Some Considerations About IXP Customers Connection Models

LACNIC XII – NAPLA - Panama

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Agenda

- Summary
- Preliminary Information
- IXP Traditional Connection Model
- IXP New Connection Model – Ethernet Family Links
  - Advantages
  - Some Negative Results
- IXP Ethernet Links
  - L2 Problem
  - L3 Problem

Summary

With the proliferation adoption of Metro Ethernet Networks to provide L2 links between Autonomous Systems (AS) and Internet eXchange Points (IXP) comes many benefits, like: connection simplification, uniform and familiar technology (Ethernet family), lower costs, less points of failures, etc.

On the other hand, directly connect Ethernet family links can expose the AS to vulnerabilities issues on security and network areas.

This presentation intends to focus the discussion on some network potential vulnerabilities and suggestions about how to protect the AS, looking forward a safe network.

The key points that will be addressed in the presentation are: routing vulnerabilities on external traffic engineering and Ethernet (L2) isolation/protection.

Information - IXP / PTT

IXP - Internet eXchange Point

PTT – Ponto de Troca de Tráfego

Presentation Reference Point

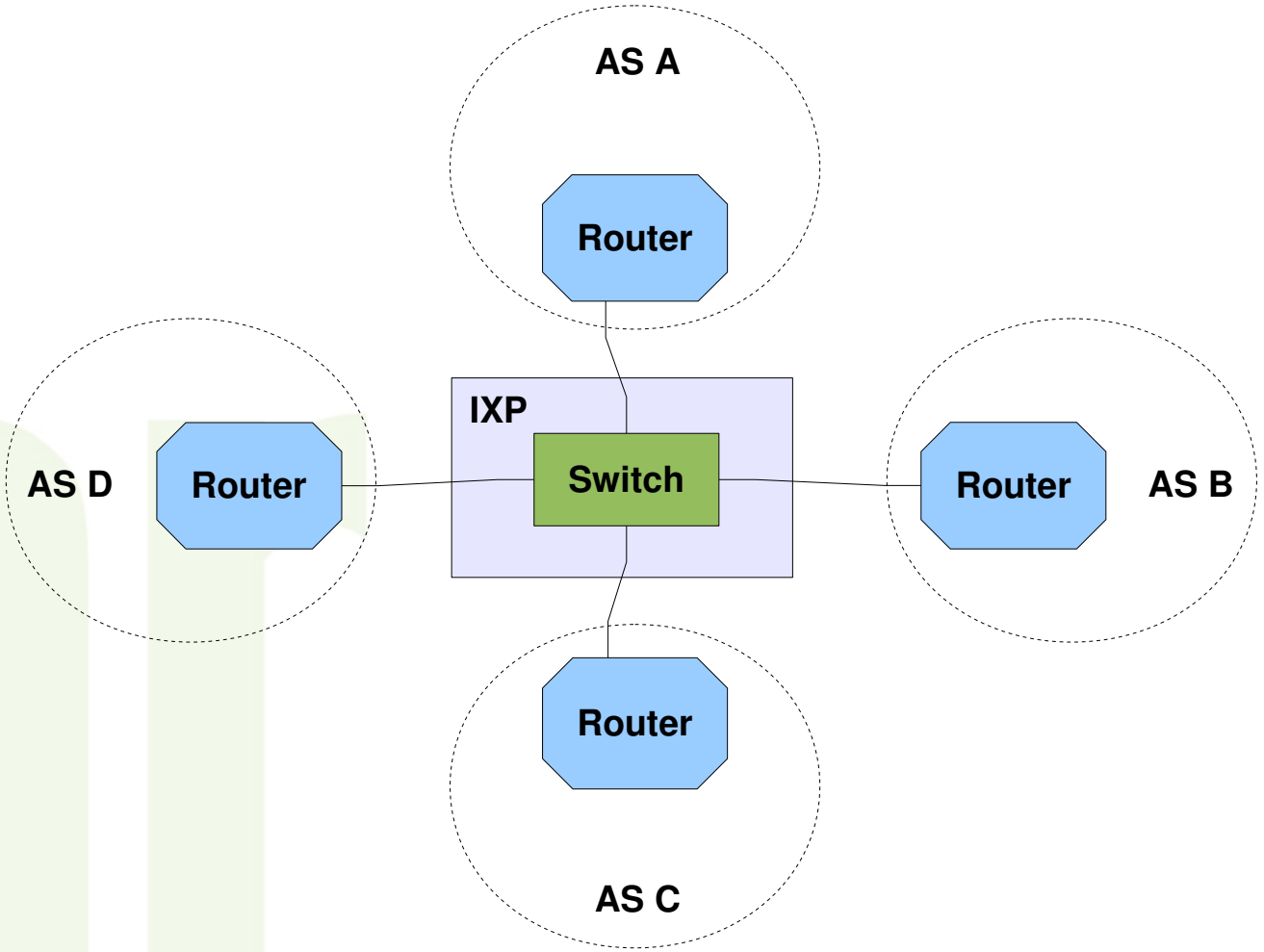
This presentation is focused on IXP participants and not on the IXP itself.

IXP - switching fabric / peering fabric

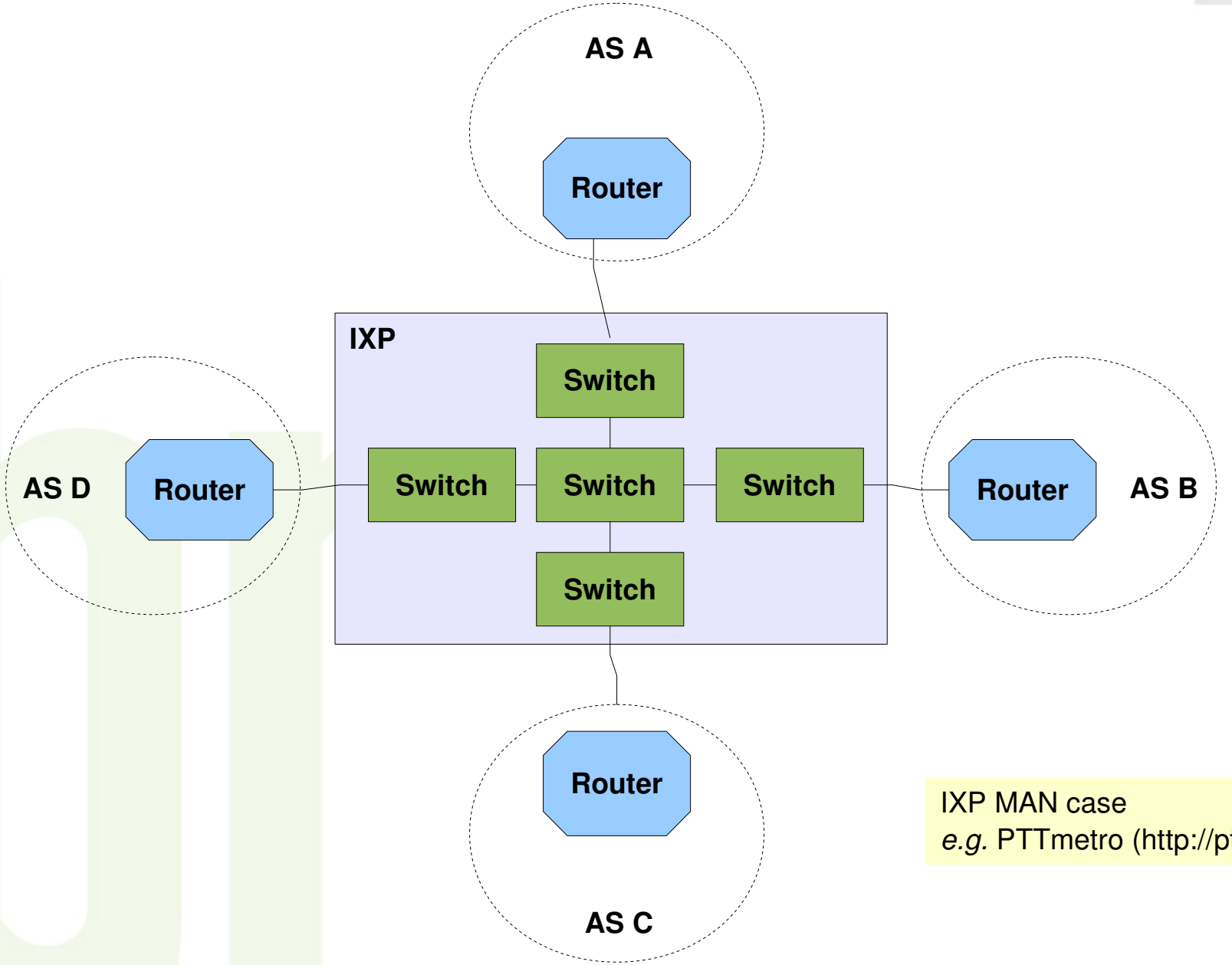
Traditionally based on exchange matrix Ethernet family equipments (switches)

IXP model can be simplified as a single LAN switch

Preliminary Information – IXP – LAN Switch Model



Preliminary Information – IXP – Metro Ethernet Model



IXP MAN case
e.g. PTTmetro (http://ptt.br)

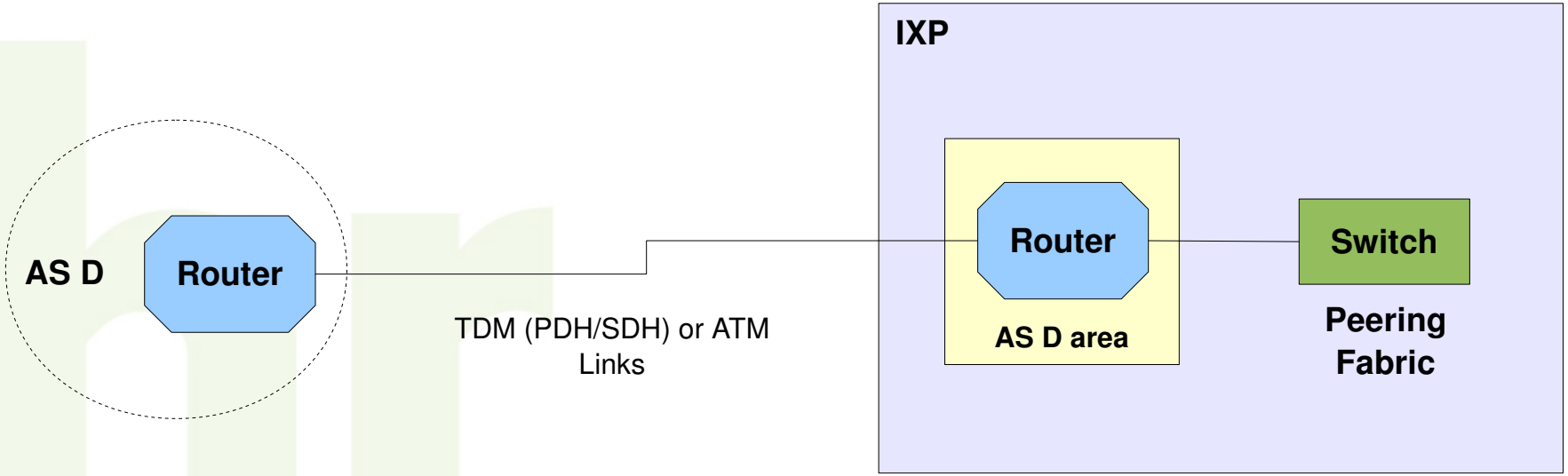
Preliminary Information – AS

Autonomous System (AS) internal network also

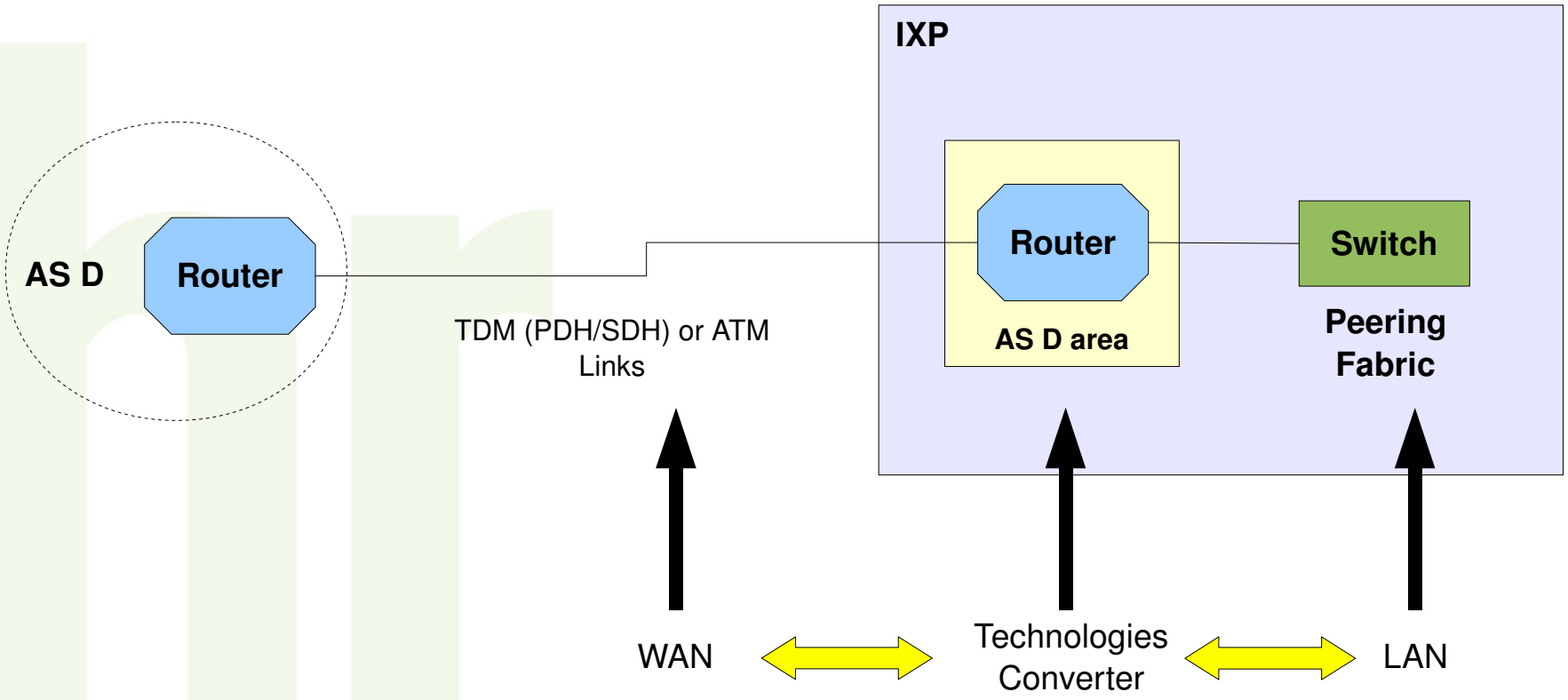
normally based on Ethernet family equipments (switches)

