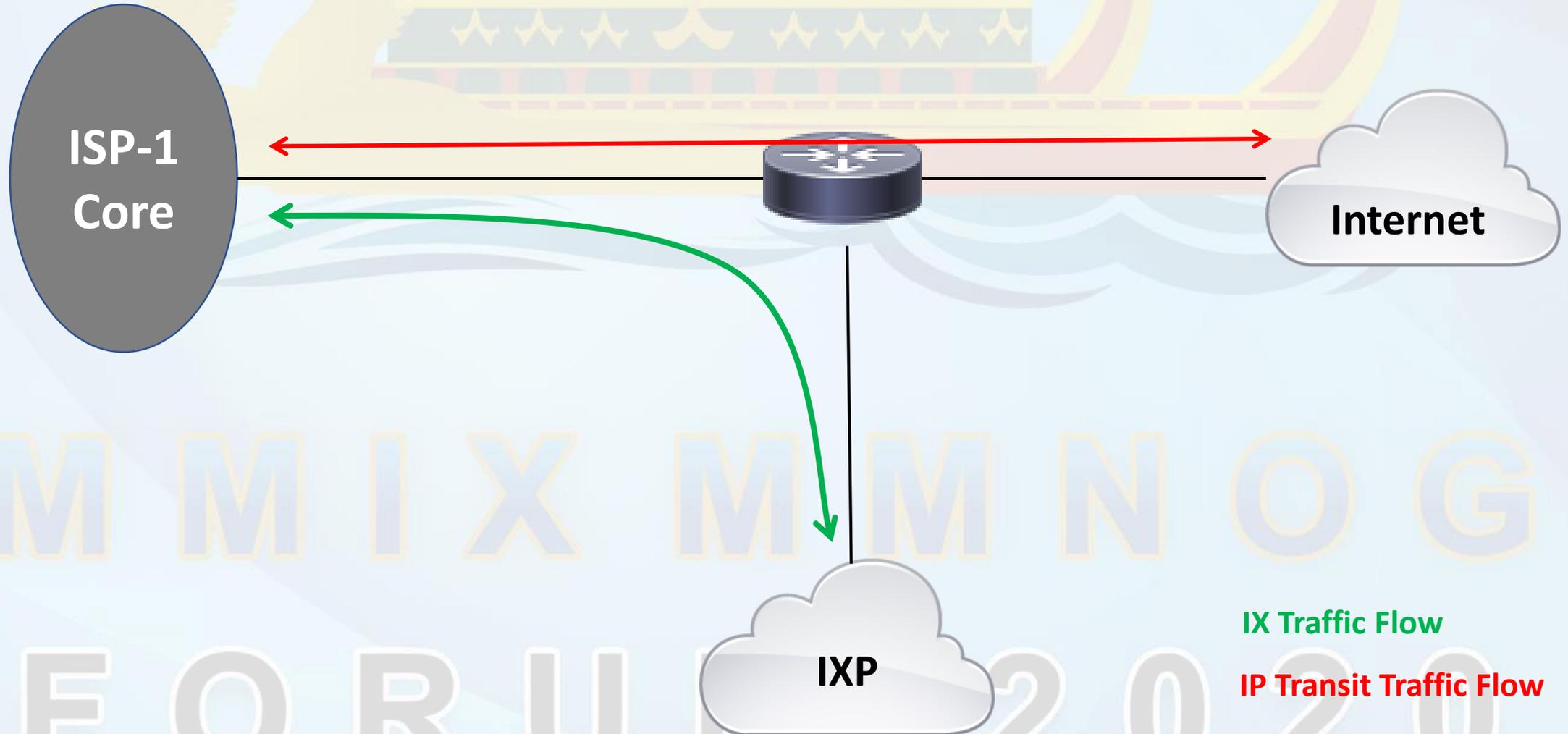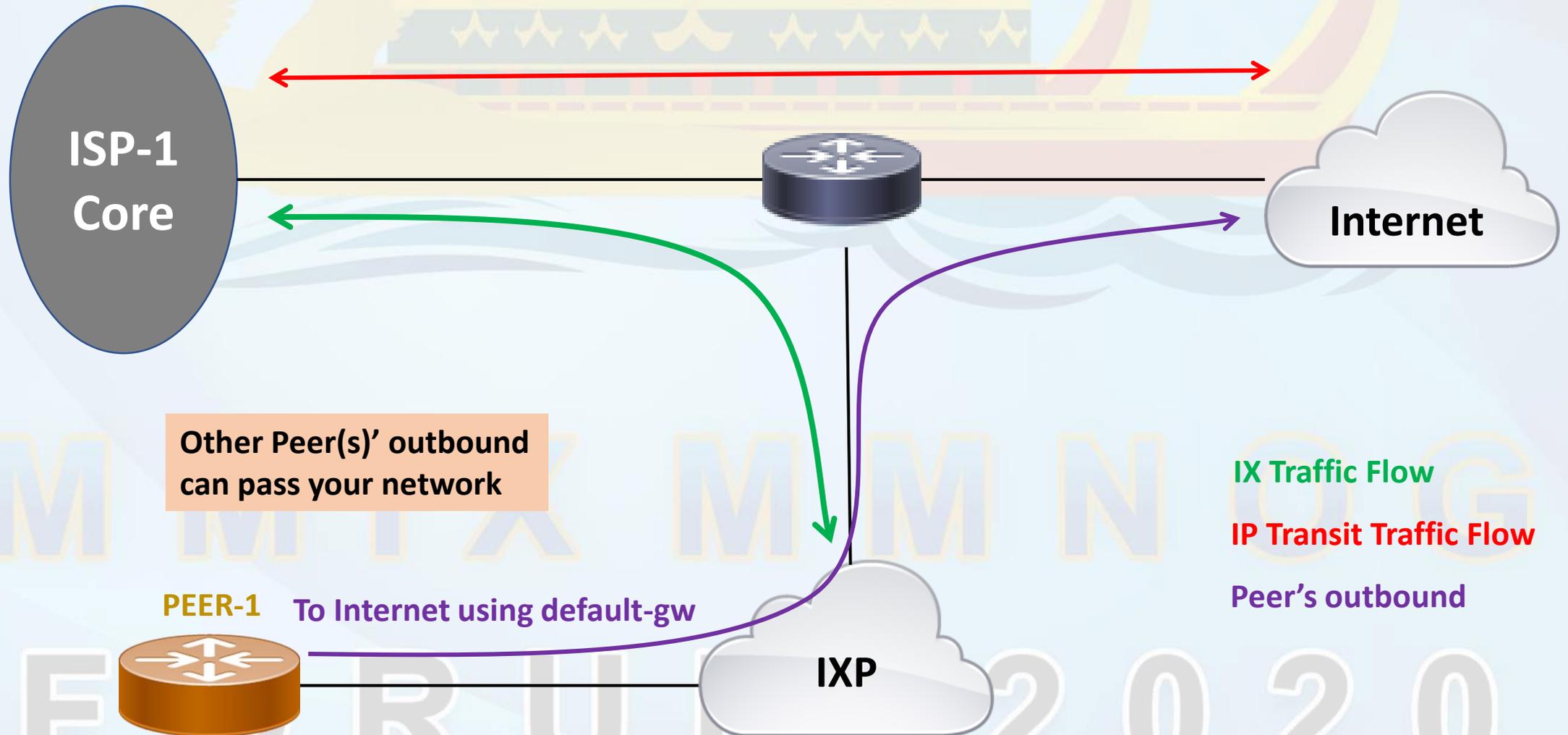
Typology 2: Simple ISP with Peer Router

This Topology is for

- Small ISP or Enterprise
- Who doesn't sell IP Transit
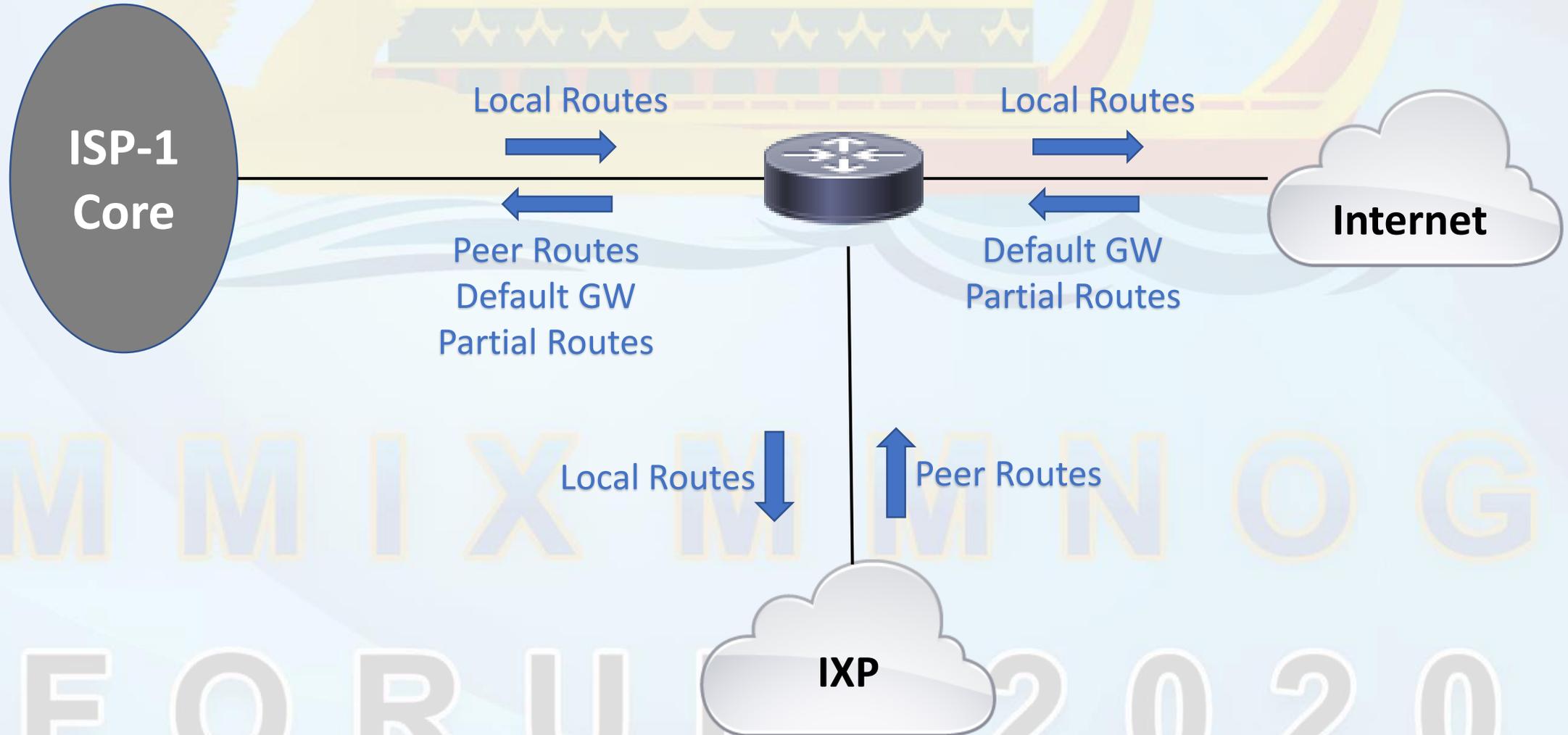- Who has dedicated Peer Router.

Topology-2: with Dedicated Peer Router

Edge/Transit
Router

**ISP-1
Core**

Internet

Local Routes   IX Routes

Peer Router   NO DEFULT GW

Local Routes   IX Routes

PEER-1

IXP

27-Nov-2019   13
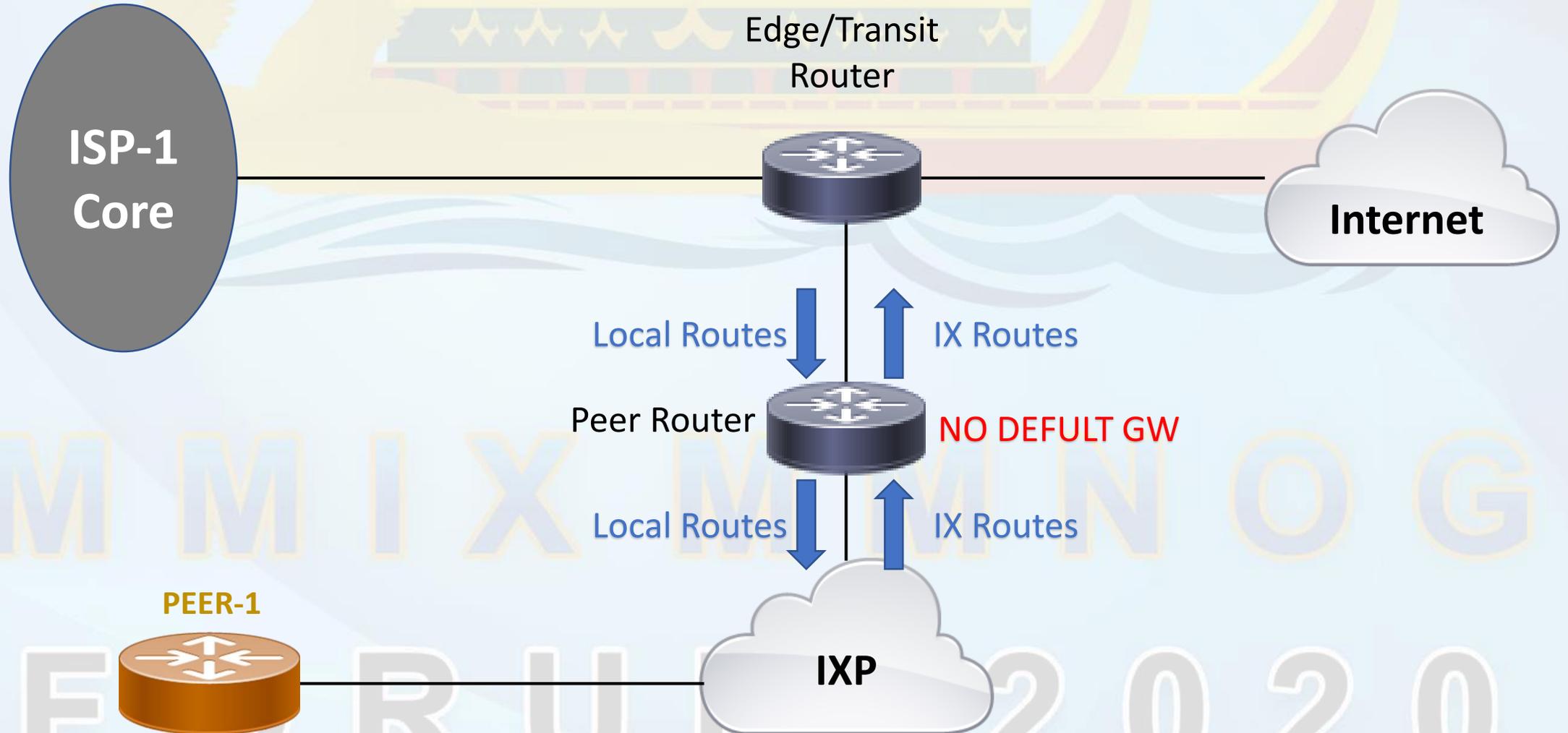
Traffic Flow shall be smooth.

Edge/Transit
Router

**ISP-1
Core**

Internet

**Other Peer(s)' outbound
cannot use your Transit link**

PEER-1

IXP
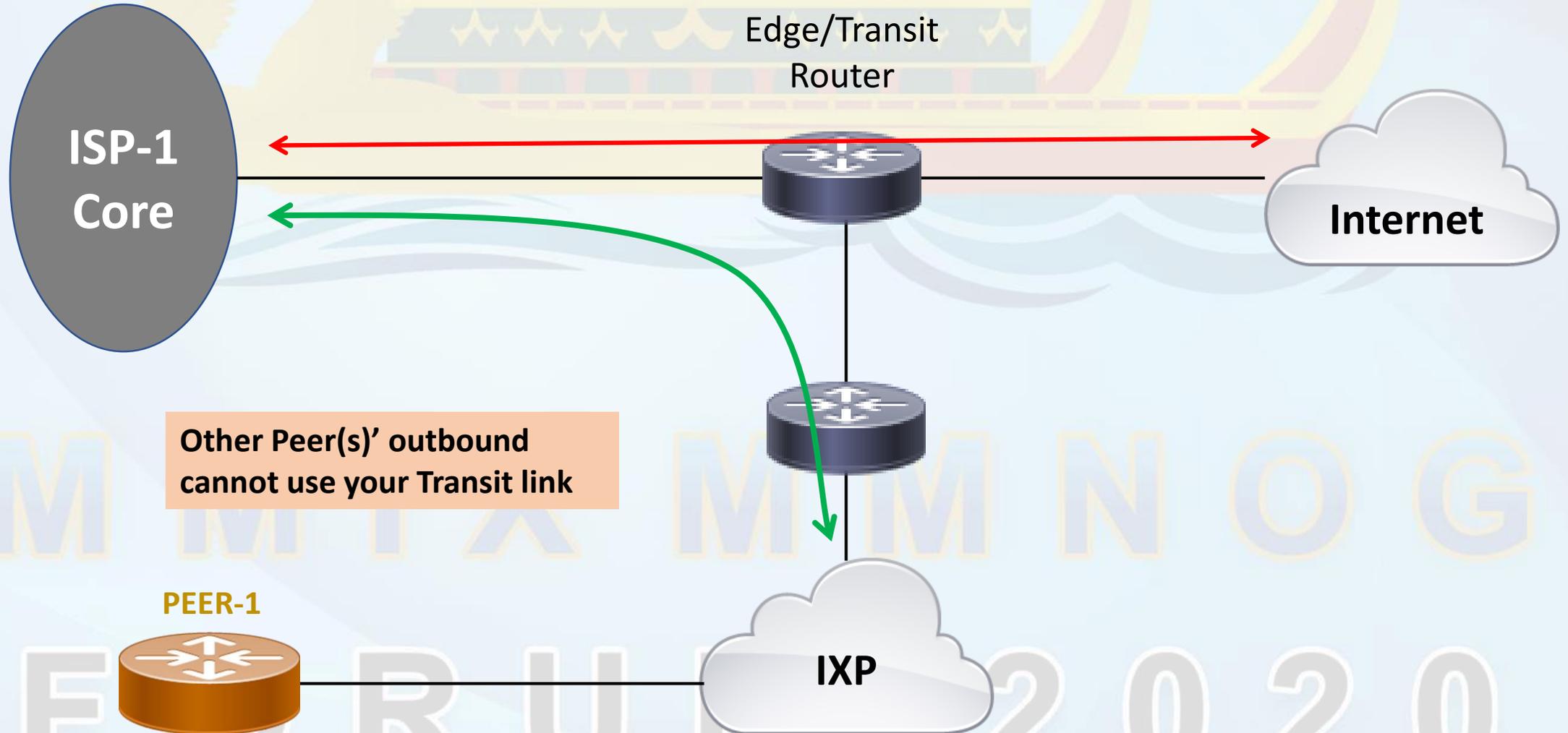
Typology 3: Simple Transit Provider

This Topology is for

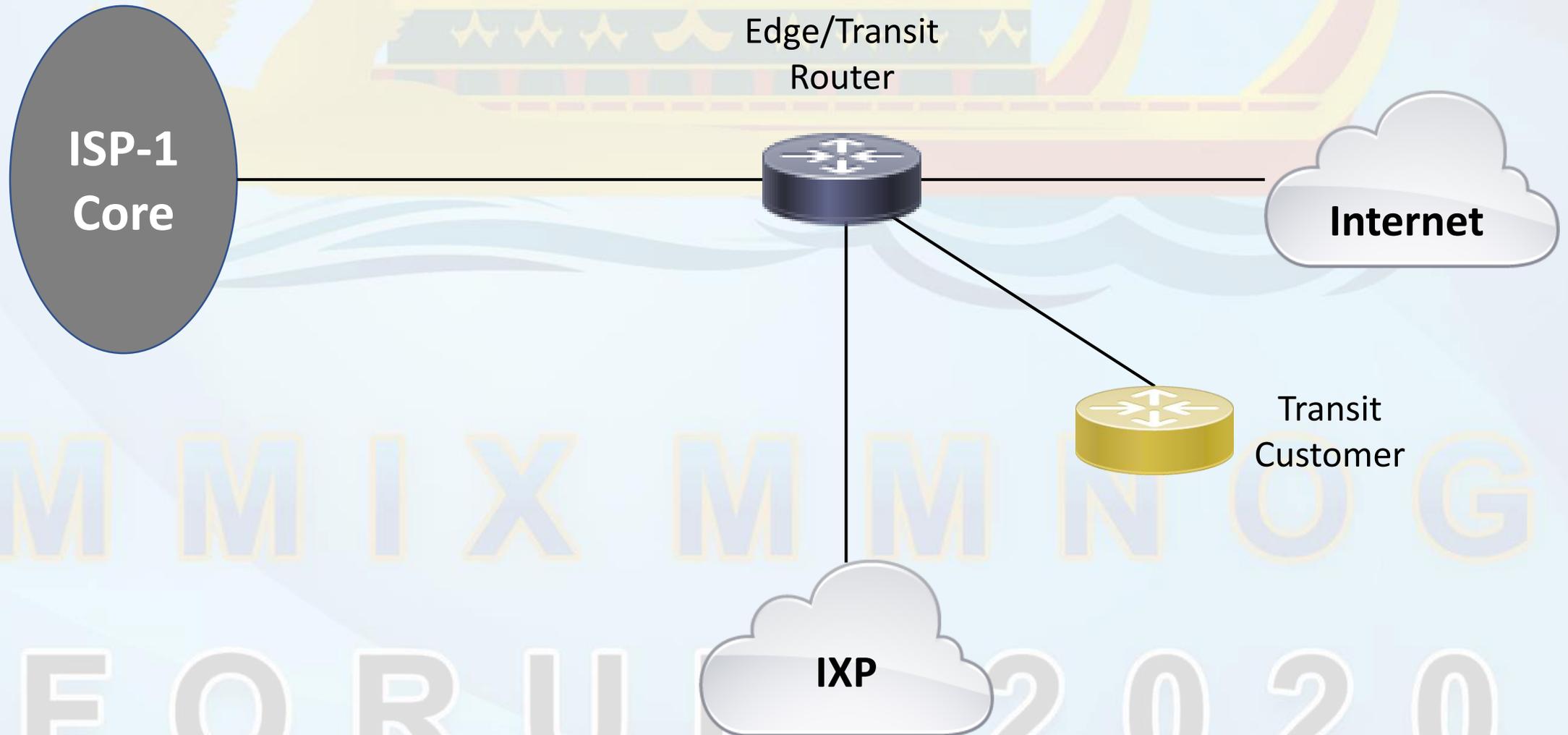- Transit Service Provider

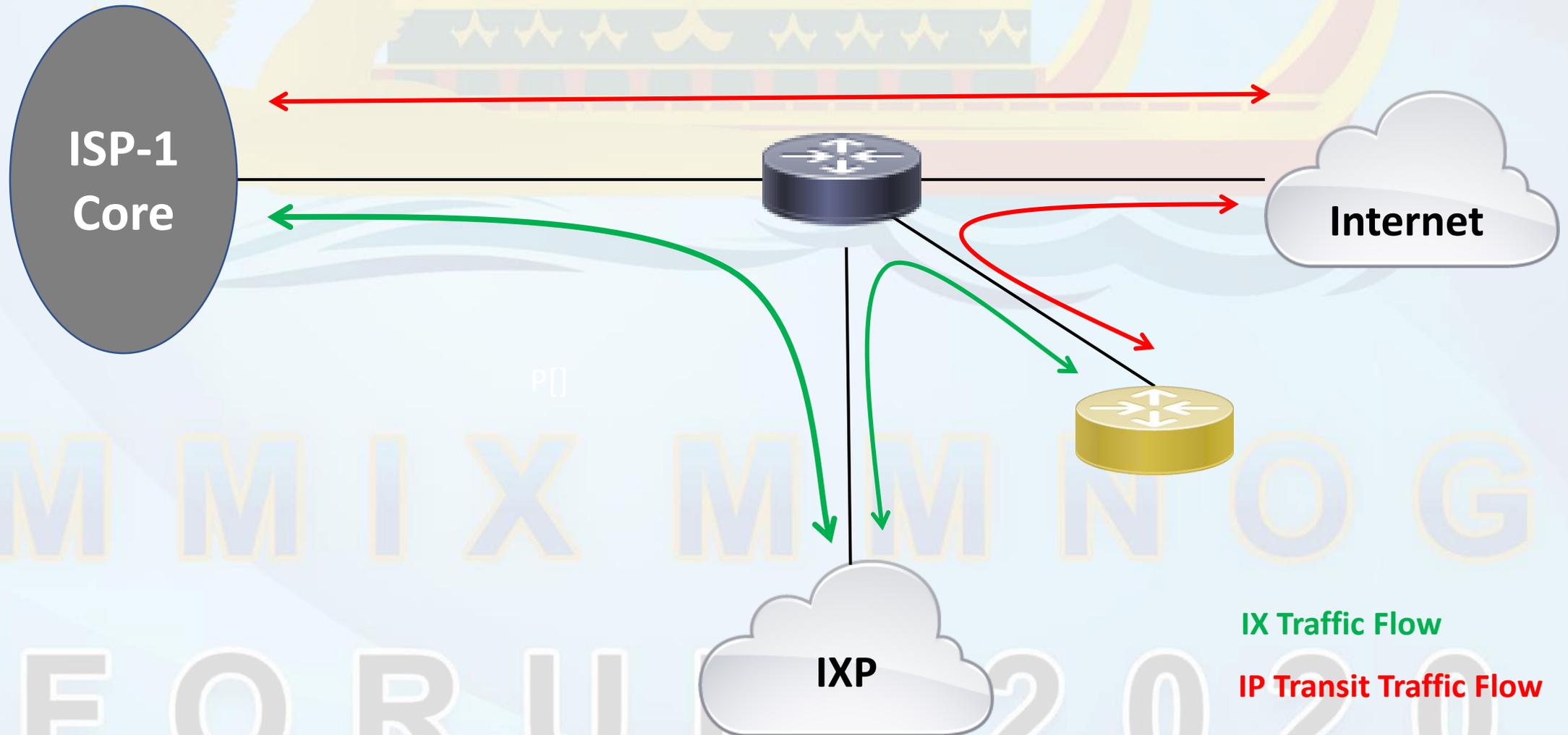- Who doesn't have dedicated Peer Router.

Possible Problem(s)

- IP Transit traffic can pass through IX networks

- Downstream traffic can get asymmetric traffic paths.