AS internal network can be simplified as a LAN

IXP Traditional Connection Model



IXP Traditional Connection Model



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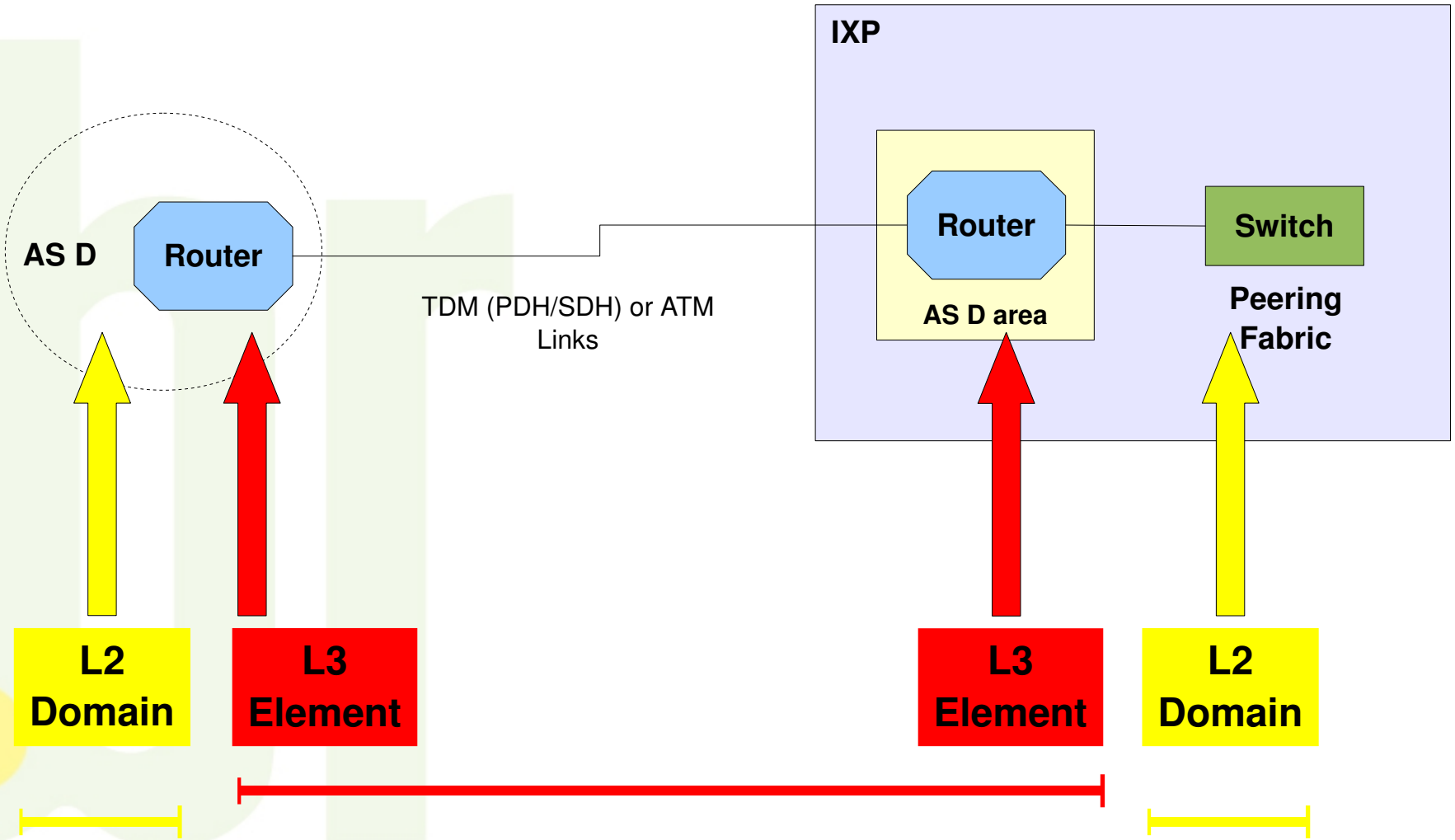

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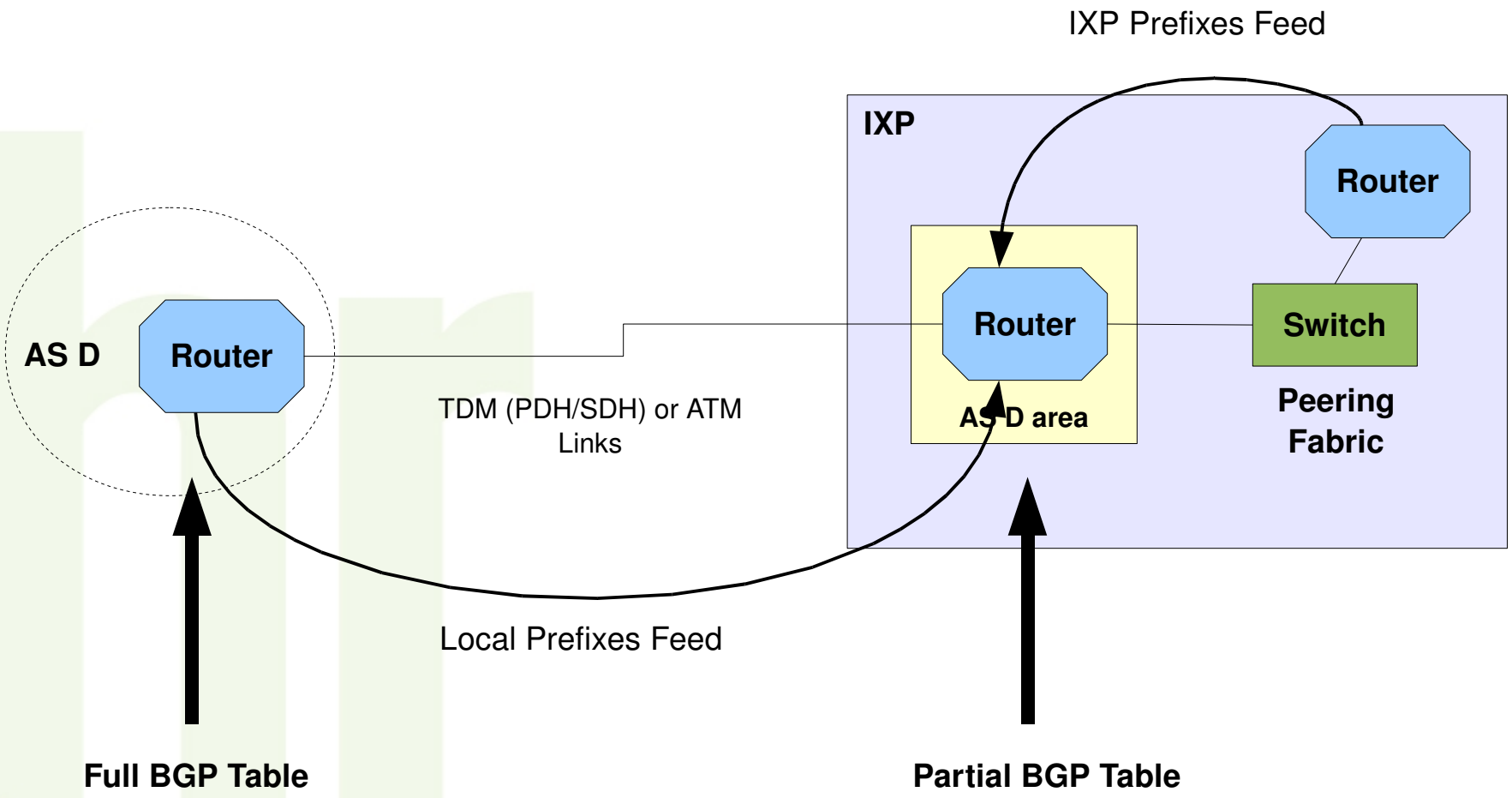


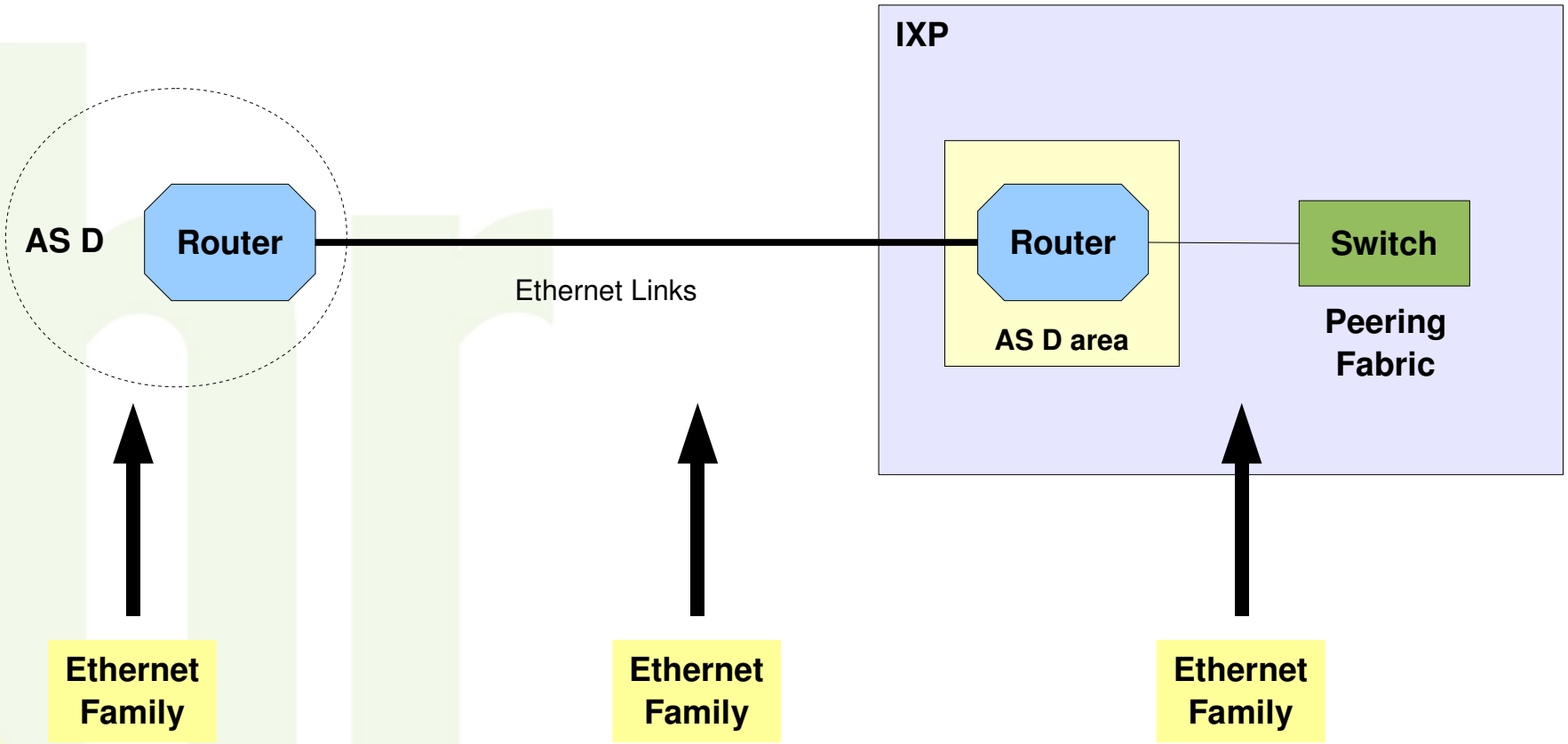
IXP New Connection Model – Ethernet Family Links

Ethernet family (Gigabit Ethernet and 10 Gibabit Ethernet)

links become a familiar technology for outside use on

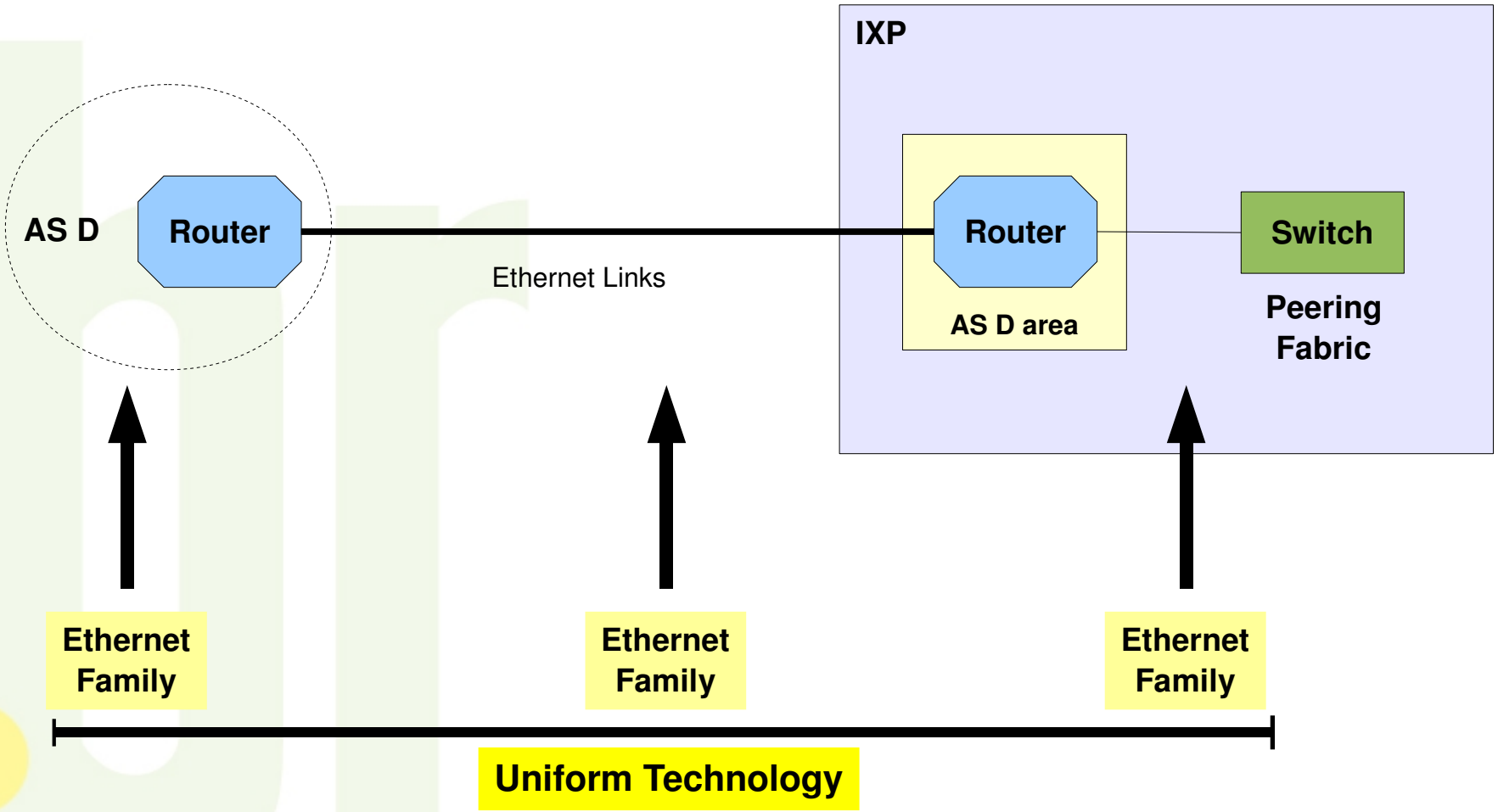
Metropolitan Networks (MAN) and even on long distance connections (WAN)