Single router connecting both Internet and IX

Edge/Transit
Router

ISP-1
Core

Internet

Transit
Customer

IXP

Traffic Flow – seems smooth but

ISP-1 Core

Internet

P[]

IXP

IX Traffic Flow

IP Transit Traffic Flow

Problem: Asymmetric Traffic Paths -1

ISP-2 prefixes are announced to Transit

ISP-1 Core

Internet

When prefixes of ISP-2 are blocked 🚫

Peer-1 prefixes will be received via IXP

ISP-2

PEER-1

IXP

Problem: Asymmetric Traffic Paths -2

Peer-2 prefixes are received from Transit Path

ISP-1 Core

Internet

When Peer-1 prefixes are blocked

ISP-1 prefixes are announced to IXP

ISP-2

IXP

PEER-1

Problem: Asymmetric Traffic Paths -3

Peer-1 prefixes are received from Transit Path

ISP-1 Core

Internet

When Peer-1 prefixes are blocked

ISP-2 prefixes are announced to IXP

ISP-2

PEER-1

IXP

When Transit Customer connects to IX

ISP-1 Core

Edge/Transit Router

Internet

Transit Customer

IXP

Prefix Announcement Between ISP-1 and Transit Customer

Problem: Traffic via unwanted path

ISP-1 Core

Edge/Transit Router

Internet

Can Choose only one Path

Transit Customer

IX Traffic Flow

IP Transit Traffic Flow

IXP
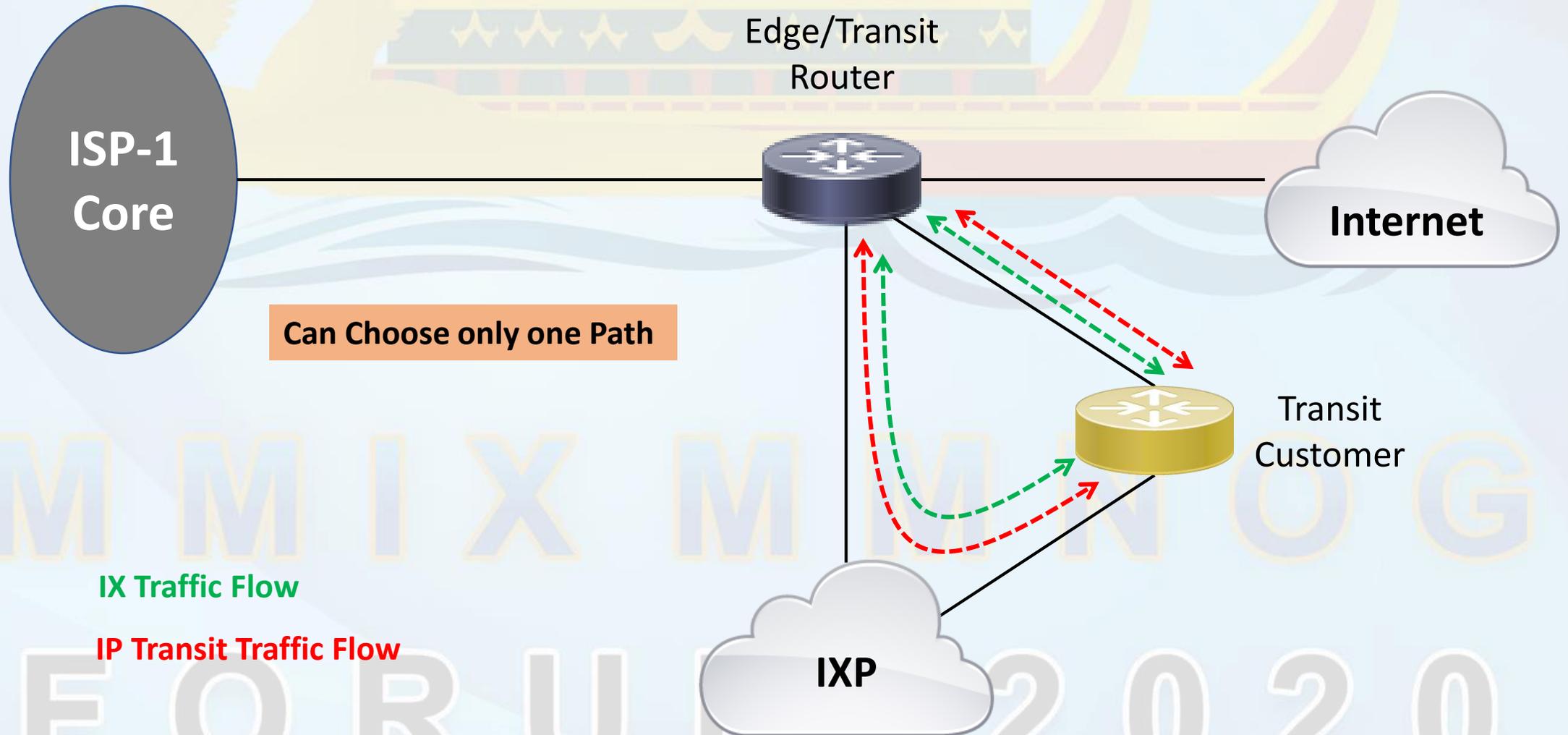
Typology 3: Recommendation

- Announce all prefixes of your downstream the same like your owned prefixes.

- If need to filter specific peer prefixes, also stop announcement of all prefixes to that peer.

- Adjust BGP parameters to your downstream who is also connecting to IX. So, both Transit & local traffic shall go via Transit link. <downstream may not happy ☹ >

- Try to deploy another router for peering. <please refer to next topologies>

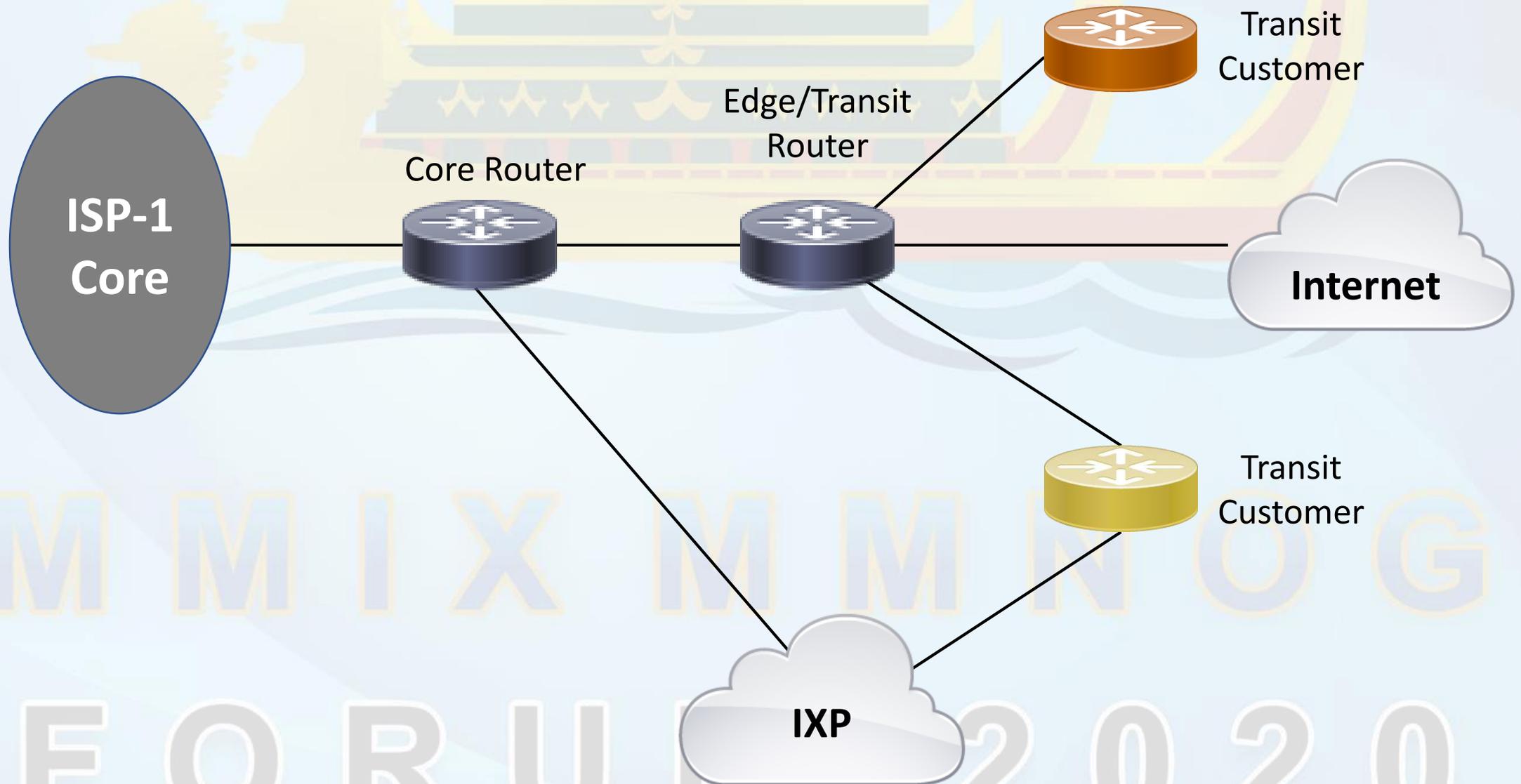# Typology 4: Transit Provider, Peer at next level

This Topology is for

- Transit Service Provider

- Without Dedicated Peer Router(s).
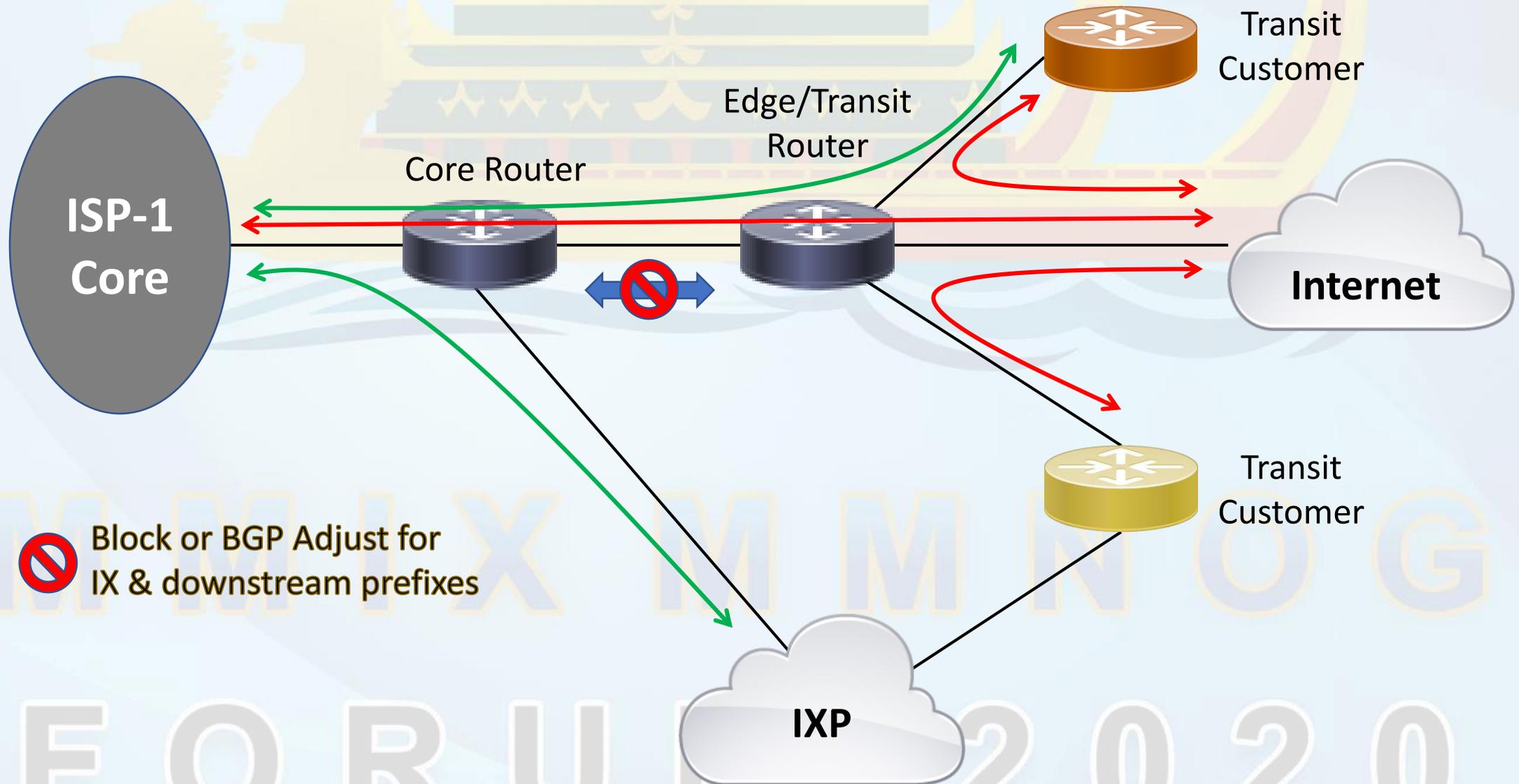
- But using another router for peering.

Possible Problem(s)

- Traffic Engineering is not easy.

- Outbound traffic of other Peers can pass through your IP Transit.