IXP New Connection Model – Ethernet Family Links - Advantages



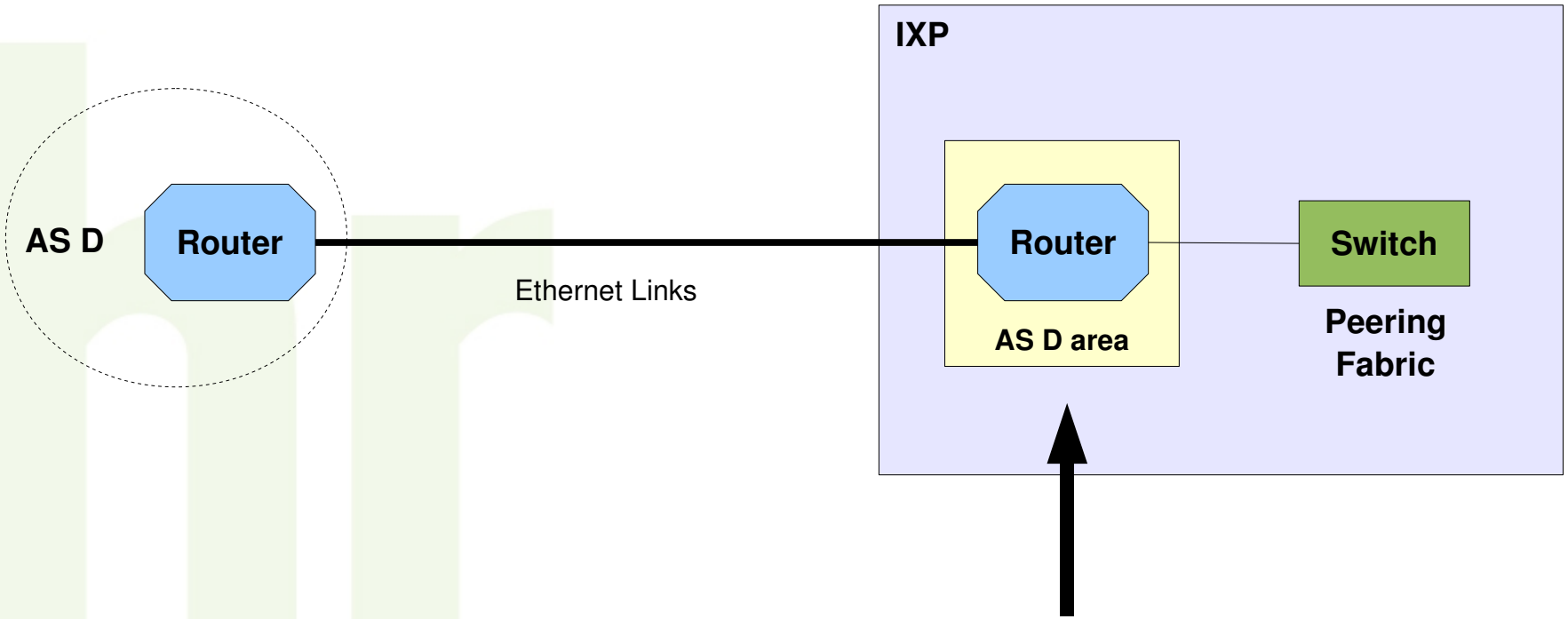
IXP New Connection Model – Ethernet Family Links - Advantages

✔ Simplification
✔ Lower Operational Cost



IXP New Connection Model – Ethernet Family Links - Advantages

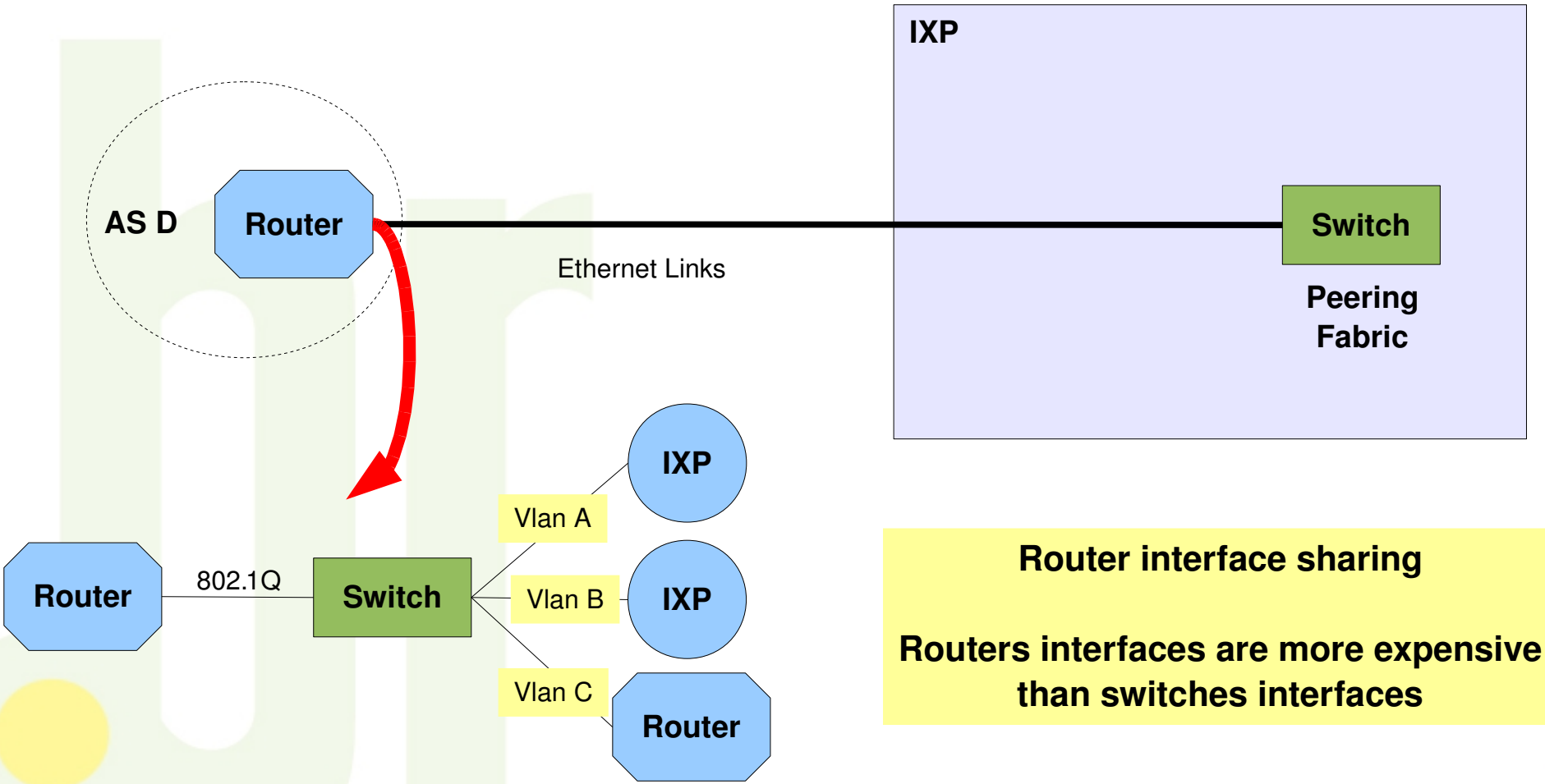
✔ Lower Cost
✔ Less equipments (less points of failure, simple management and support)



No more need for remote router and eventually data center collocation at IXP site

IXP New Connection Model – Ethernet Family Links - Advantages

✔ Lower Cost
✔ Equipments Optimization



Router interface sharing

Routers interfaces are more expensive than switches interfaces

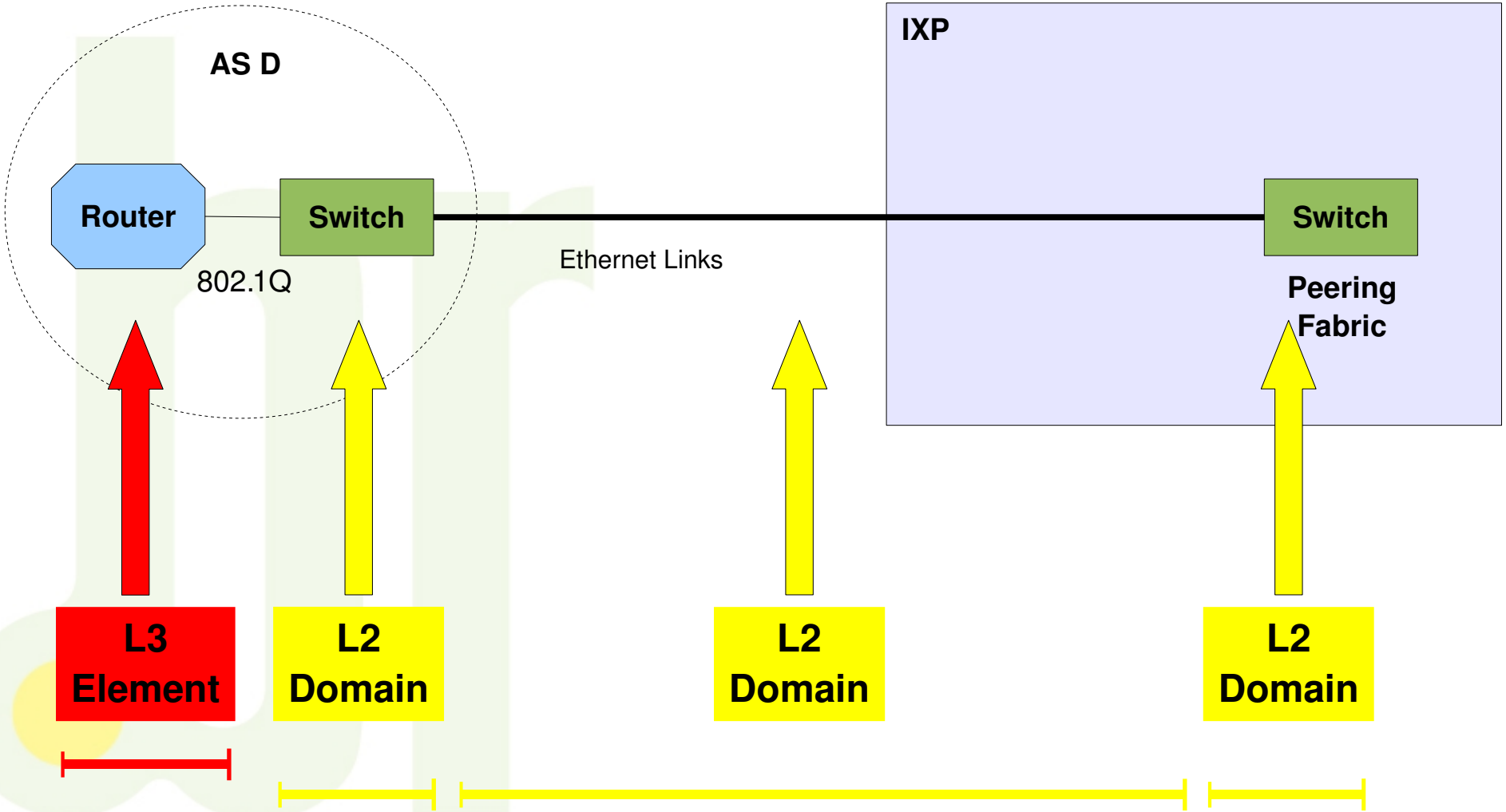
IXP New Connection Model – Some Negative Results

At Least Two Kinds of Possible Problems

- ✗ **Lose of Simple Logical Isolation Between L2 Domains**
- ✗ **Lose of Intra AS BGP Tables Isolation (Global and IXP)**

IXP Ethernet Links – L2 Problem

✗ **Lose of Simple Logical Isolation Between L2 Domains**



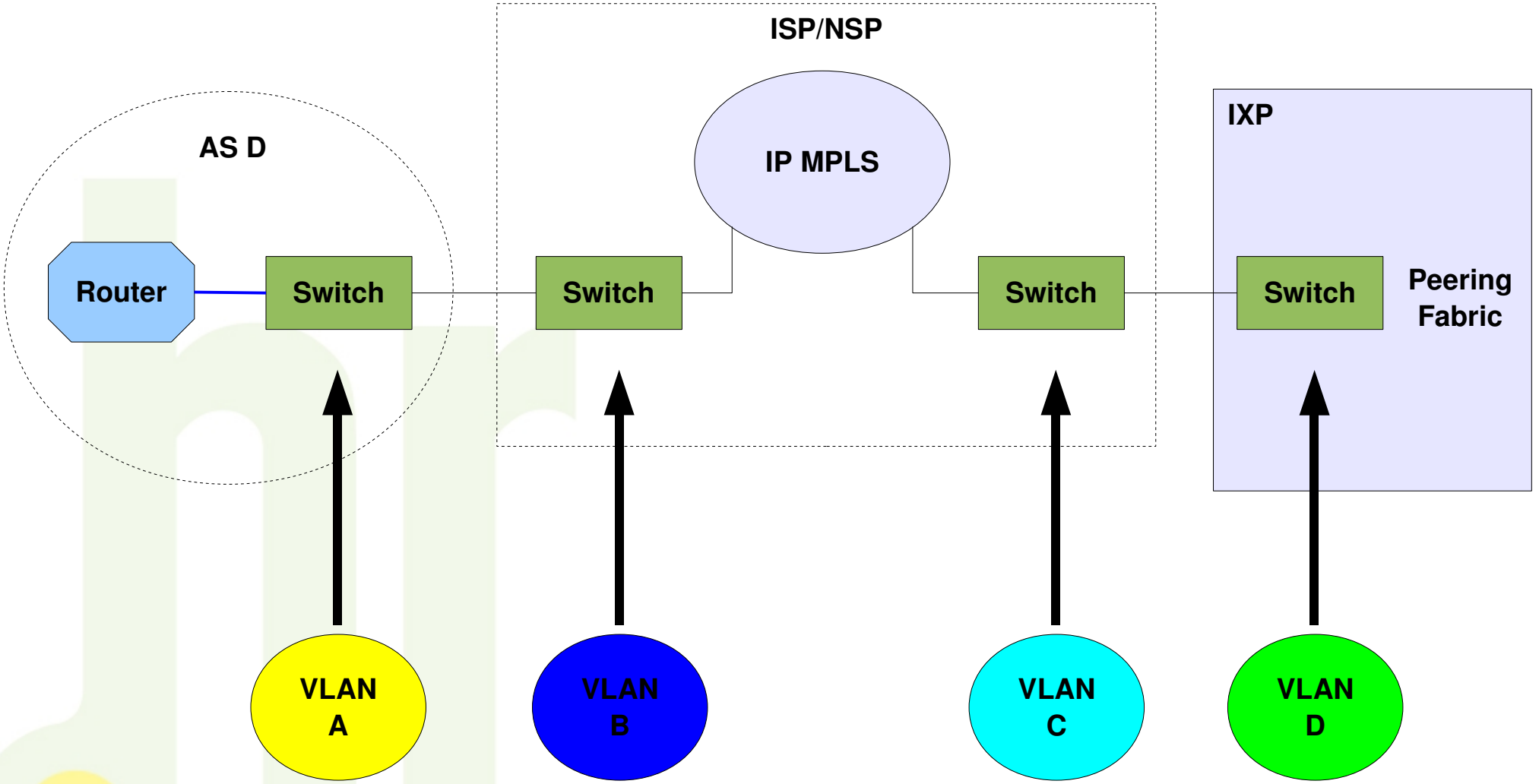
IXP Ethernet Links – L2 Problem

Ethernet networks were not originally design to prevent against problems on different administration networks L2 interconnection.

Special resources may be needed for protection and nowadays some solutions are only possible when using proprietary features.