Peer from different router

Transit Customer

Edge/Transit Router

Core Router

ISP-1 Core

Internet

Transit Customer

IXP

Traffic flow – seems fine but

ISP-1 Core

Core Router

Edge/Transit Router

Transit Customer

Internet

Transit Customer

IXP

Block or BGP Adjust for IX & downstream prefixes

Peer's outbound can pass your Transit

ISP-1 Core

Core Router

Edge/Transit Router

Transit Customer

Internet

Transit Customer

PEER-1 **To Internet using default-gw**

IXP
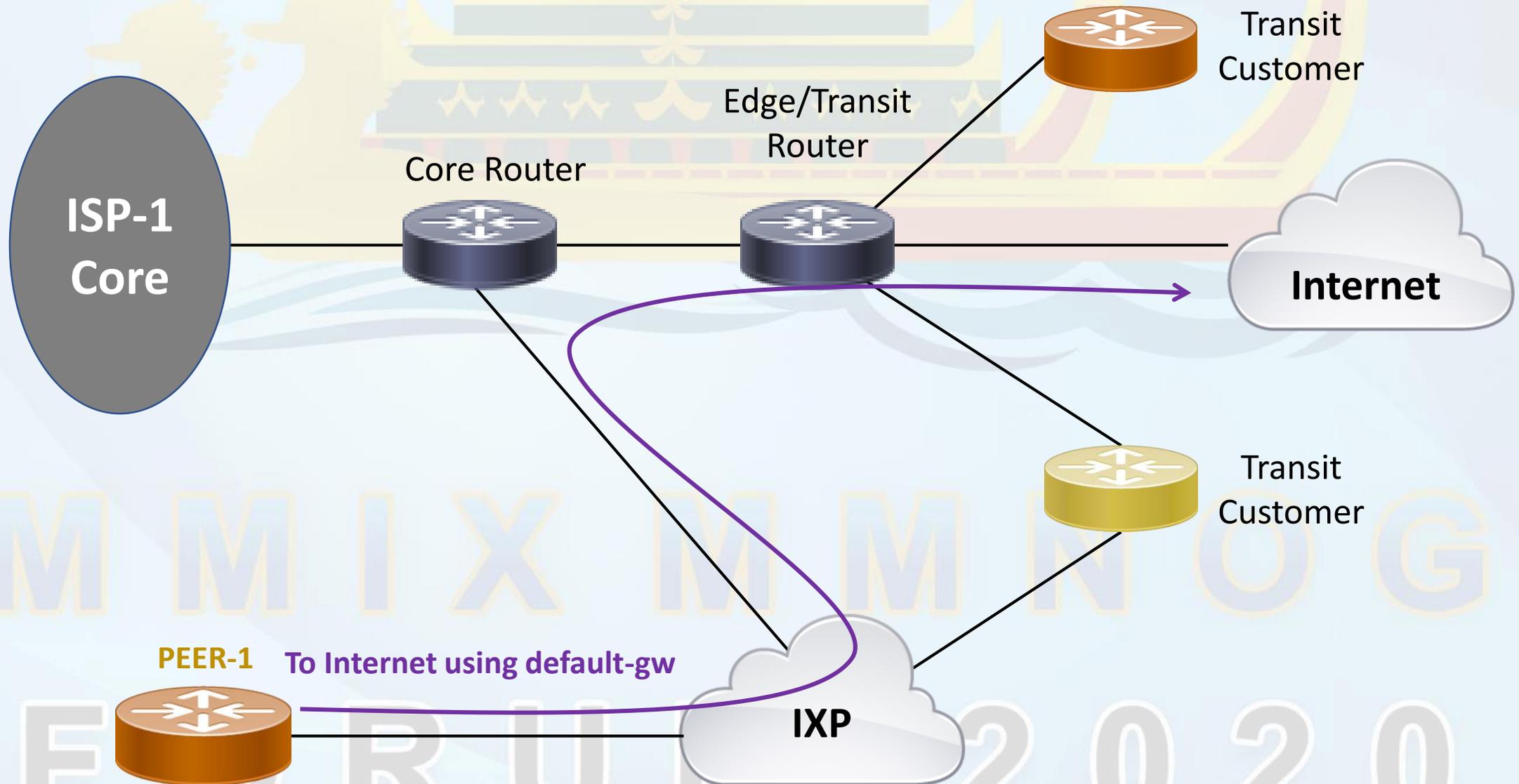
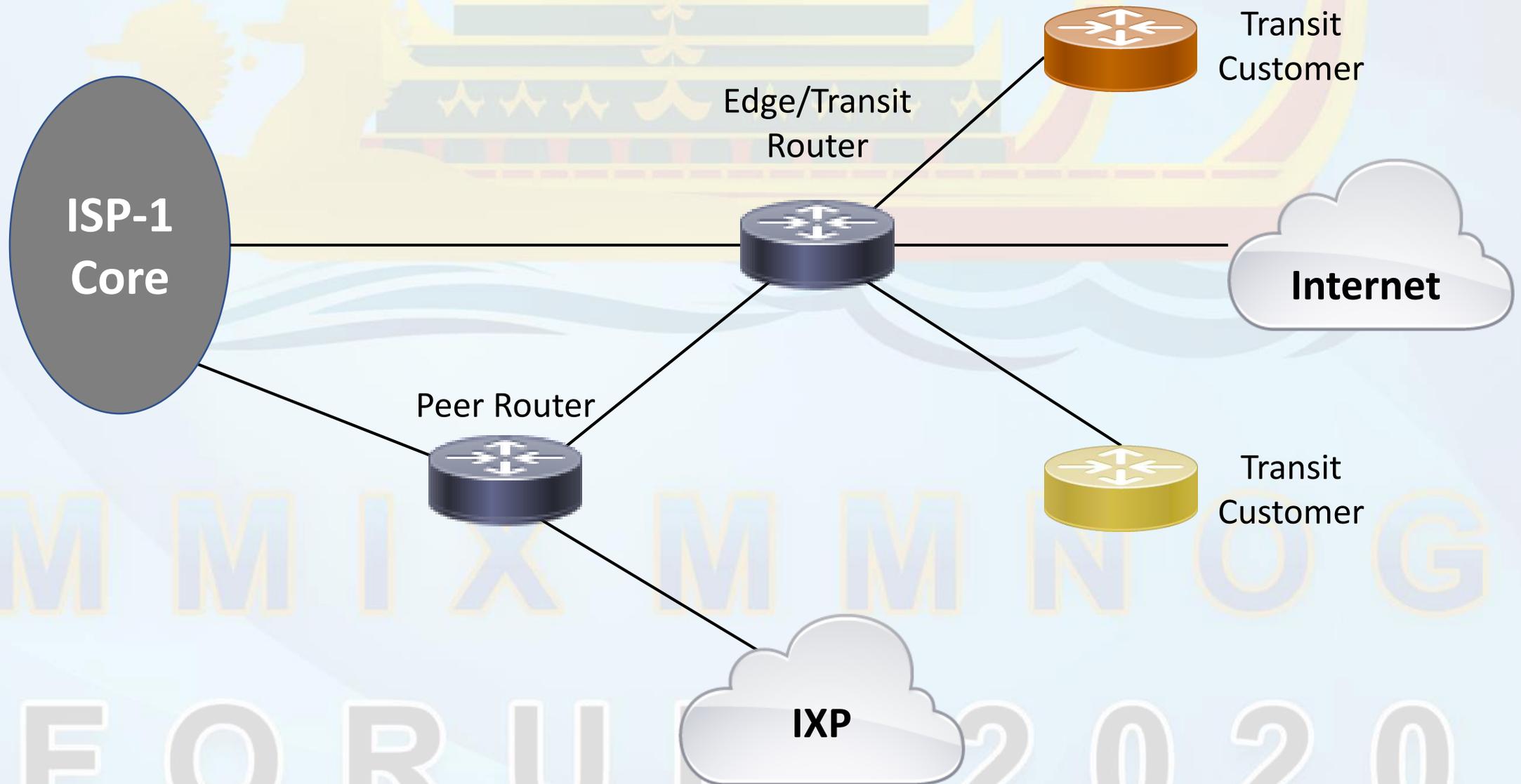# Typology 5: Transit Provider with Dedicated Peer Router(s)

This Topology is for

- Transit Service Provider
- With Dedicated Peer Router(s).
- But Flat BGP Network (Single AS)

Possible Problem(s)

- Traffic Engineering is not easy.

With Dedicated Peer Router
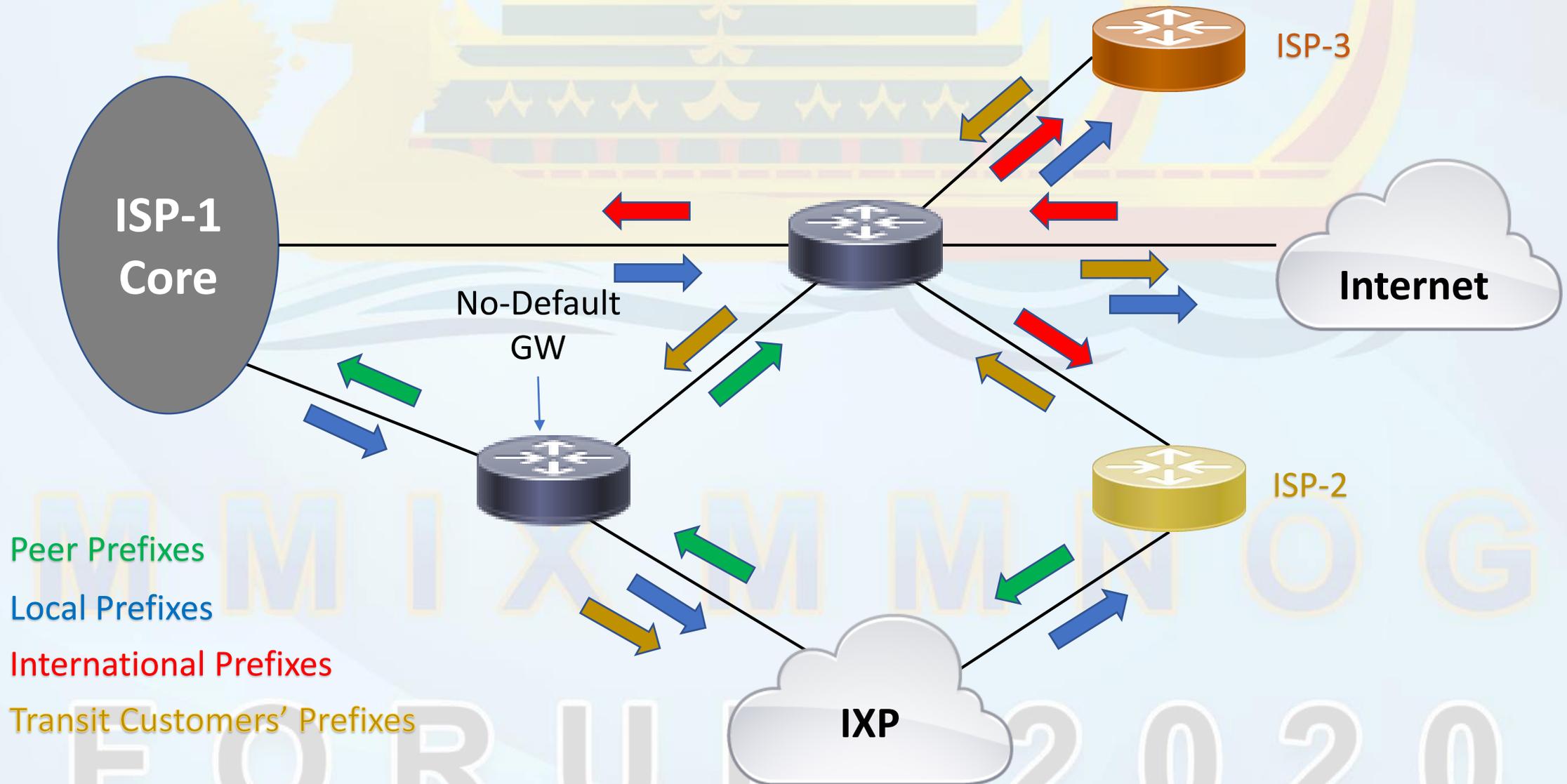
ISP-1 Core

Edge/Transit Router

Transit Customer

Internet

Peer Router

Transit Customer

IXP

When Transit Customer connects to IX

ISP-3

ISP-1
Core

No-Default
GW

Internet

ISP-2

Peer Prefixes

Local Prefixes

International Prefixes

Transit Customers' Prefixes

IXP

When Transit Customer connects to IX

Prefixes Announcement of downstream

ISP-3

ISP-1 Core

Internet

ISP-2

IXP

ISP-2 Prefixes

ISP-3 Prefixes

🚫 Block or adjust bgp

When Transit Customer connects to IX

Prefixes Announcement to downstream

ISP-1 Core

ISP-3

Internet

ISP-2

IXP

ISP-1 Prefixes

🚫 Block or adjust bgp

27-Nov-2019

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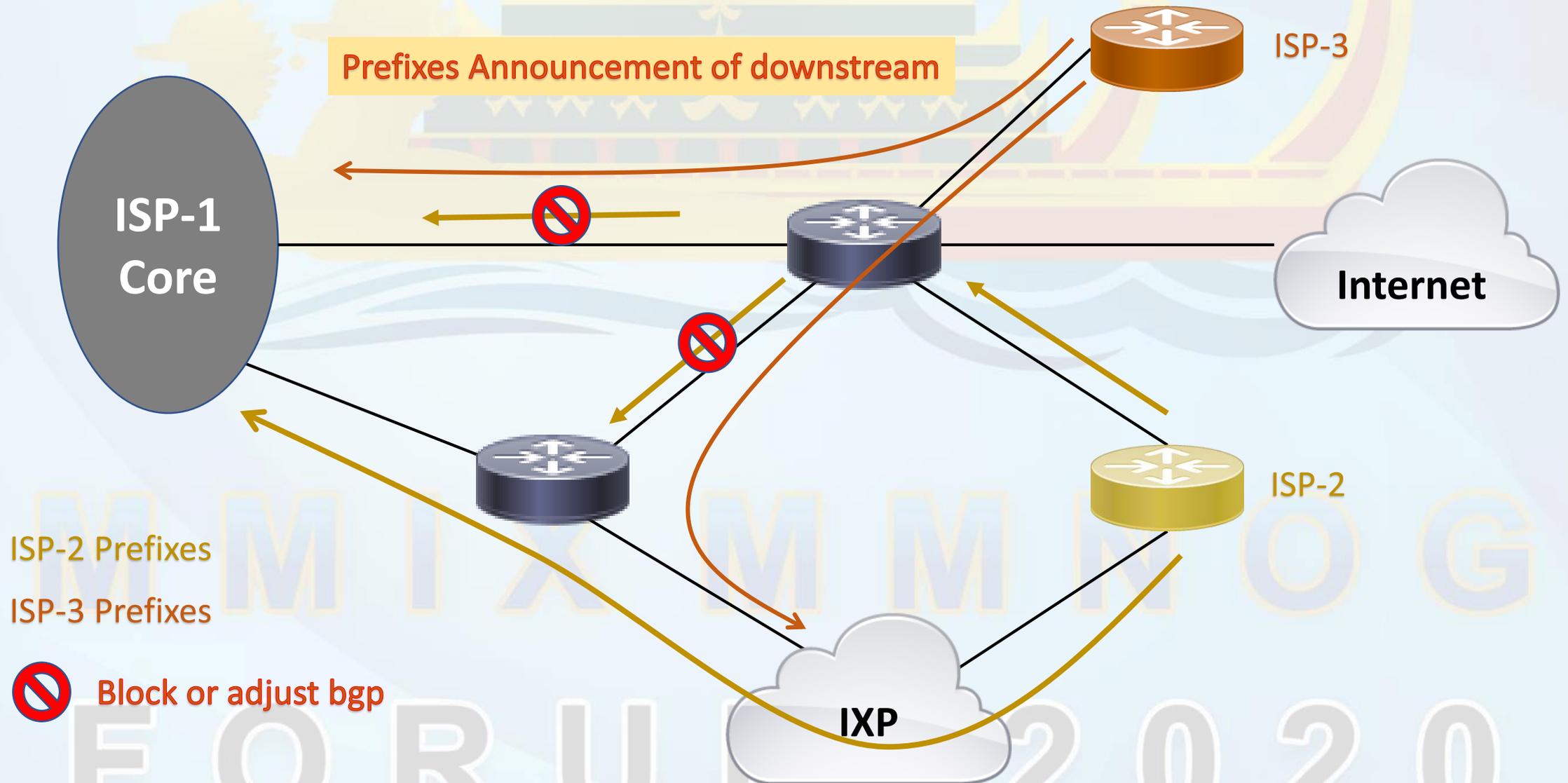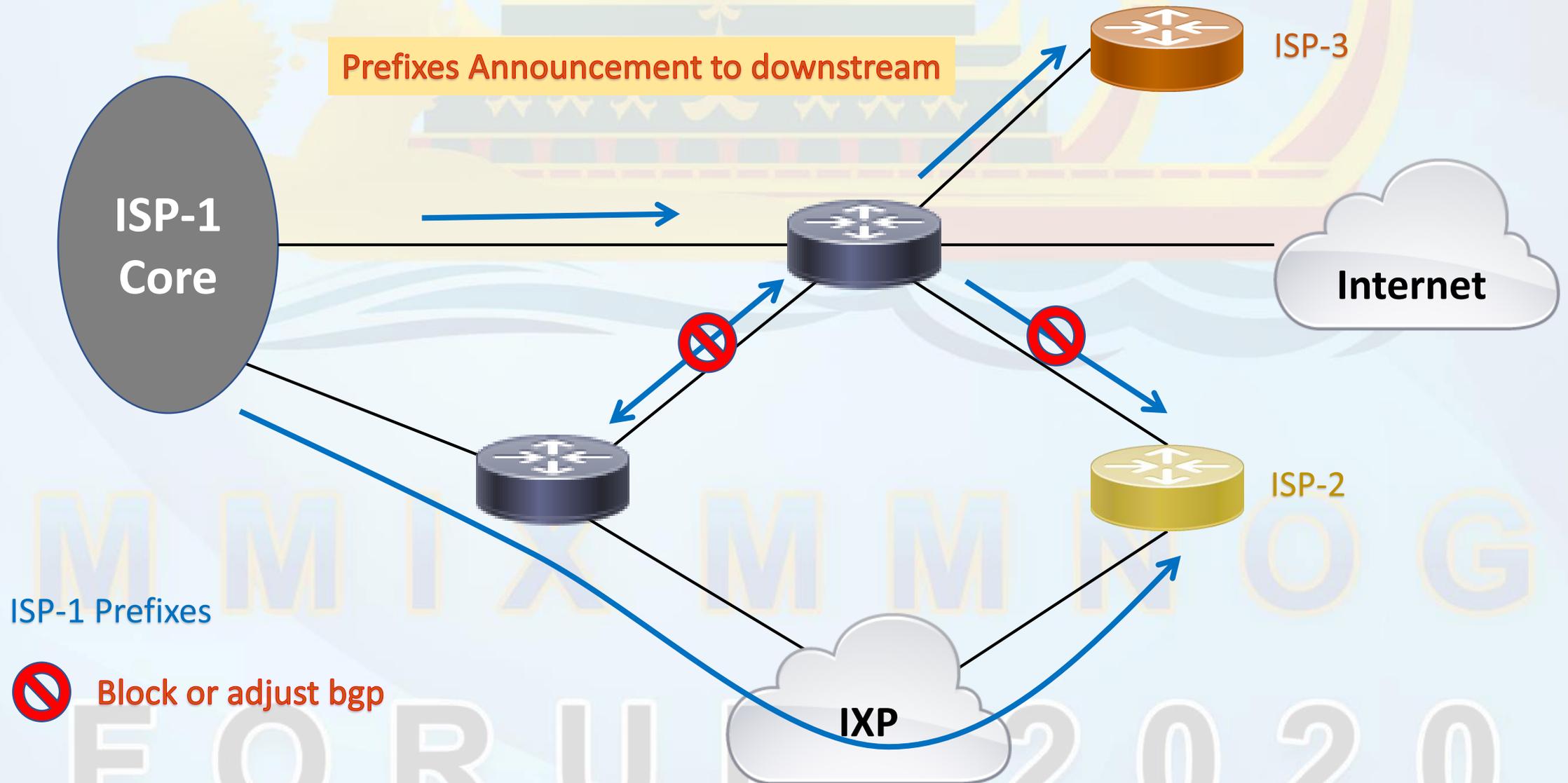
Traffic Flow shall smooth with careful BGP adjustment

Peer flow

Transit Flow

ISP-1 Core

Internet

IXP
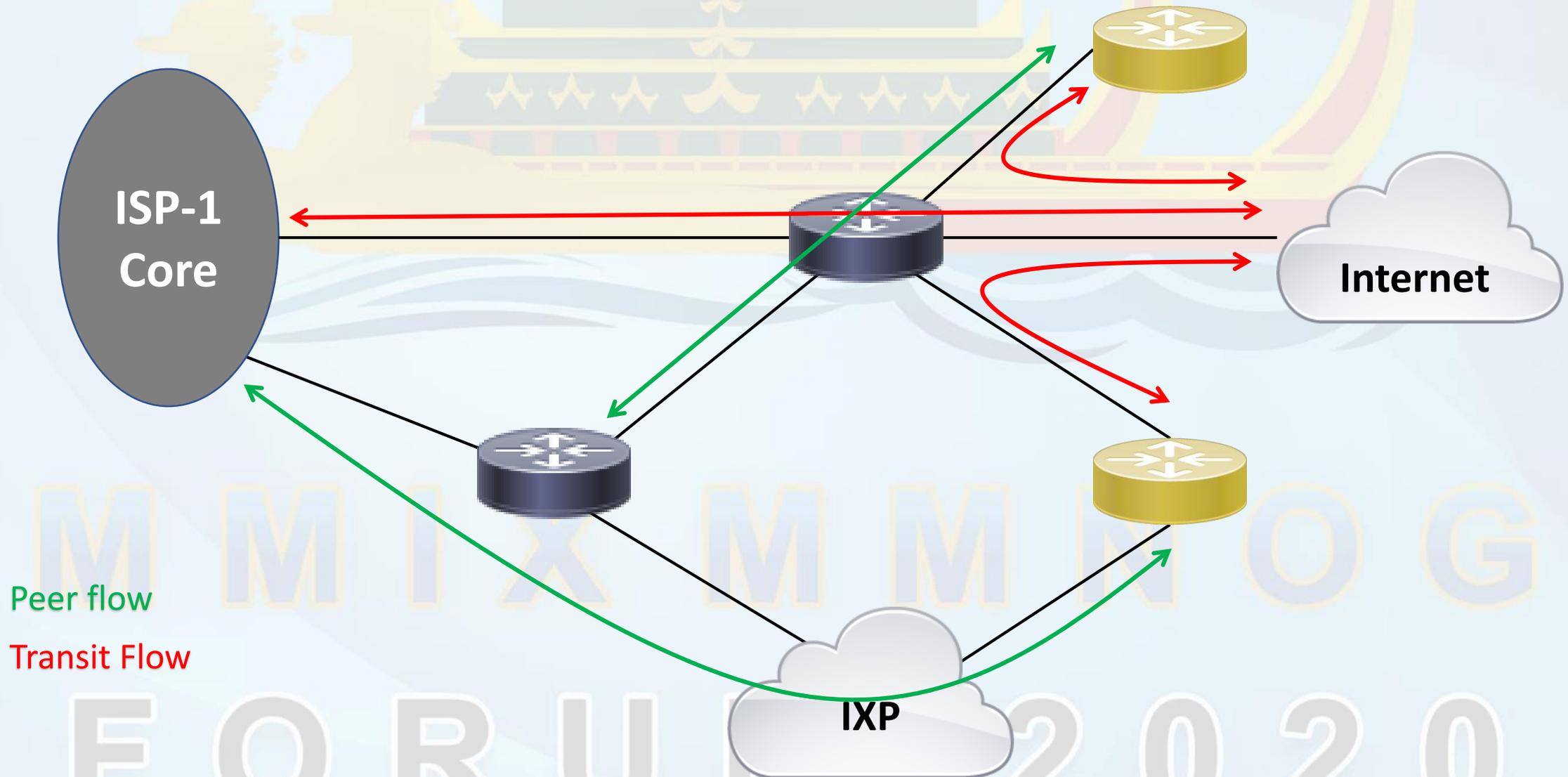
BGP and Traffic Engineering

AS-1001

ISP-1 Core

Edge/Transit Router

Transit Customer

Internet

Peer Router

Single-Hop

Transit Customer

IXP
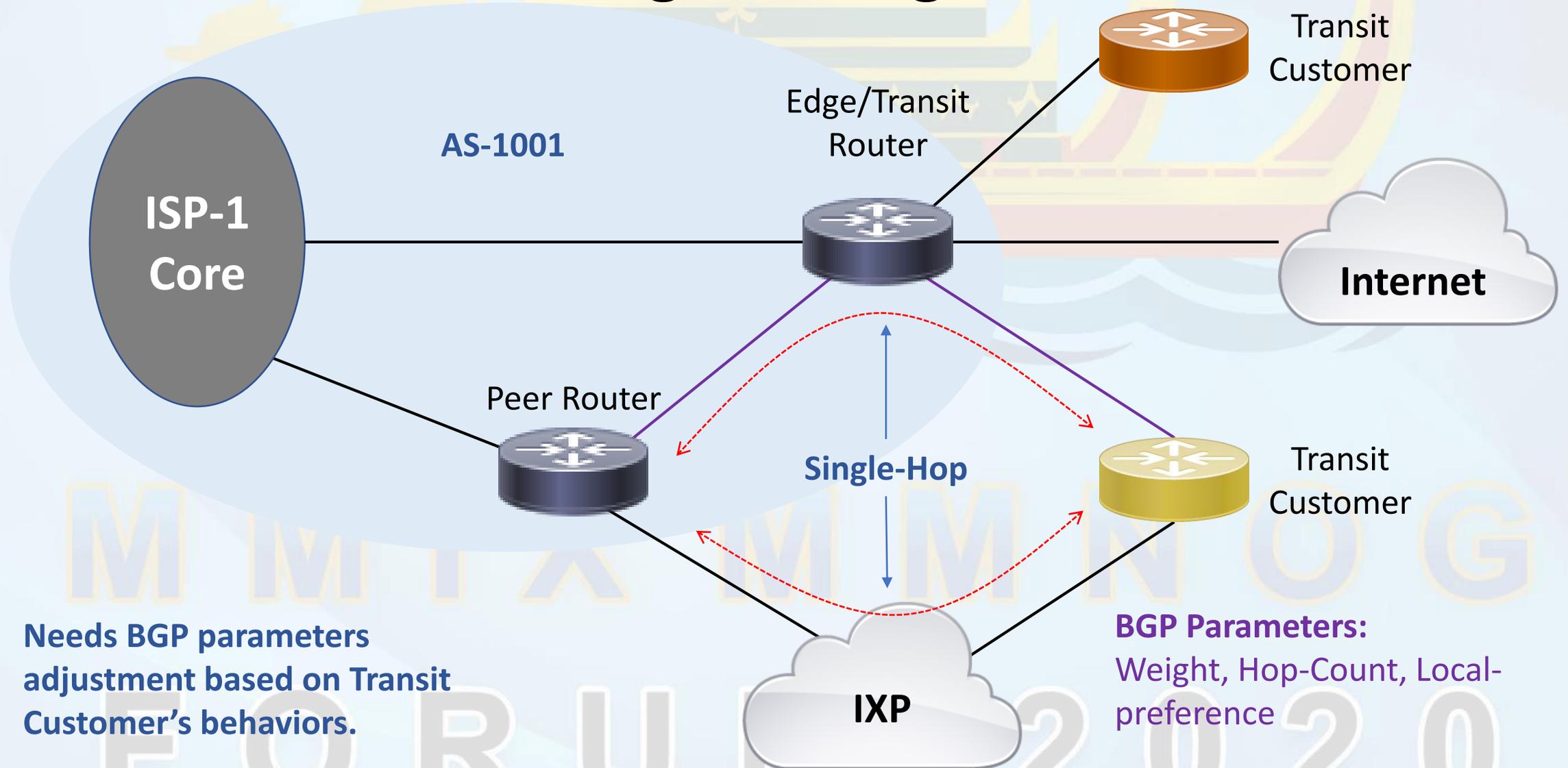
Needs BGP parameters adjustment based on Transit Customer's behaviors.