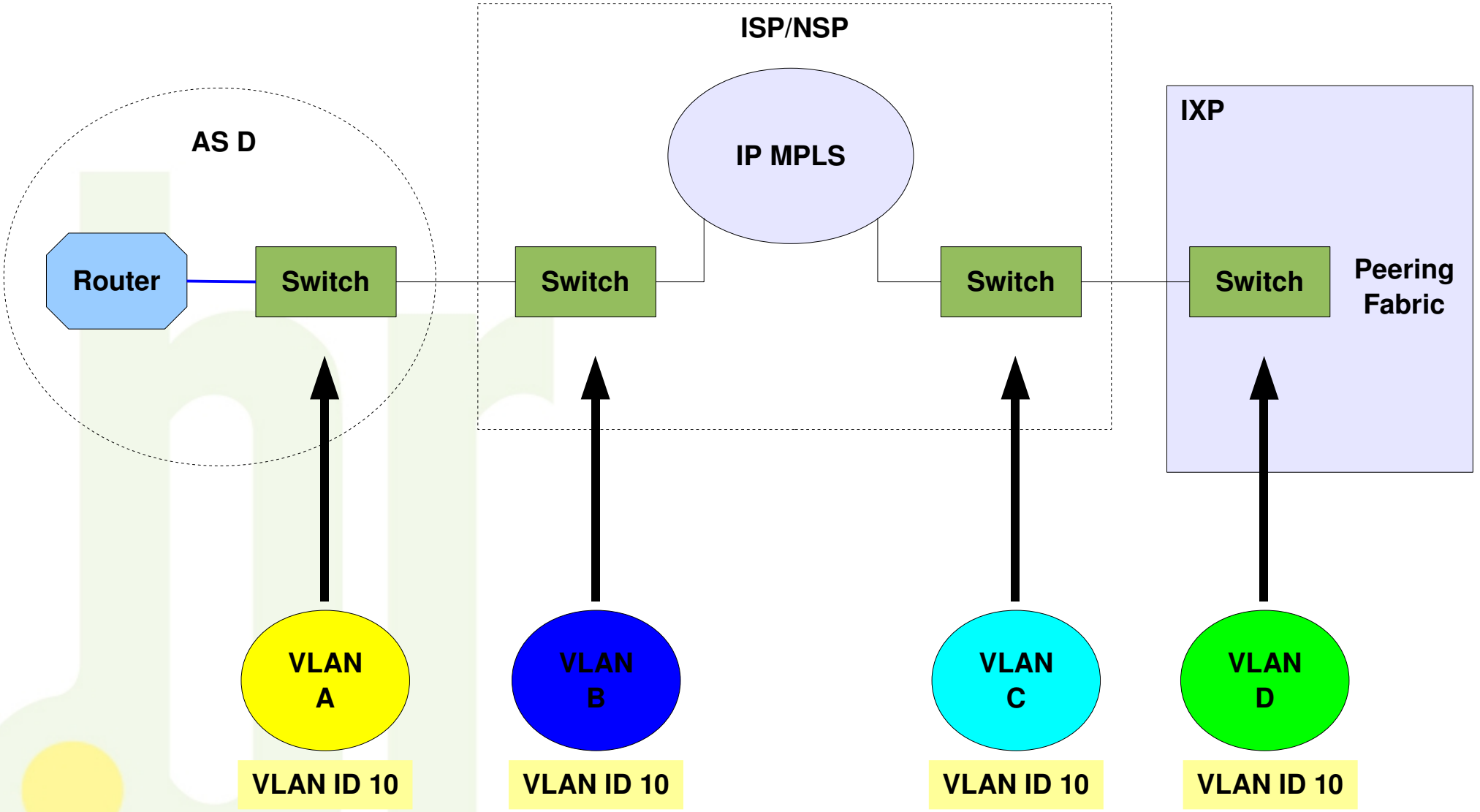
IXP Ethernet Links – L2 Problem

Ethernet logical isolation is done by VLANs



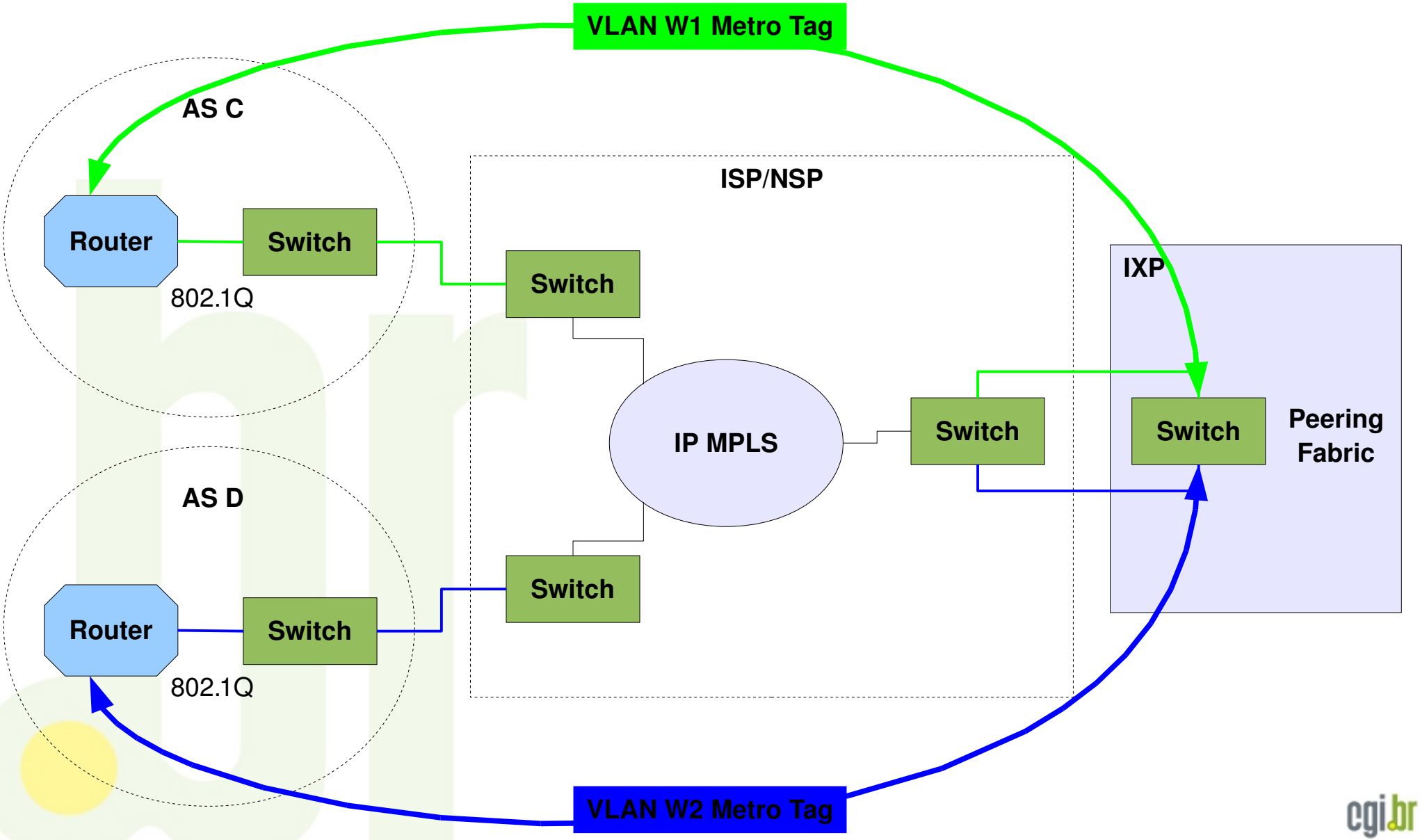
IXP Ethernet Links – L2 Problem

Independent connected VLANs may have the same ID

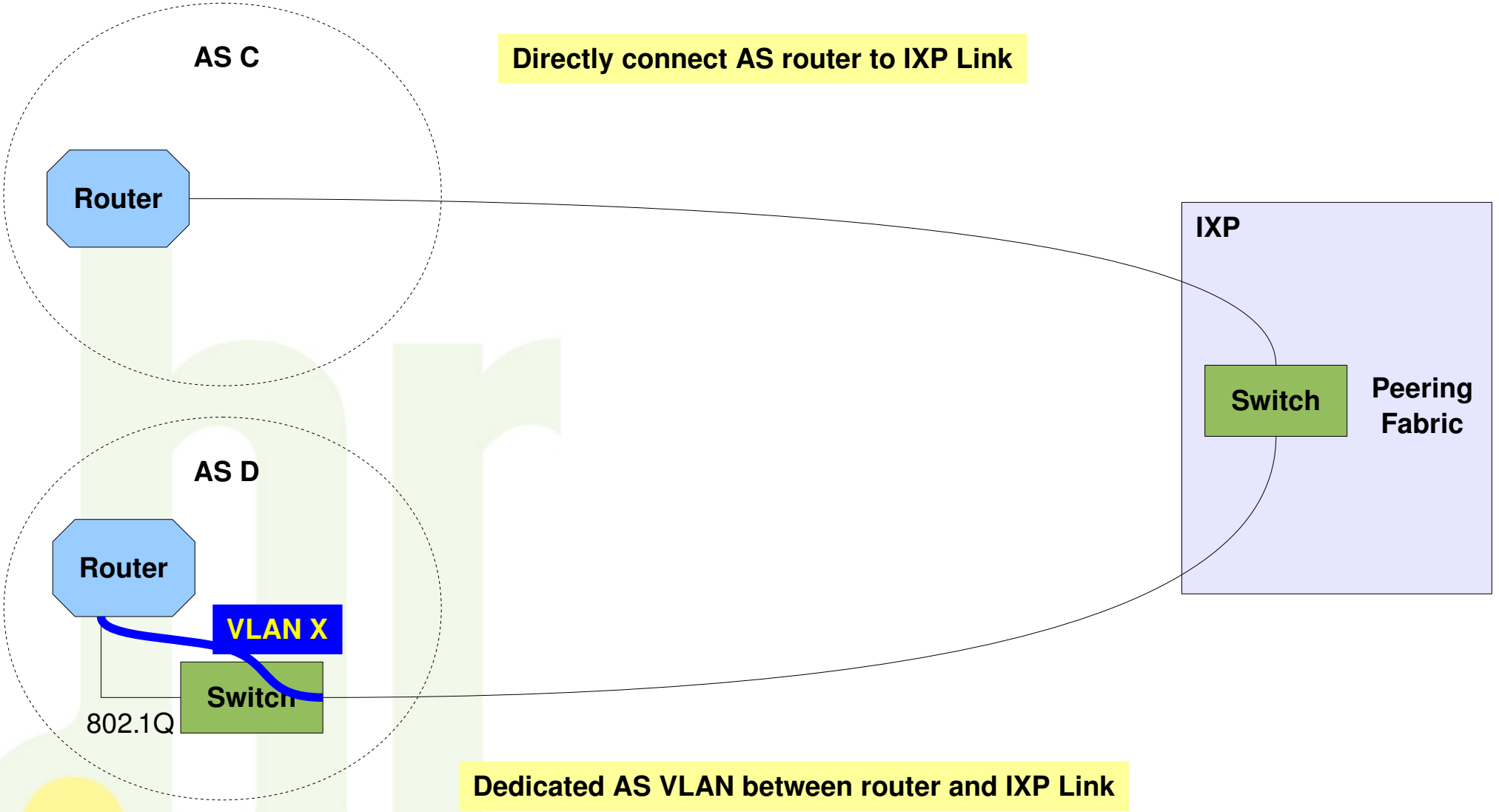


Special care must be taken when trunk (802.1Q) connections are used between L2 domains

Ethernet logical isolation on ISP/NSP - 802.1ad (QinQ)



IXP Ethernet Links – L2 Problem



Some Ethernet Protections Points

- Explicitly define trunk mode between L2 domains interconnection
  (avoid auto / dynamic configuration)

- Explicitly define and control links aggregation conditions
  (LACP - 802.3ad)

- Ethernet frames inbound and outbound filters
  - Neighbor discover protocols (e.g. CDP, EDP, etc)
  - Loop-free / Fault tolerant L2 protocols (e.g. STP, EAPS, REP, etc)
  - Non ARP Broadcast

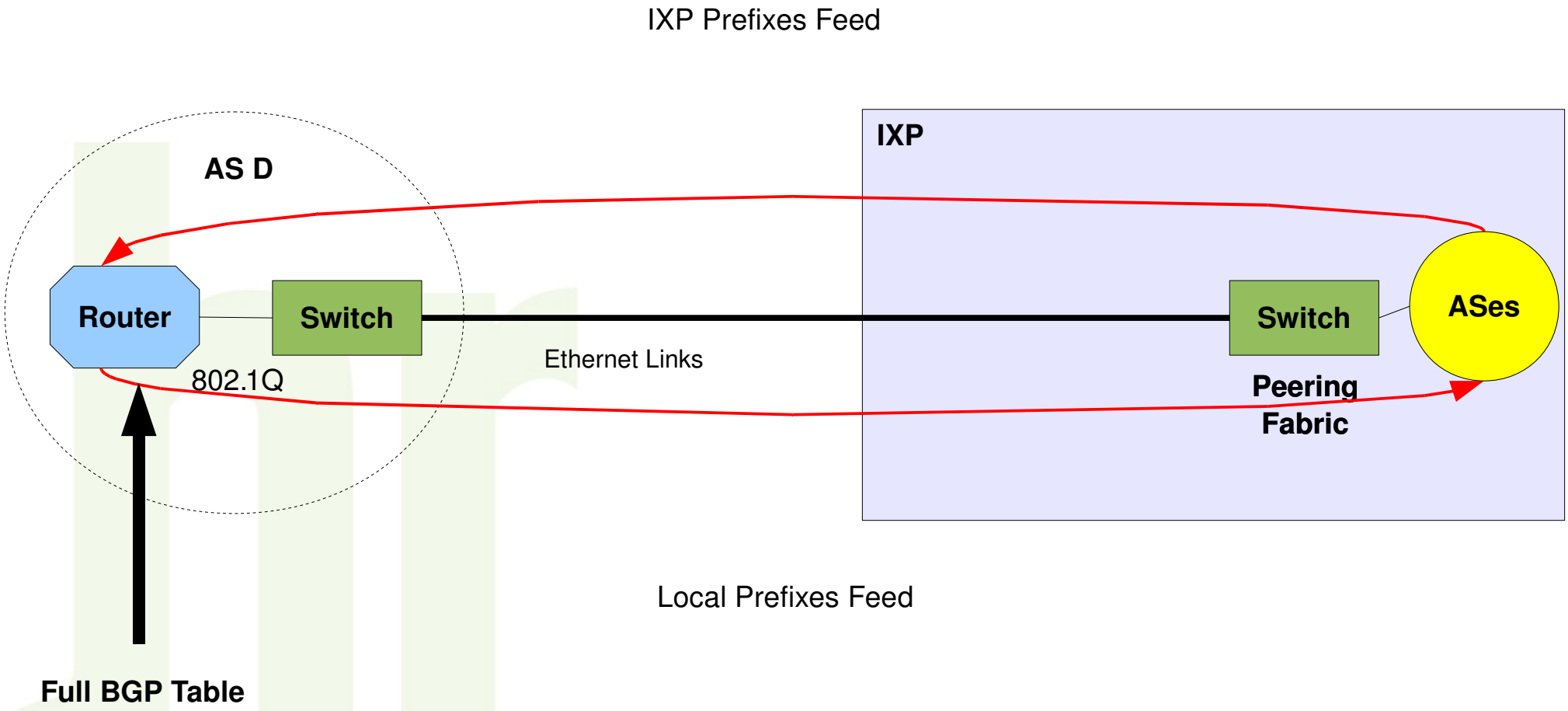
Restrictive Allowed Ethernet Frames Operation

AS permit only specific and expected Ethertypes frames on links to IXP

- 0x0800 - IPv4
- 0x0806 - ARP
- 0x86dd - IPv6

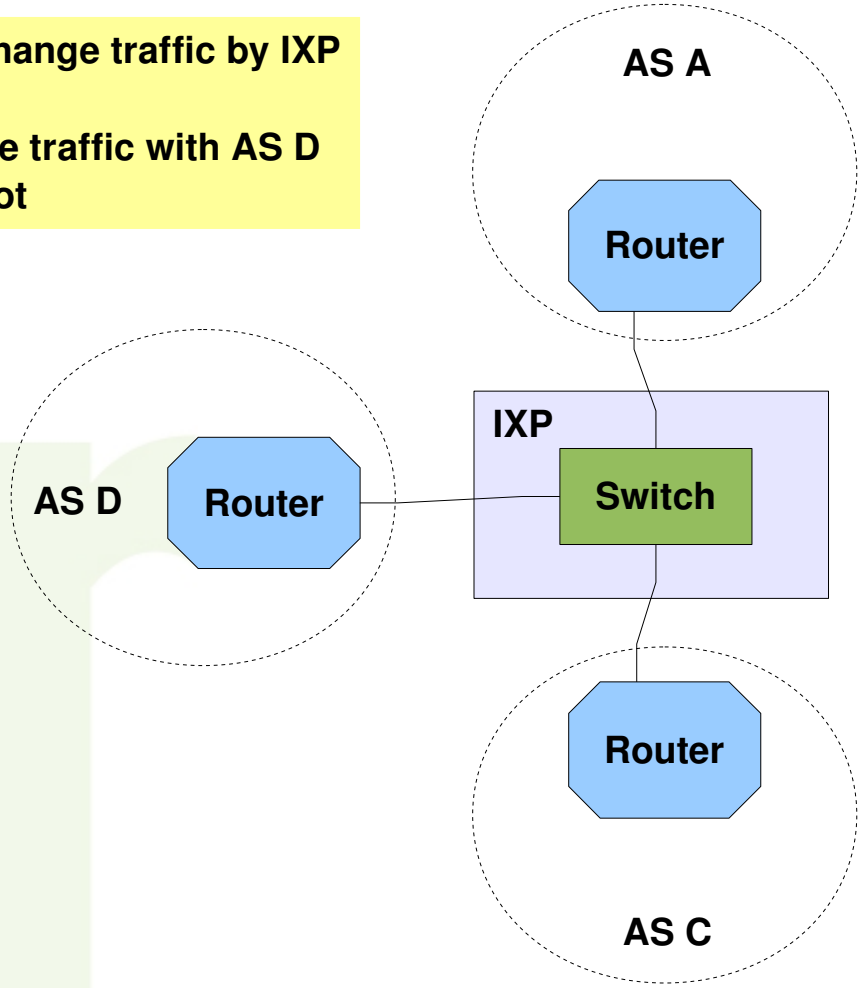
IXP Ethernet Links – L3 Problem

✗ **BGP Table**



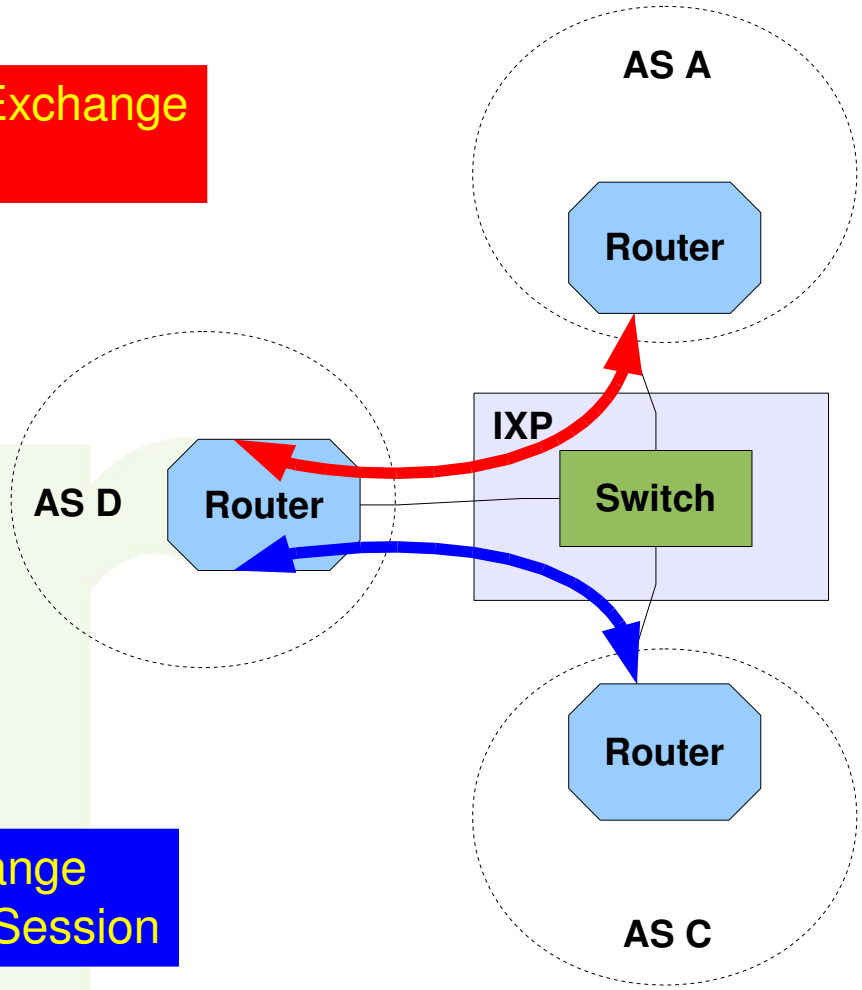
IXP Ethernet Links – L3 Problem

- AS D and AS C want to exchange traffic by IXP
- AS A would like to exchange traffic with AS D by IXP, but AS D does not



IXP Ethernet Links – L3 Problem

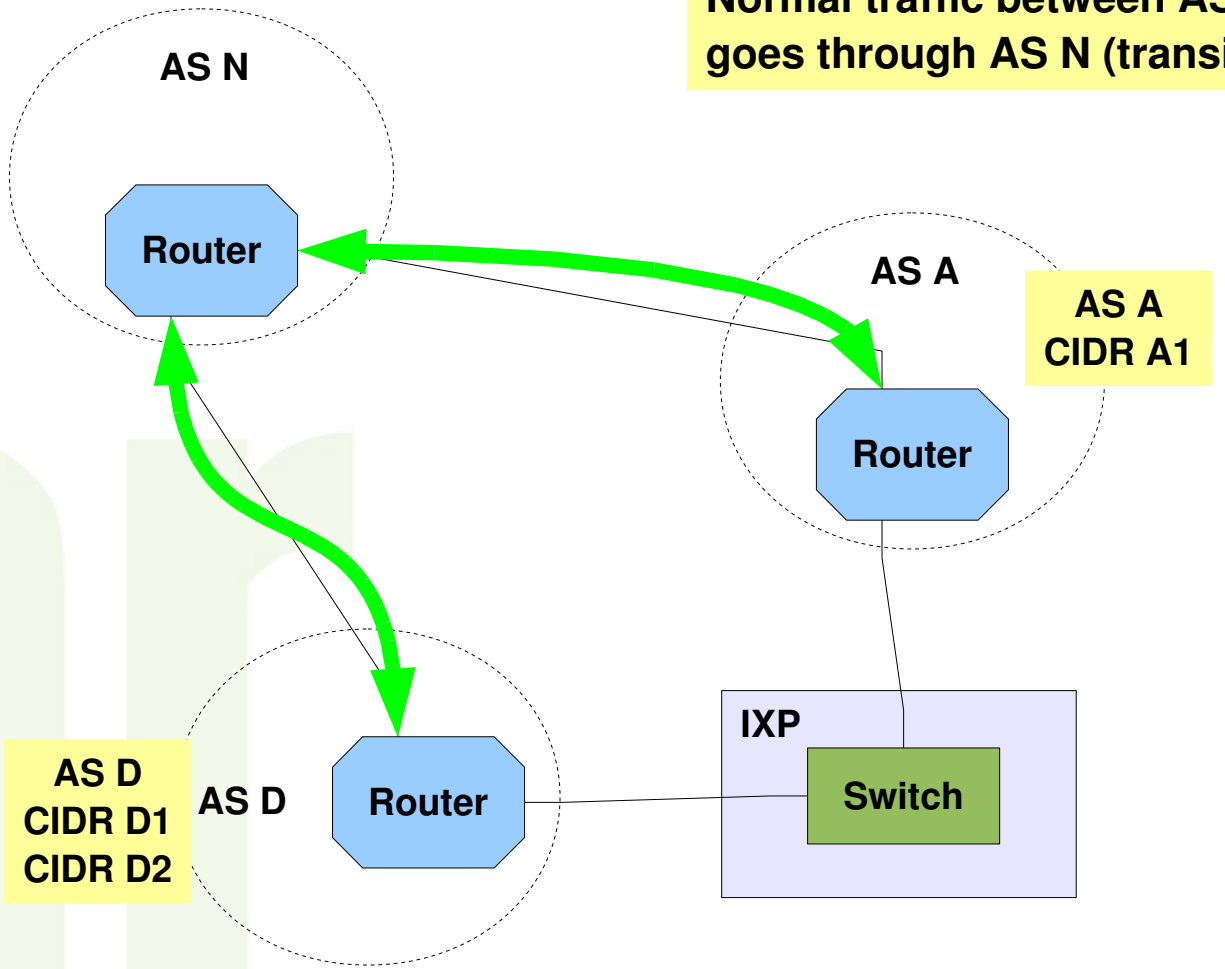
Non Valid Traffic Exchange
No BGP Session



Valid Traffic Exchange
Established BGP Session

IXP Ethernet Links – L3 Problem

Normal traffic between AS A and AS D goes through AS N (transit)



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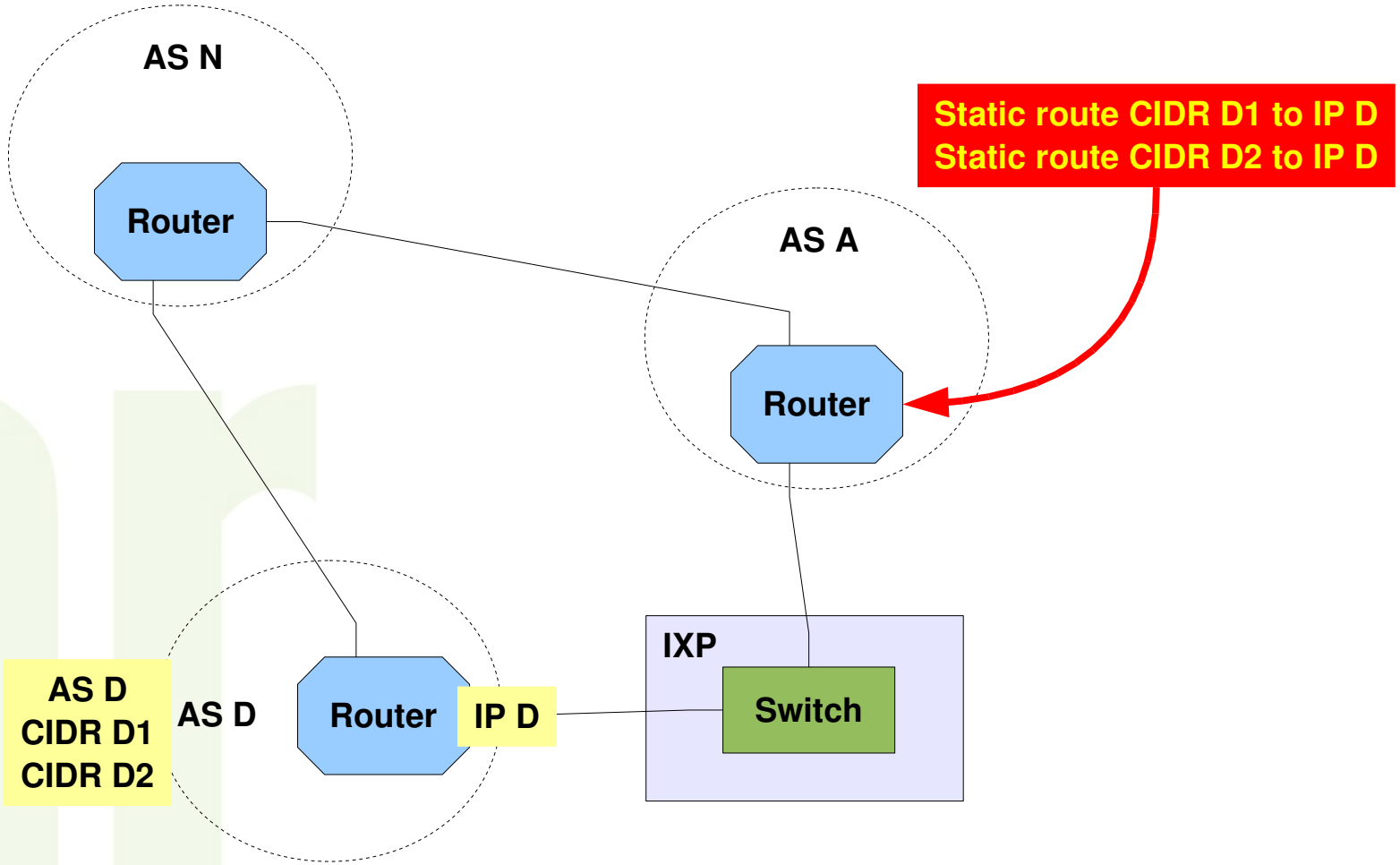