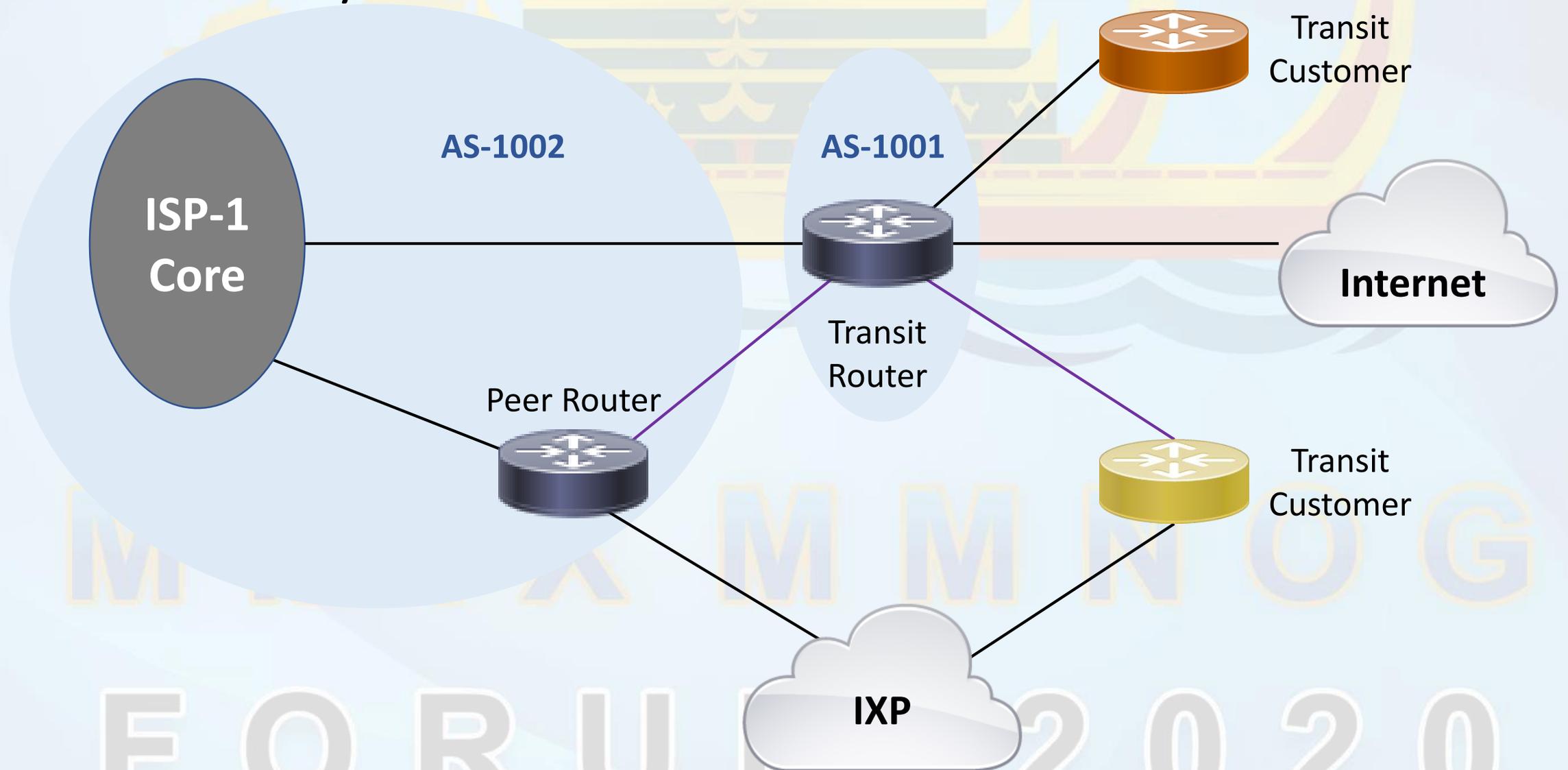**BGP Parameters:** Weight, Hop-Count, Local-preference
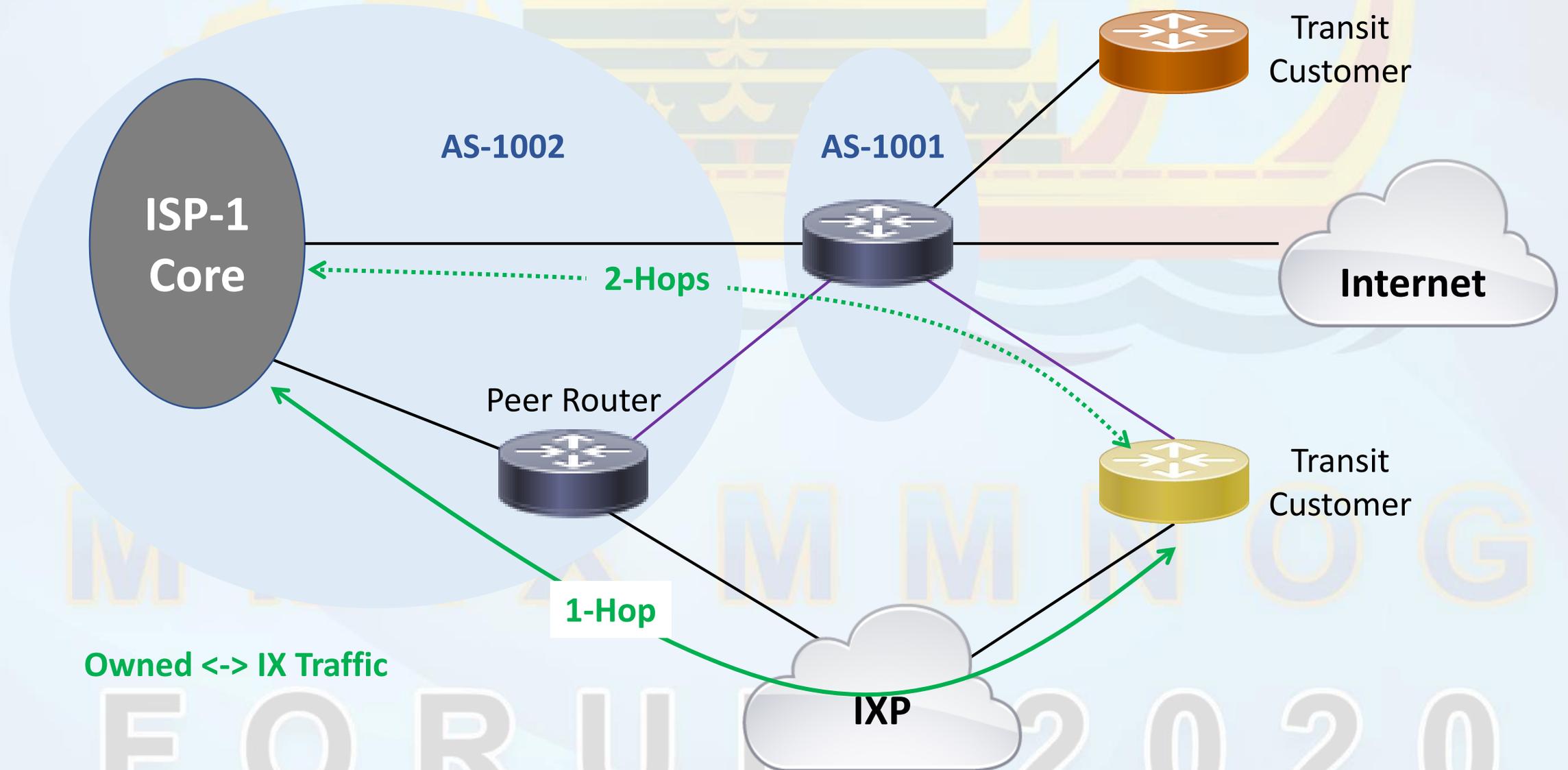
Typology 6: Hierarchy Transit Provider

This Topology is for

- Transit Service Provider

- With hierarchy Network Structure

- With at least 2 ASNs.

- Shall get optimized paths.

- Easy Traffic Adjustment.

Hierarchy Networks

AS-1002

AS-1001

ISP-1 Core

Transit Customer

Internet

Transit Router

Peer Router

Transit Customer

IXP

Local Traffic via IXP

AS-1002

AS-1001

Transit Customer

ISP-1 Core

Internet

2-Hops

Peer Router

Transit Customer

1-Hop

Owned <-> IX Traffic

IXP

IP Transit Paths for downstream

AS-1002

AS-1001

ISP-1 Core

Transit Customer

Internet

2-Hop+

1-Hop+

Peer Router

Transit Customer

IP Transit Traffic

IXP
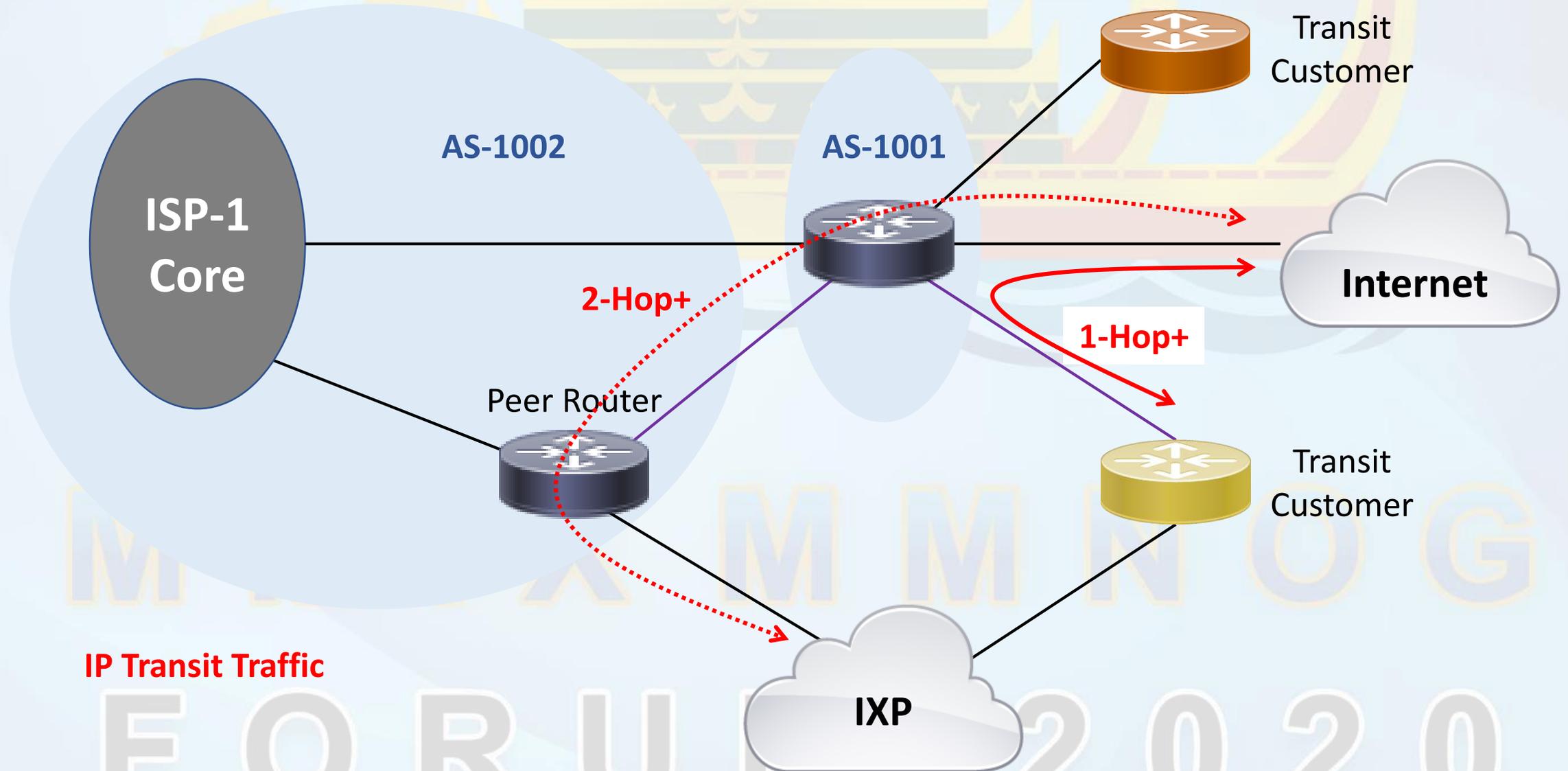
Topology Comparison

	Topo-1	Topo-2 ⭐	Topo-3	Topo-4	Topo-5	Topo-6 ⭐
	Simple ISP	Simple ISP	Transit Provider	Transit Provider	Transit Provider	Transit Provider
Peer Router(s)	No	Yes	No	Combo	Yes	Yes
Public ASN(s)	1	1	1	1	1	2+
Unwanted Outbound	Yes	No	Yes	Yes	No	No
Unwanted Traffic Path	N/A	N/A	Possible	Possible	Possible	No
Need BGP Adjustment for Downstream	N/A	N/A	Yes	Yes	Yes	No

⭐ Best Choice

Virtual Router(s)

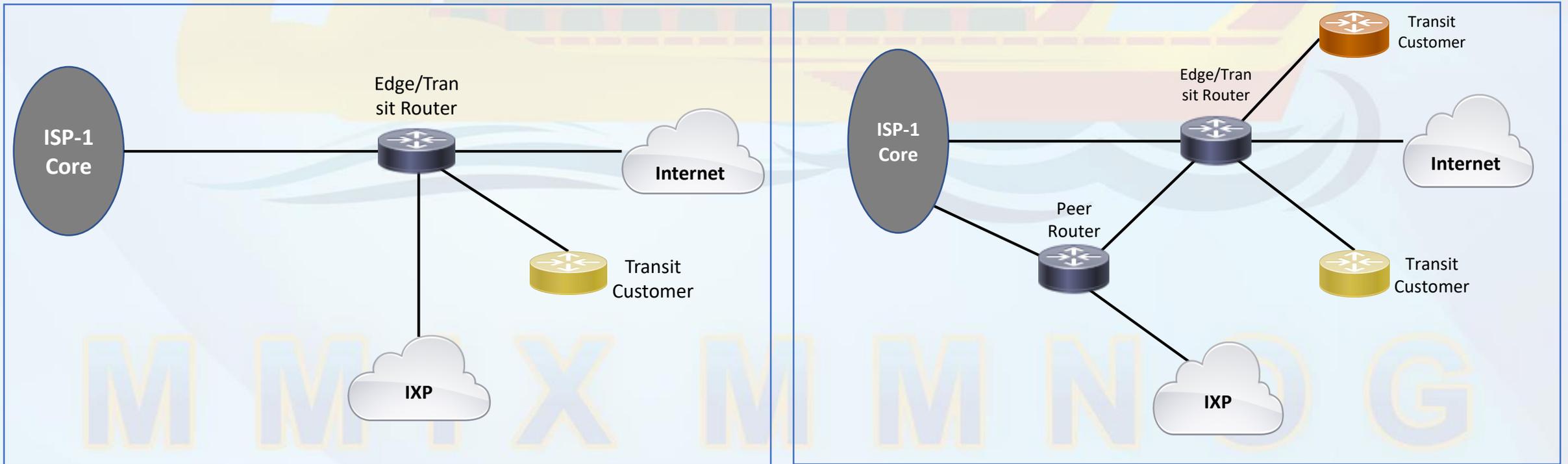If Budget or/and resources are limited

- Shall consider Virtual Routers instead of physical routers.
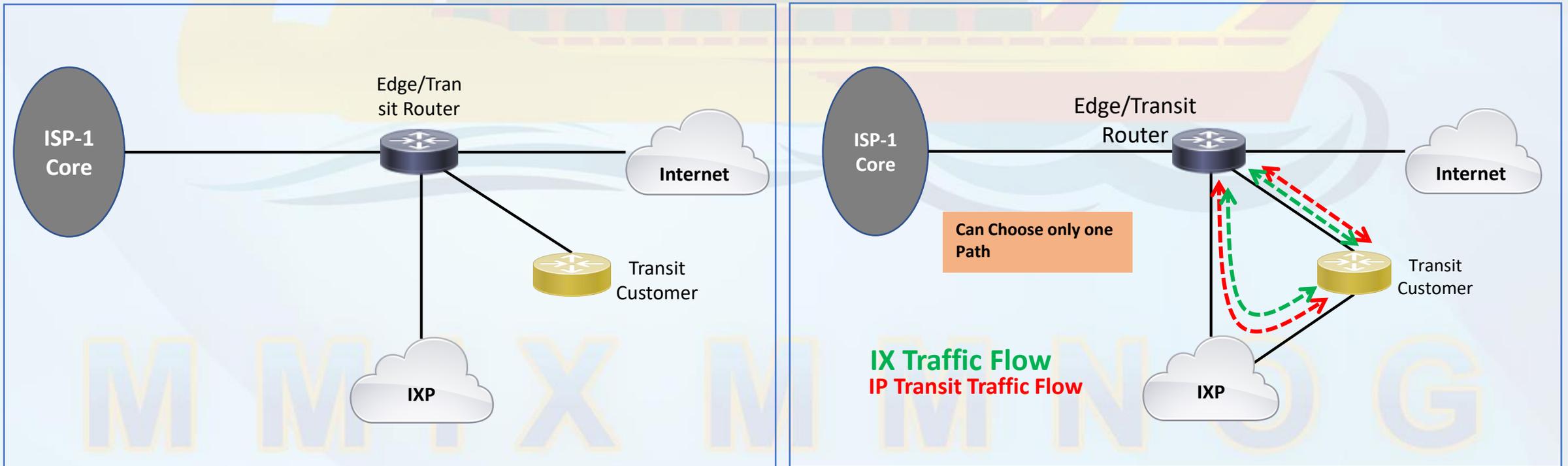- Topology 3 can be migrated into Topology 5.