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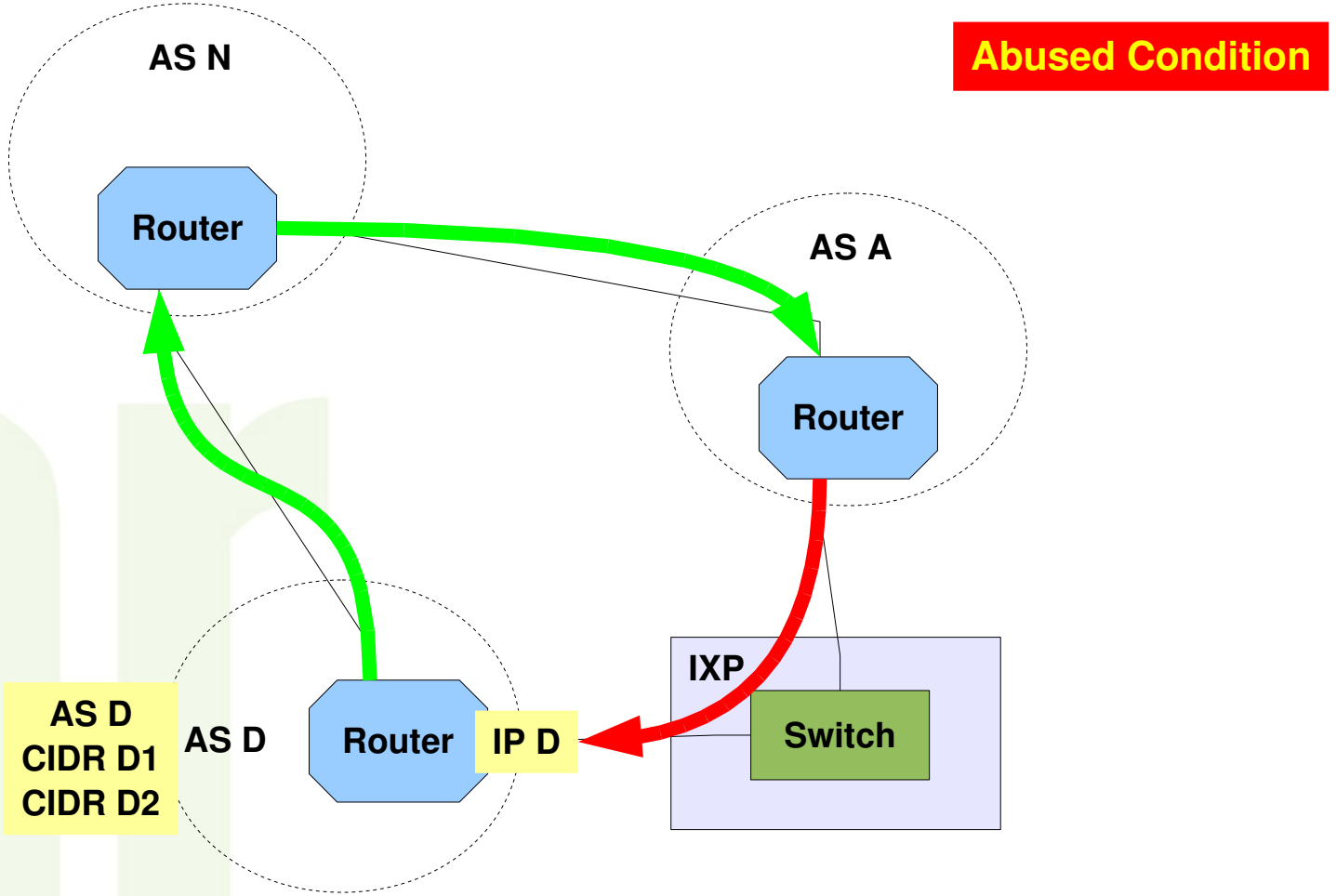

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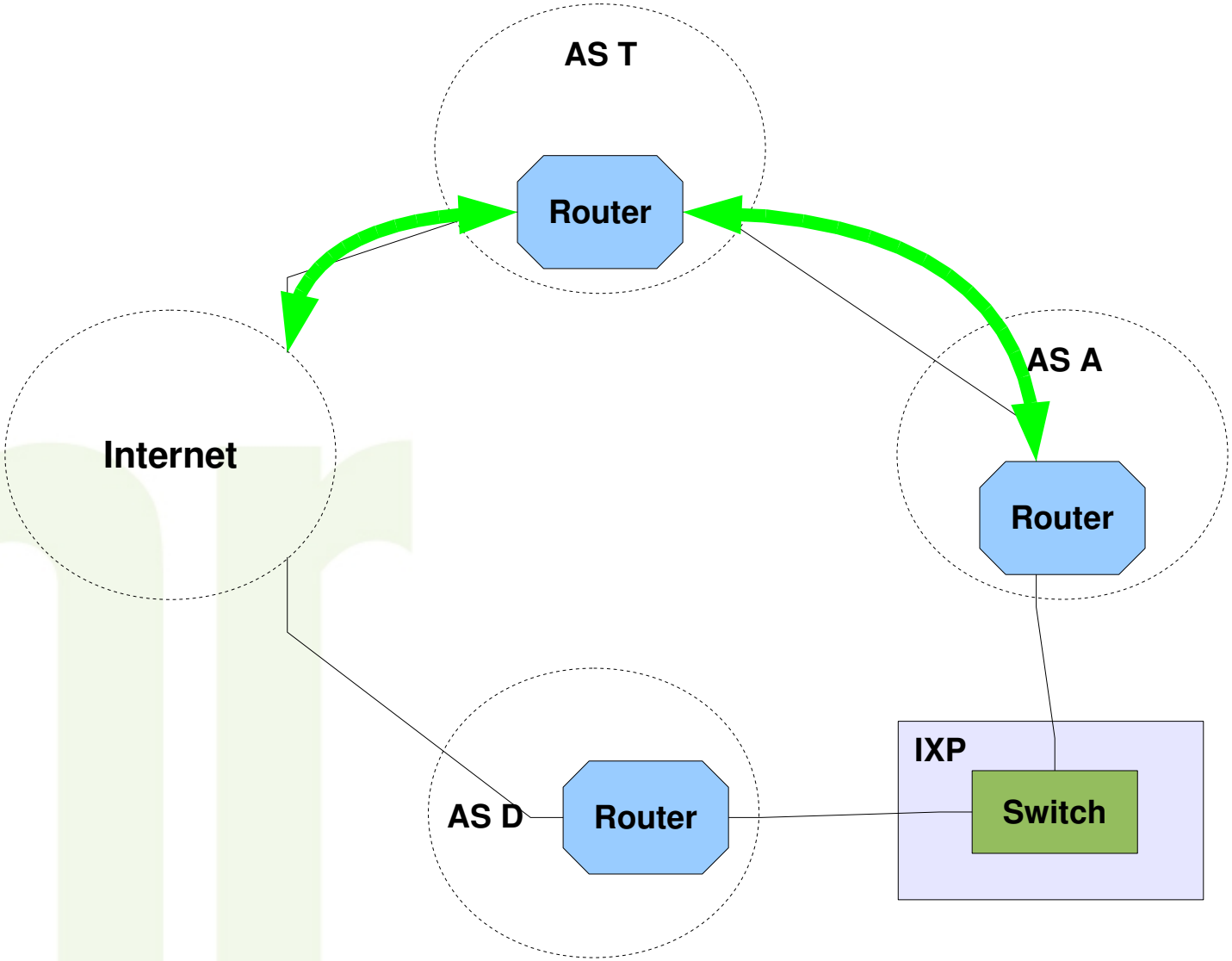

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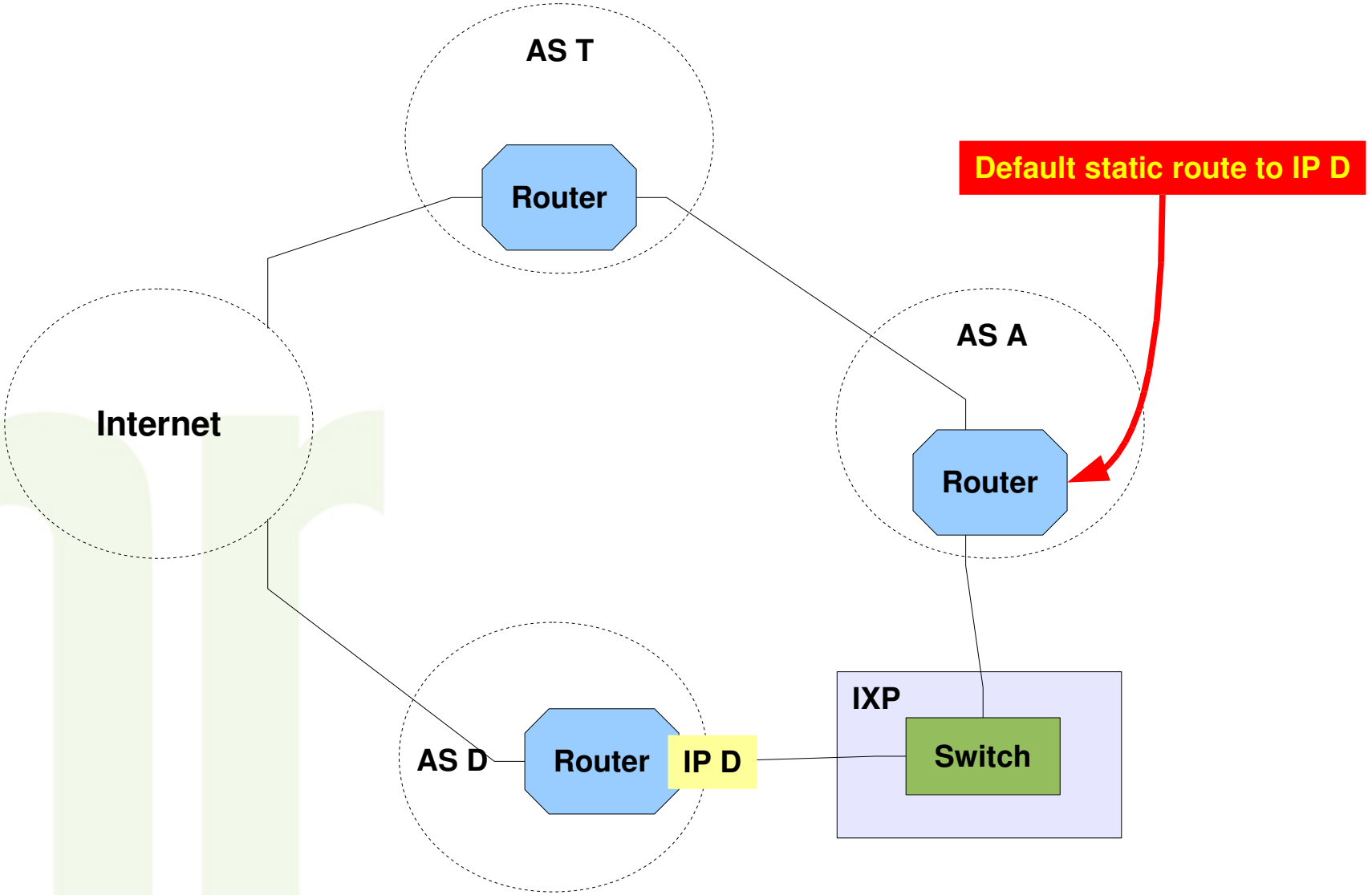

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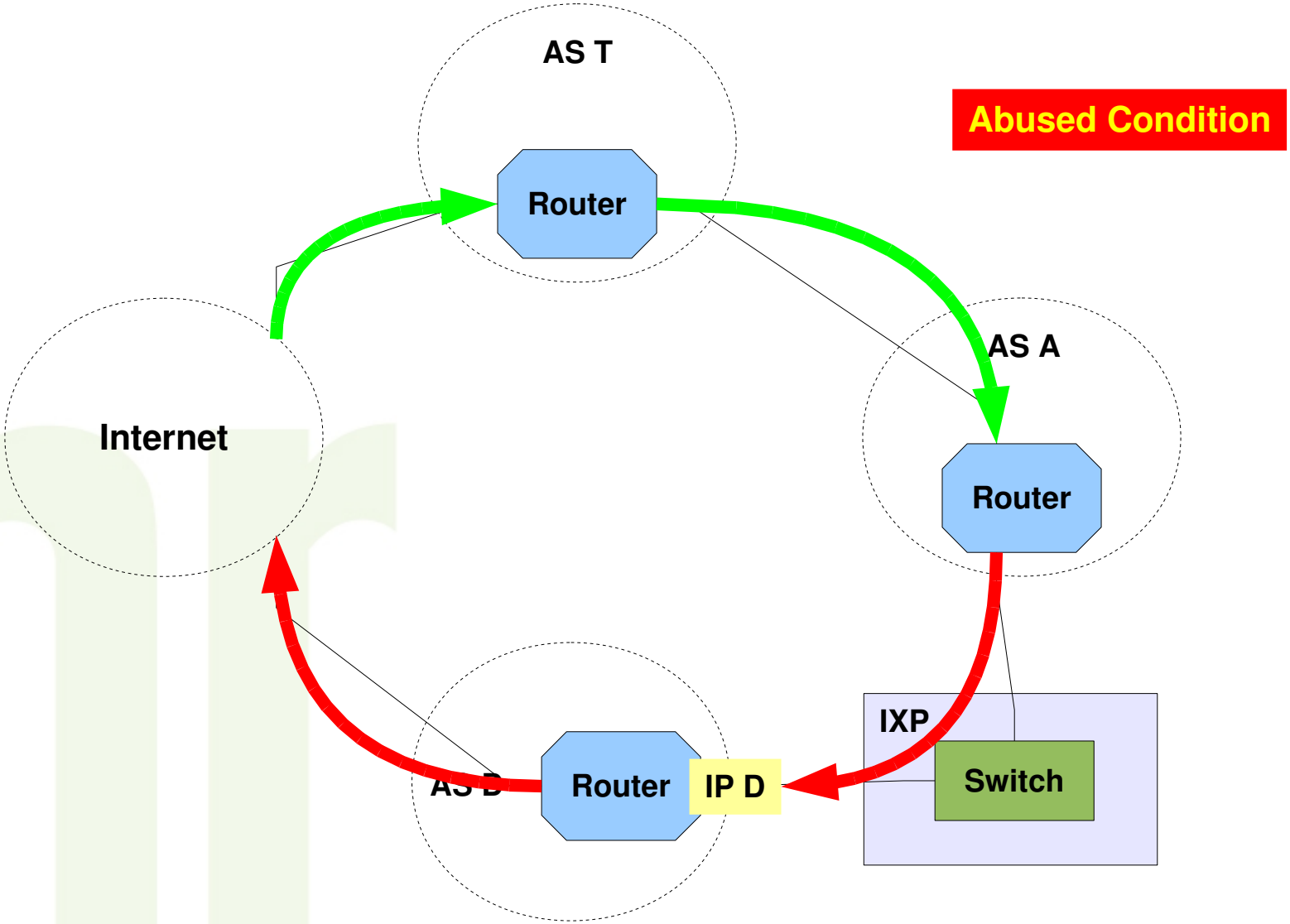
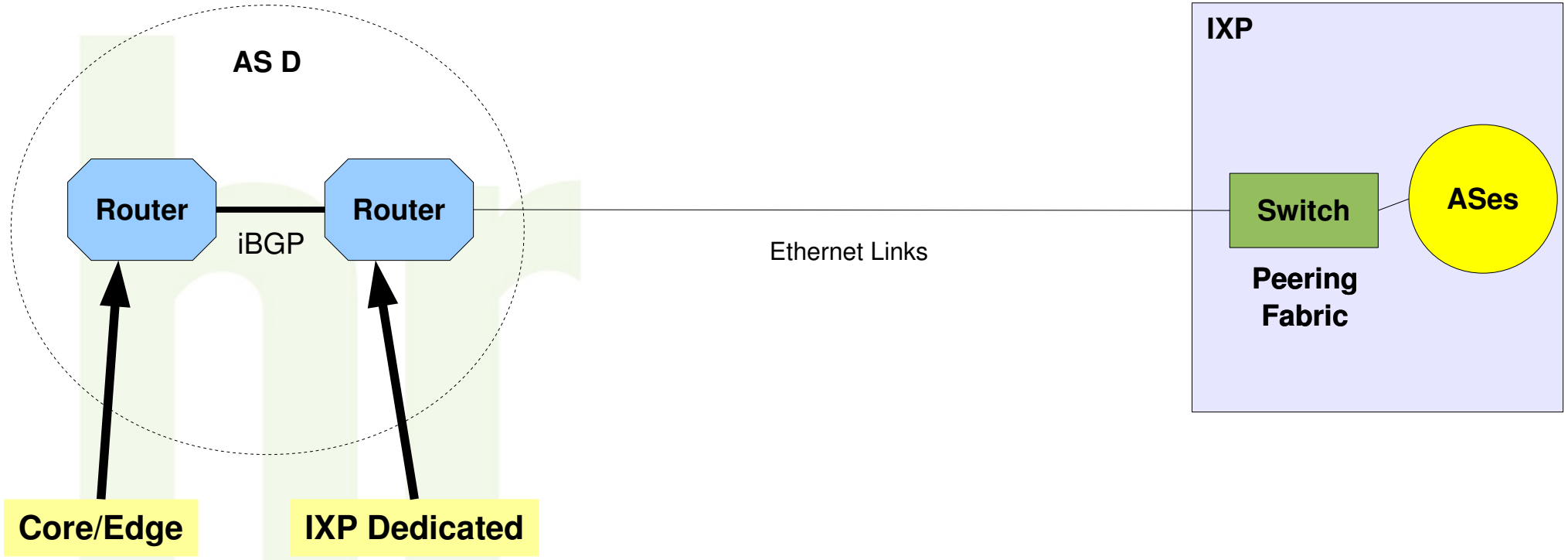


IXP Ethernet Links – L3 Problem - Solution



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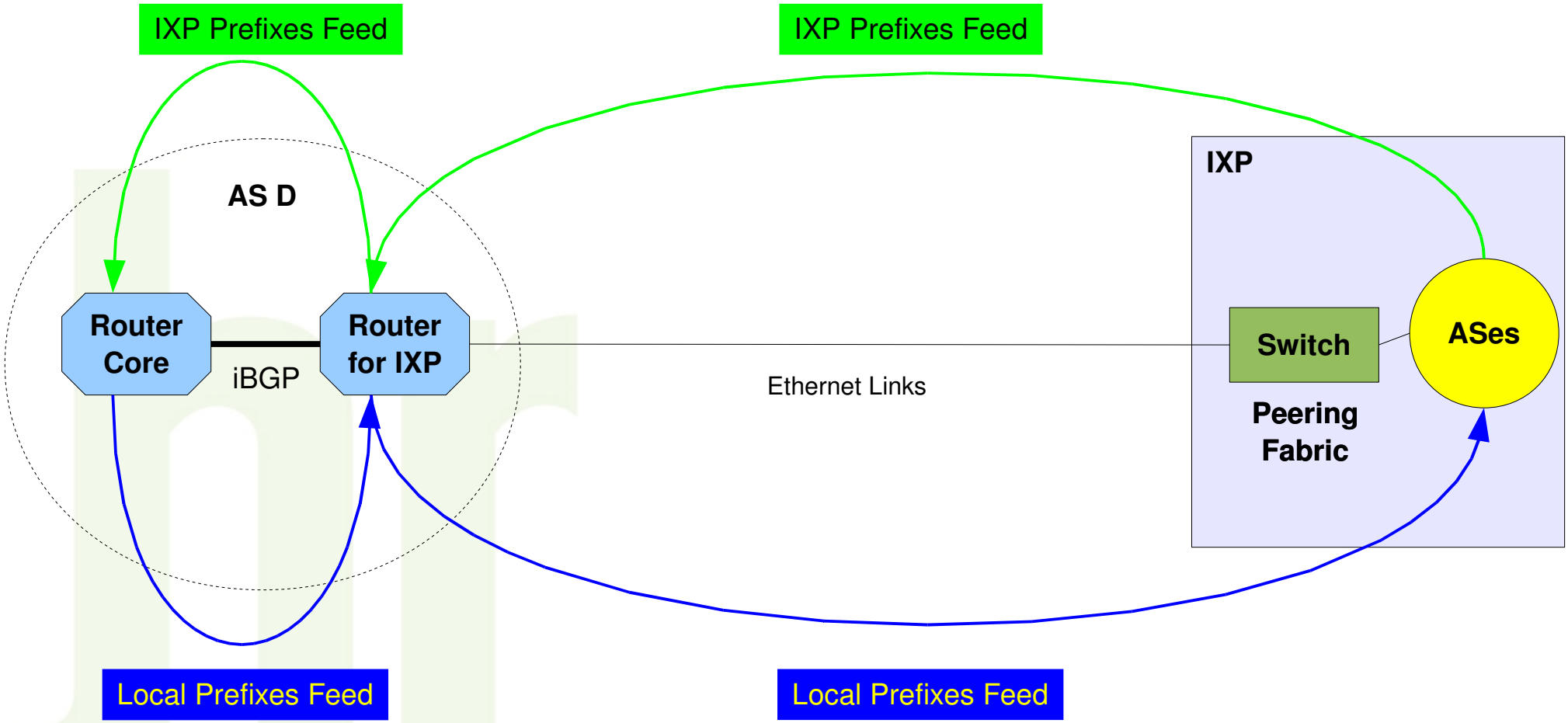

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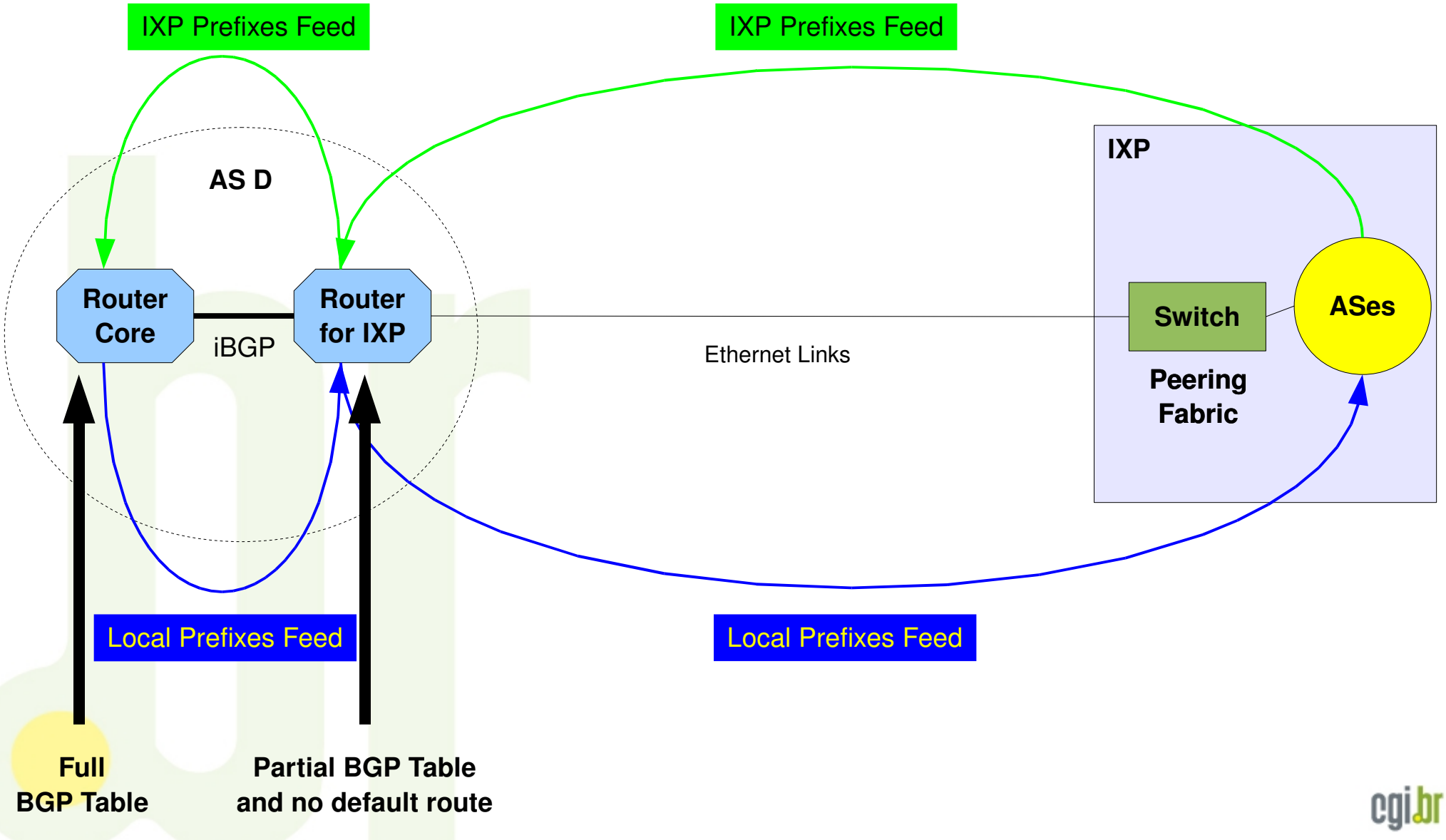

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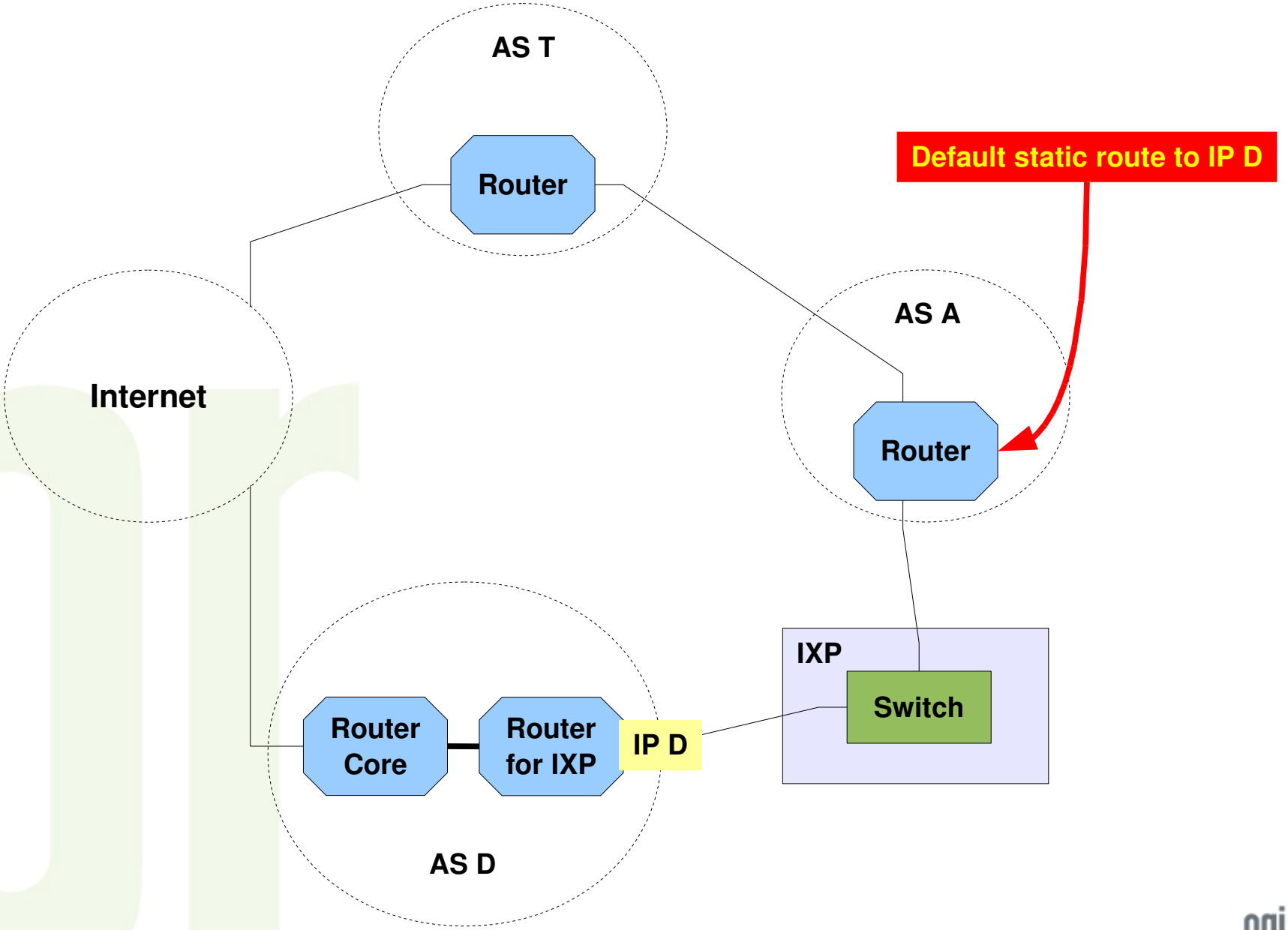

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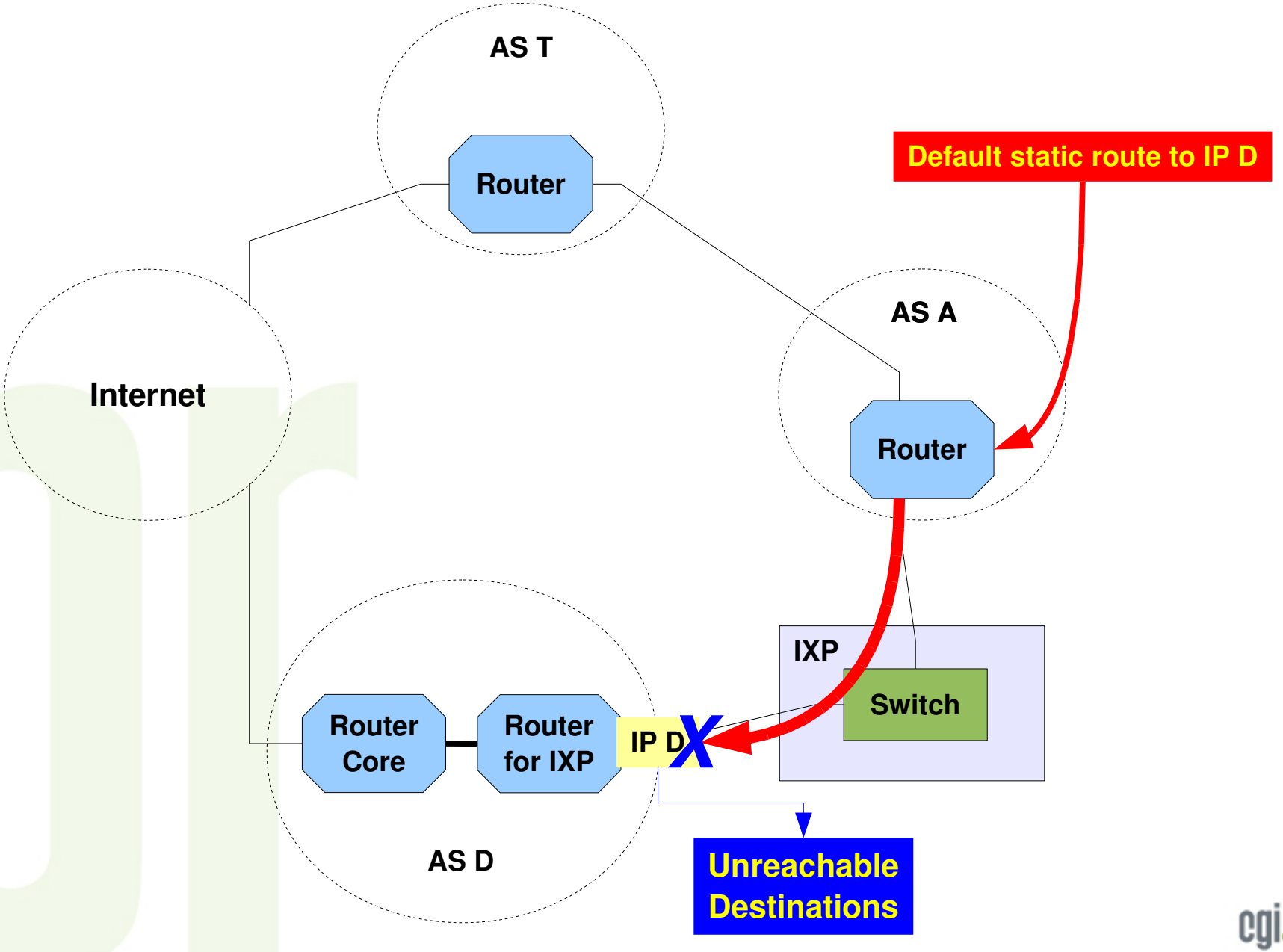