Topology 3 into Topology 5 to solve problems

Topology 3 and Routing Path problem
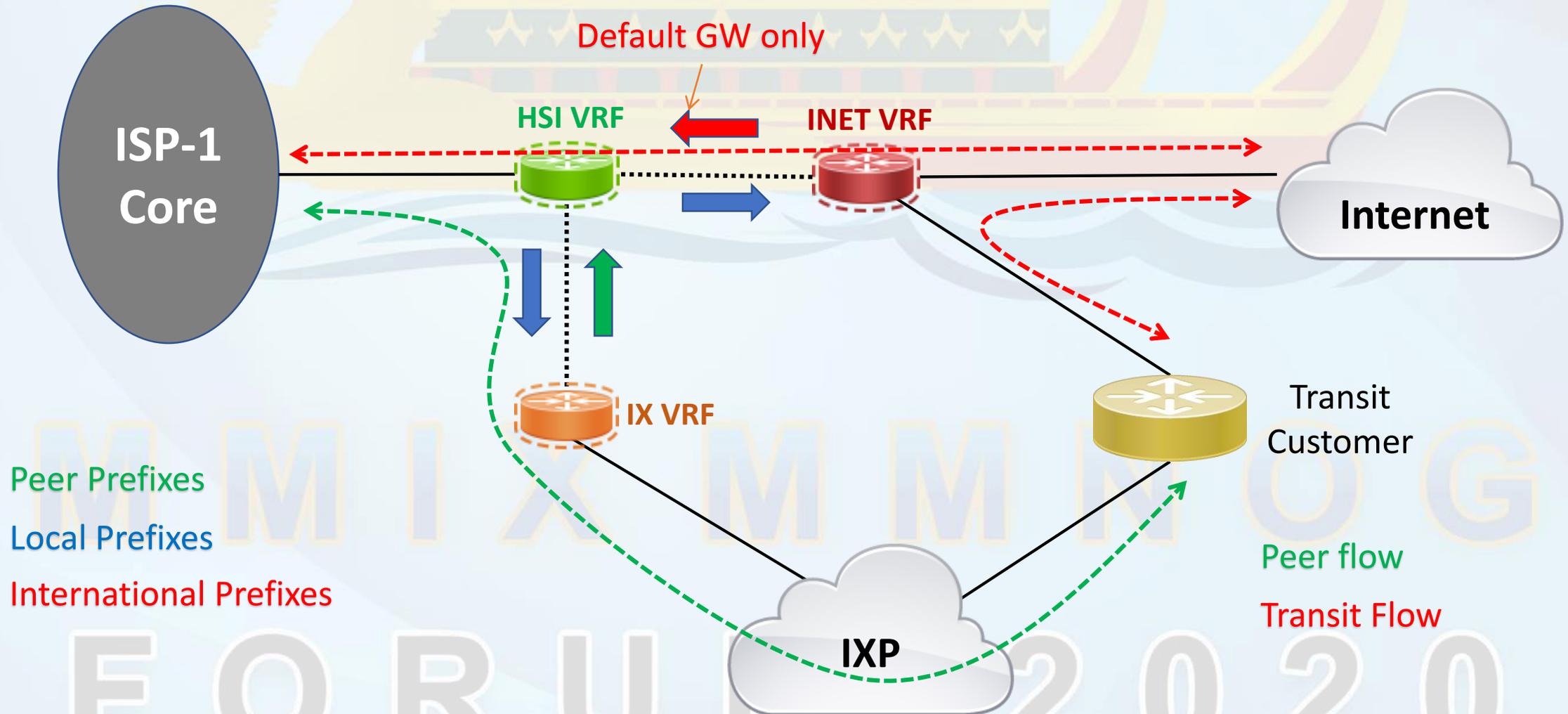
Edge/Tran
sit Router

**ISP-1
Core**

Internet

Transit
Customer

IXP

Edge/Transit
Router

**ISP-1
Core**

Internet

Can Choose only one
Path

Transit
Customer

IX Traffic Flow
IP Transit Traffic Flow

IXP

Virtual Routers solved unwanted traffic paths

HSI VRF import only default route from INET VRF
HSI VRF import IX Prefixes from IX VRF

INET VRF import local prefix from HSI VRF
INET VRF advertise local prefixes & Downstream prefixes to UPSTREAM

Edge/Transit Router

ISP-1 Core

AS1001

HSI VRF

INET VRF

Internet

IX VRF import only local prefix from HSI VRF

IX VRF

Transit Customer

IX Traffic Flow

IP Transit Traffic Flow

BGP Parameters:
Weight/Local-preference for AS1001 prefixes

IXP

Virtual Routers solved unwanted traffic paths

ISP-1 Core

Default GW only

HSI VRF   INET VRF

Internet

IX VRF

Transit Customer

Peer Prefixes
Local Prefixes
International Prefixes

Peer flow
Transit Flow

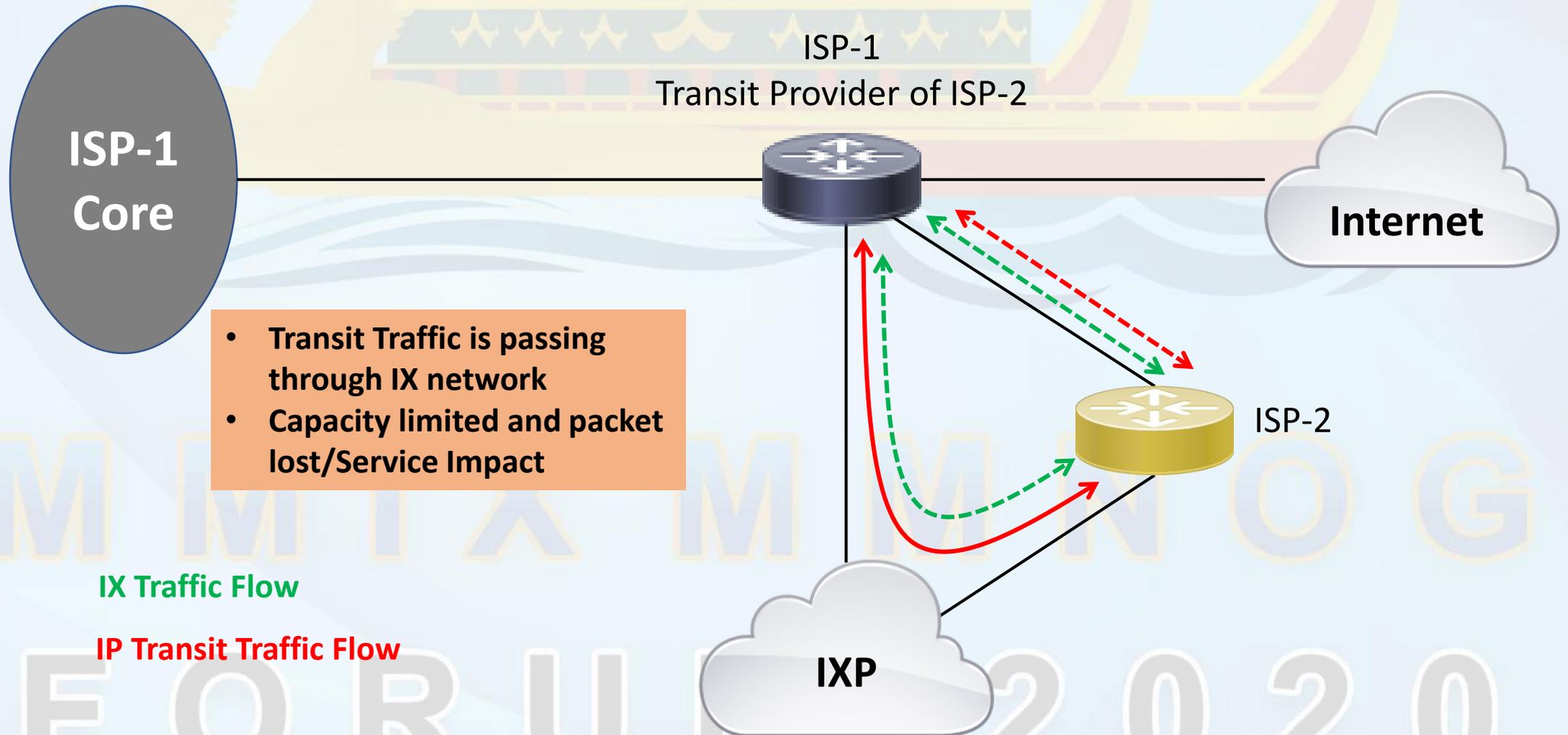IXP

Case Studies:

Case 1: IX member gets IP Transit from another IX member.

Case 2: IX's Transit Provider is also IX's peer member.

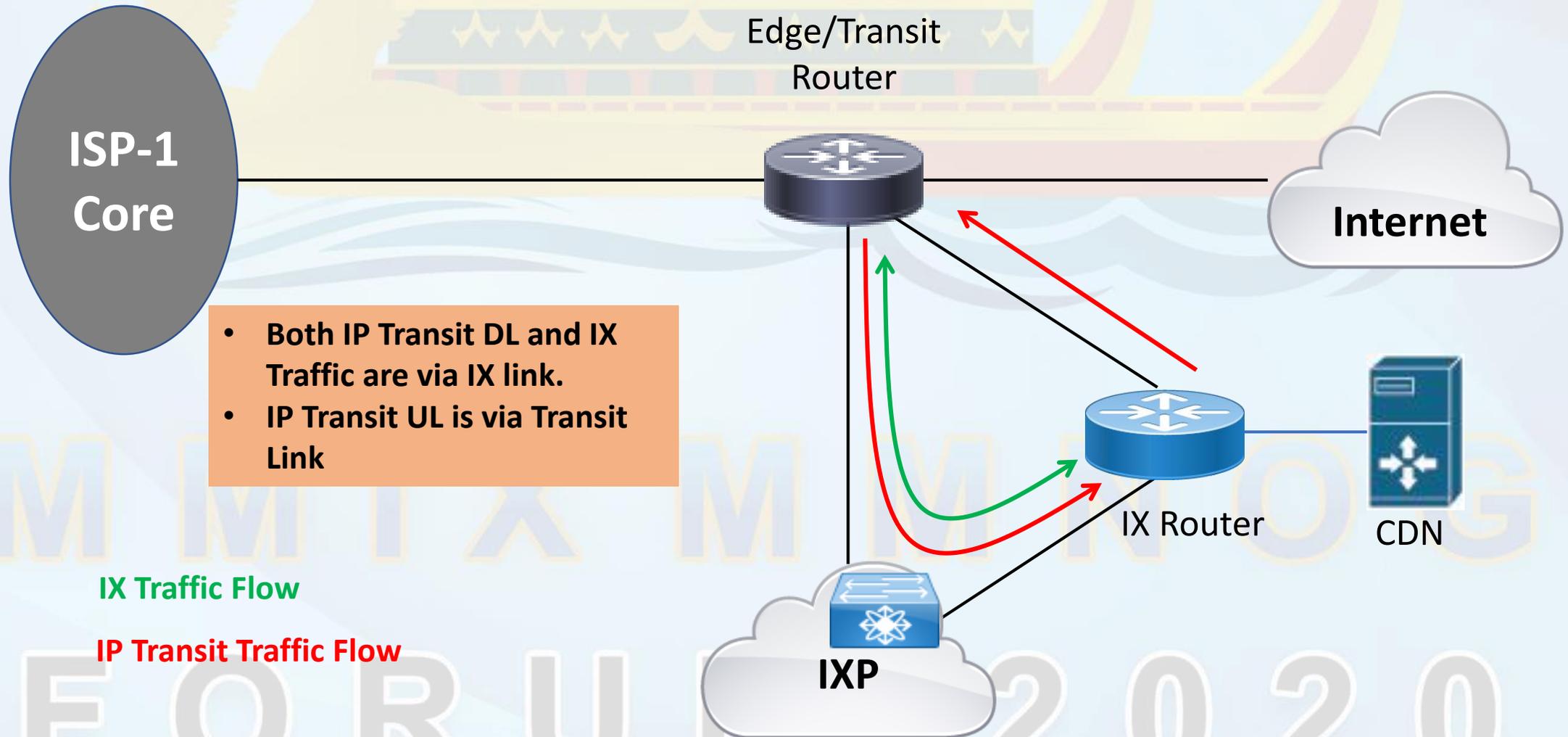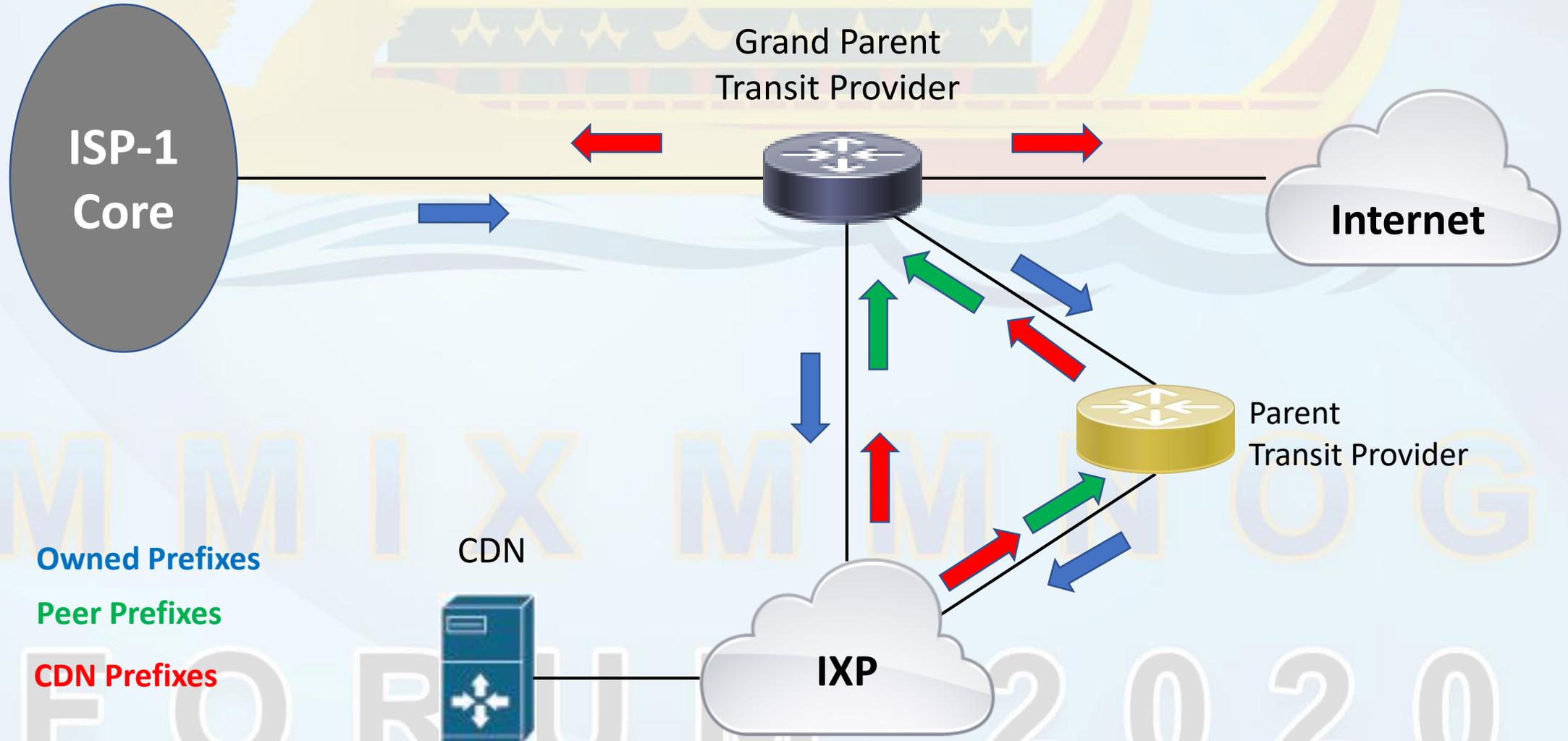Case 3: Upstream of IX's Transit Provider is also IX's peer member.