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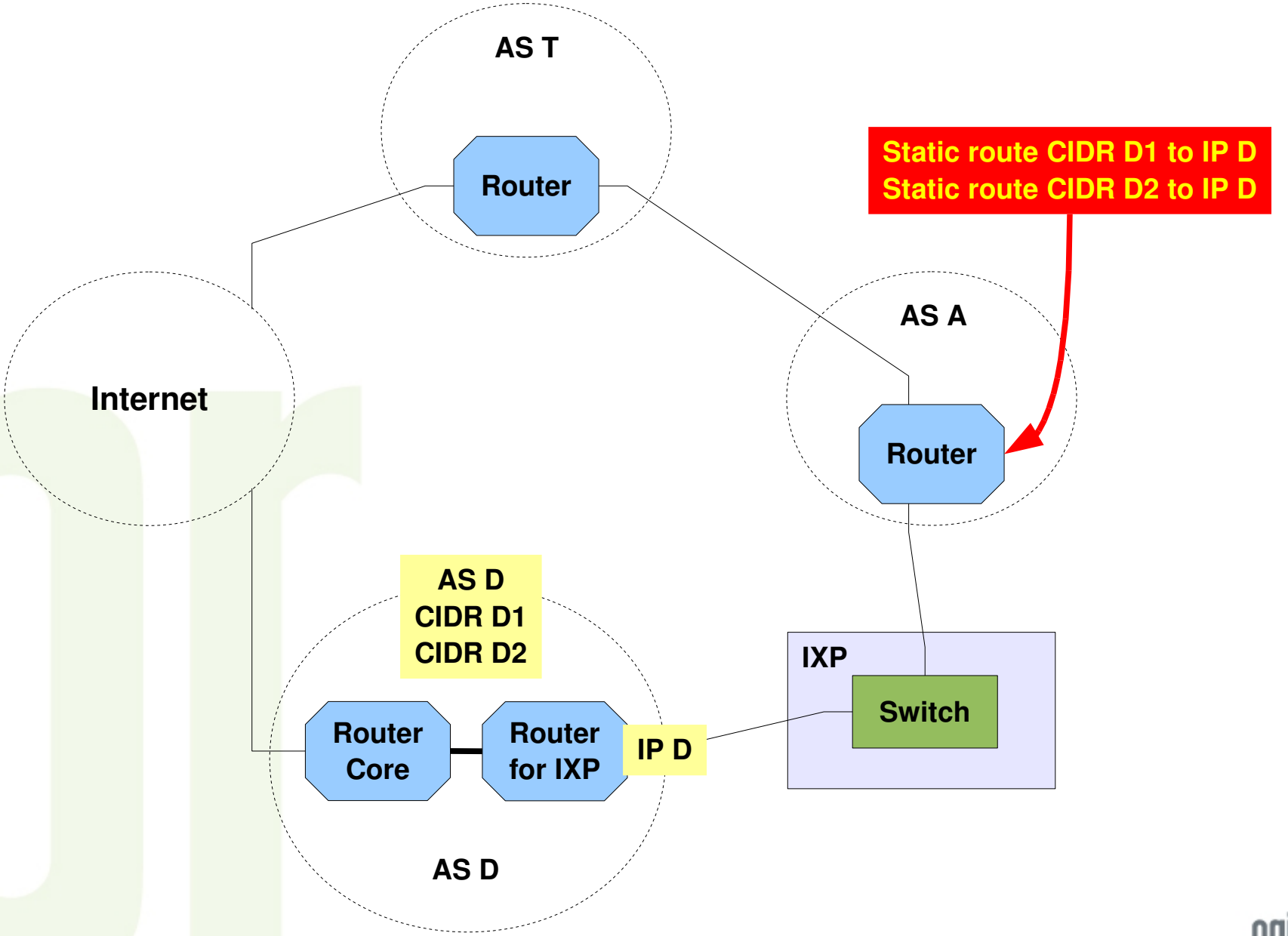

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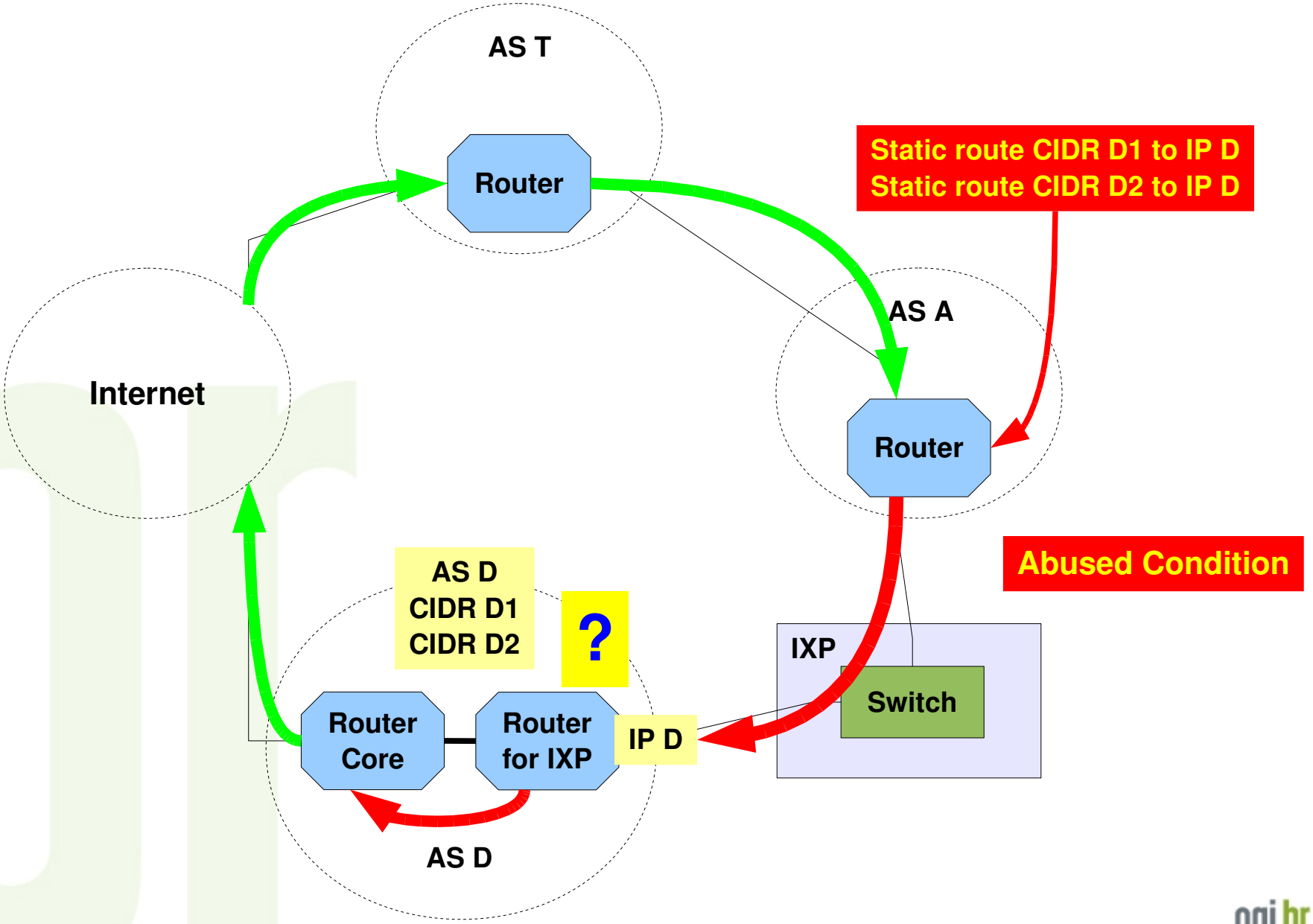

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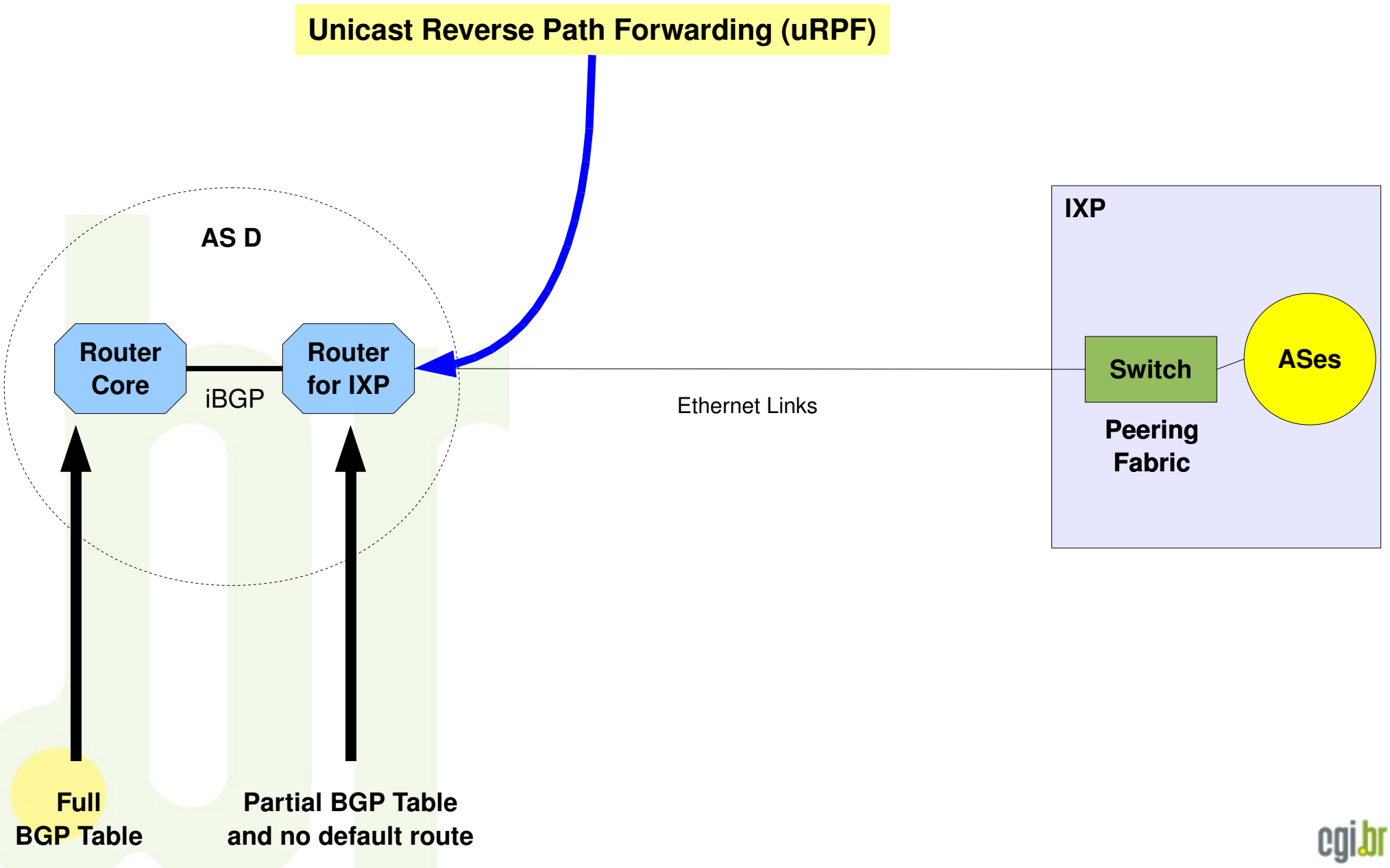

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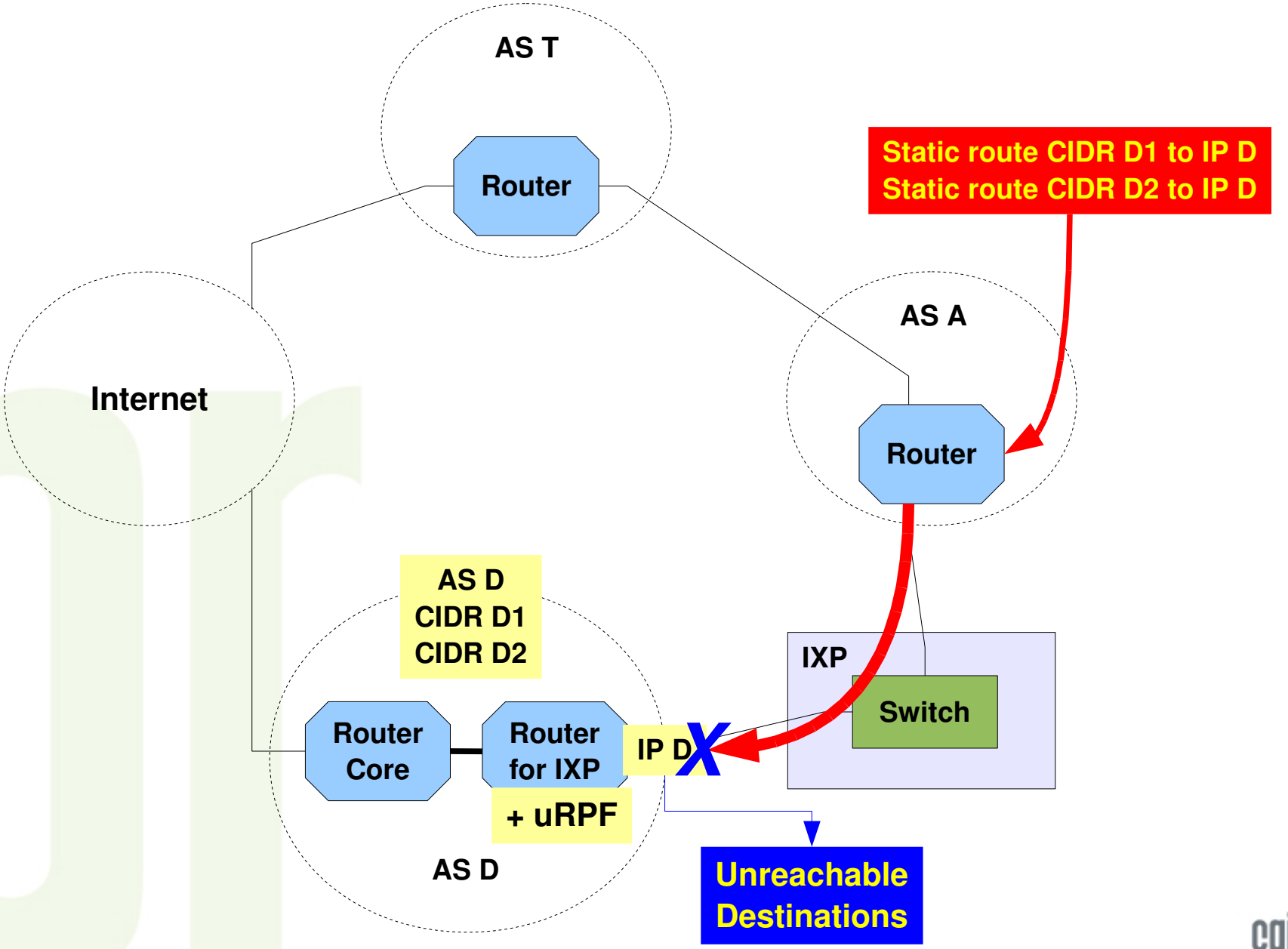

Thanks

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