Case 1: Traffic via unwanted path (same as Topology-3)

ISP-1
Transit Provider of ISP-2

ISP-1 Core

Internet

- **Transit Traffic is passing through IX network**
- **Capacity limited and packet lost/Service Impact**

ISP-2

IX Traffic Flow

IP Transit Traffic Flow

IXP

Case 2: IX traffic & Transit Traffic (same as Topology-3)

Edge/Transit Router

ISP-1 Core

Internet

- **Both IP Transit DL and IX Traffic are via IX link.**
- **IP Transit UL is via Transit Link**

IX Router

CDN

IX Traffic Flow

IP Transit Traffic Flow

IXP

Case 3: When IX's Grand Parent Transit Provider Peer with IX.

Owned Prefixes

Peer Prefixes

CDN Prefixes

Traffic Flow via undesired path
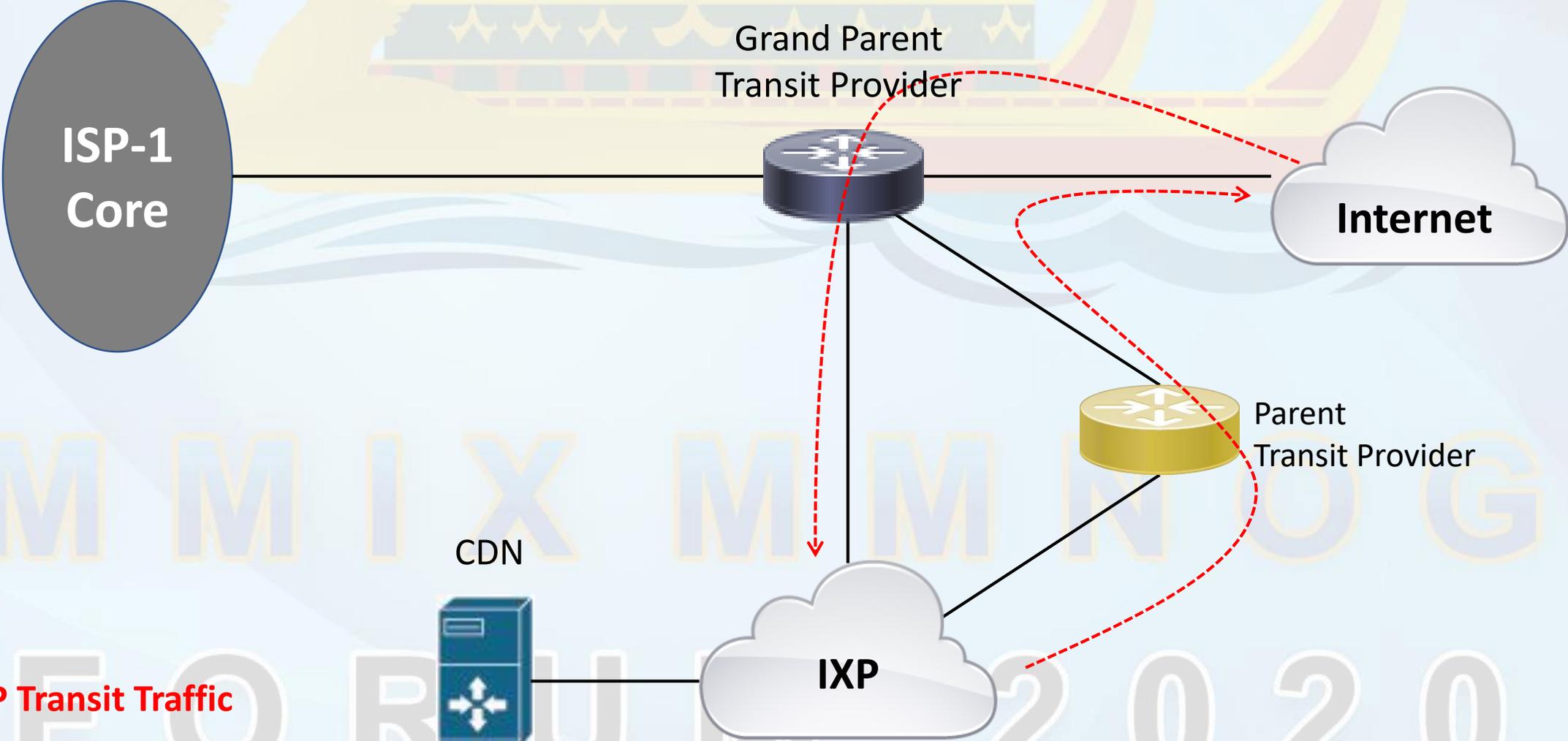
Integration with ISP's Core
&
Multiple POPs

Typical ISP Edged Network
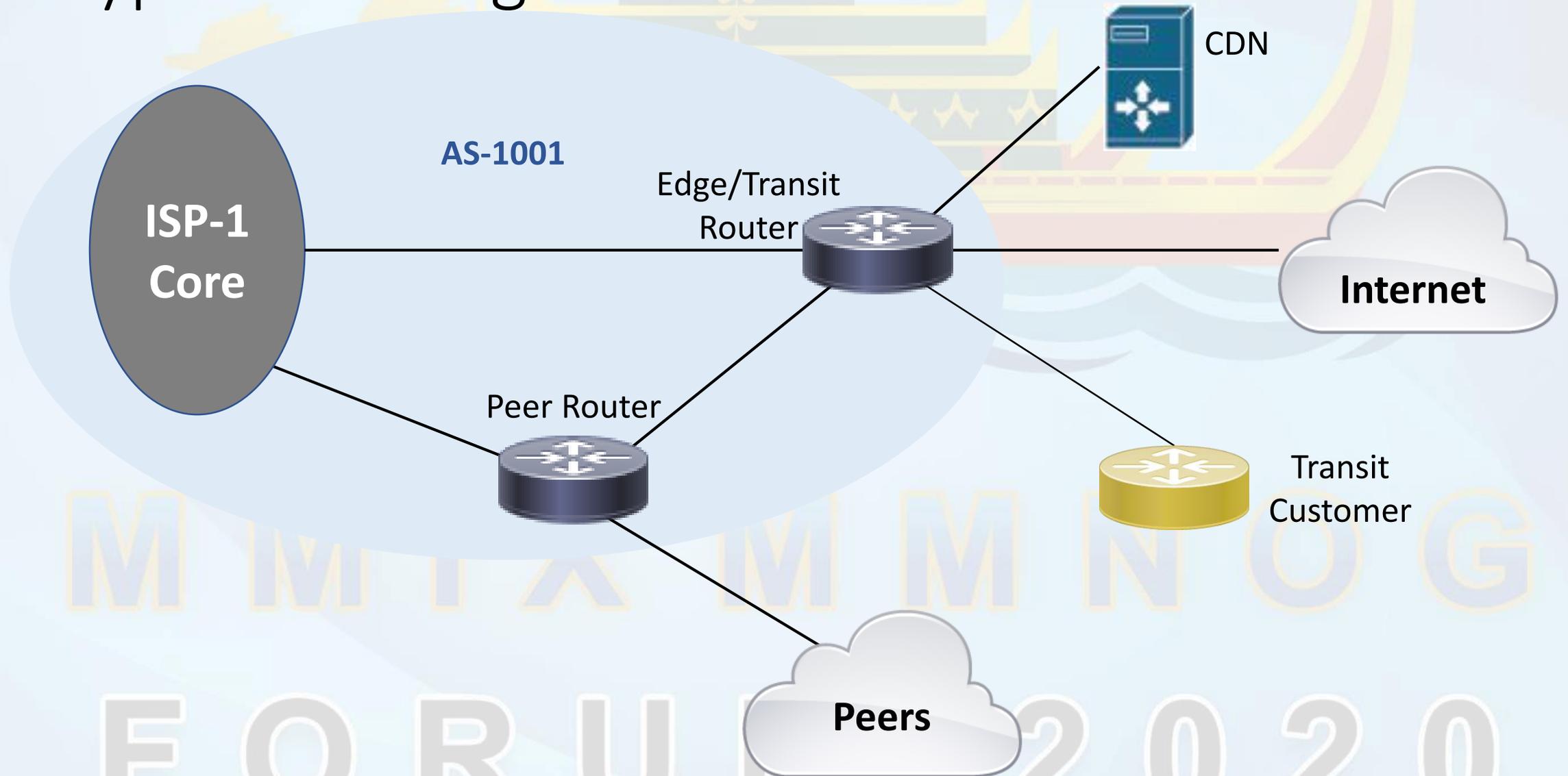
City To City and Peering
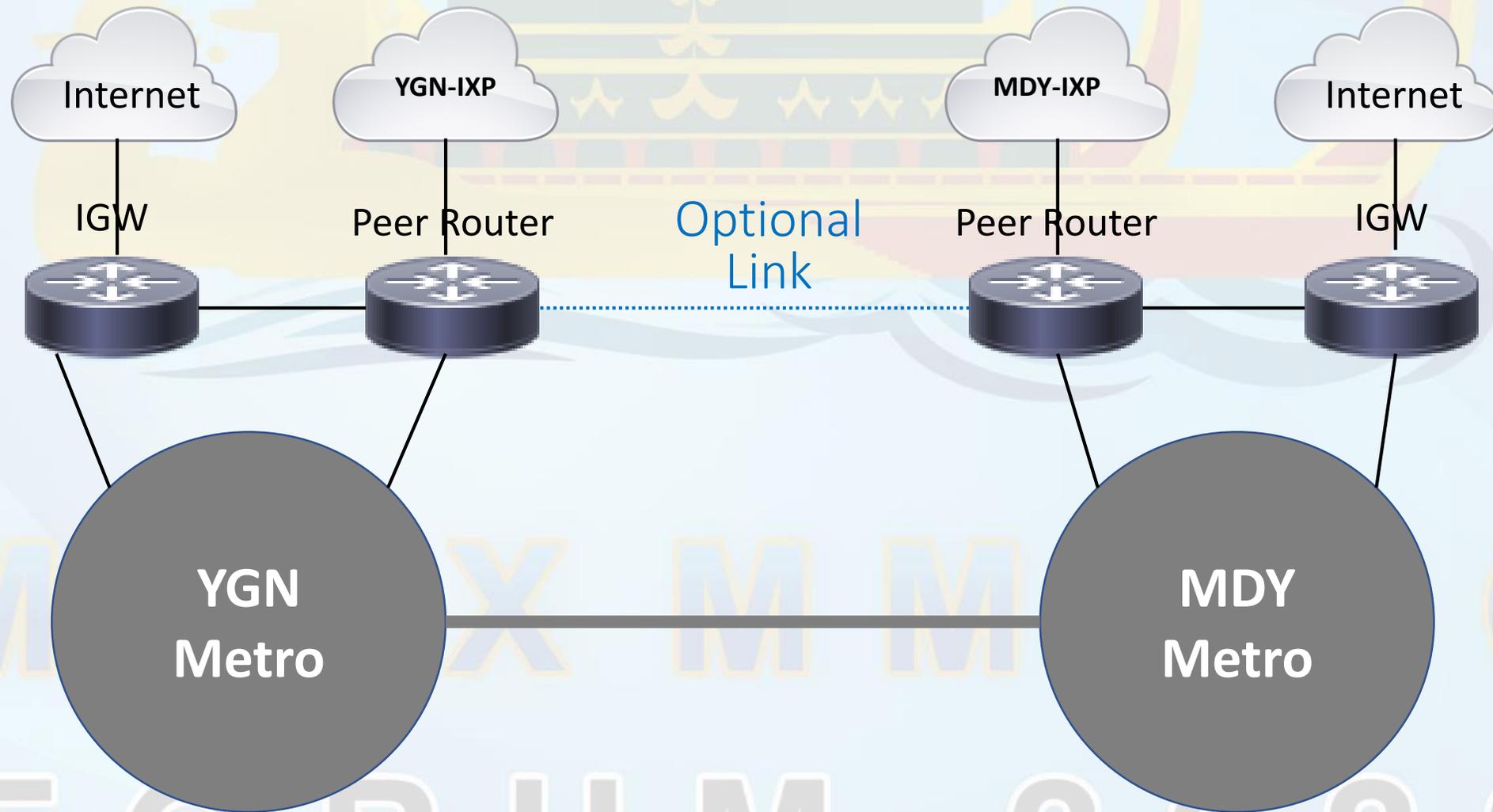
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FORUM 2020

Thank you

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www.mmnog.net