Inter-domain Source Address Validation (SAVNET) Architecture

draft-wu-savnet-inter-domain-architecture-00

J. Wu, D. Li, M. Huang, L. Qin, N. Geng, T. Zhou

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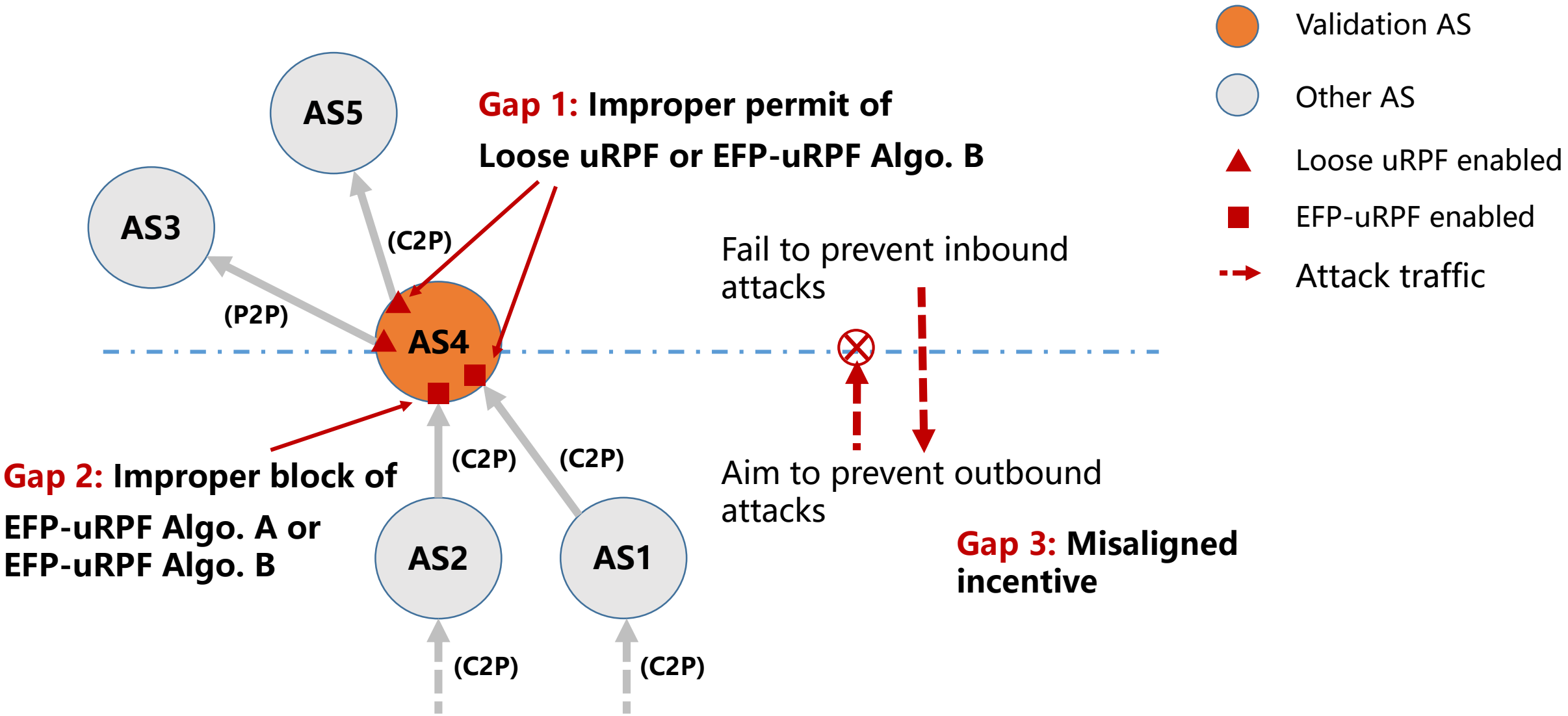
Gaps of Existing Inter-domain SAV Mechanisms



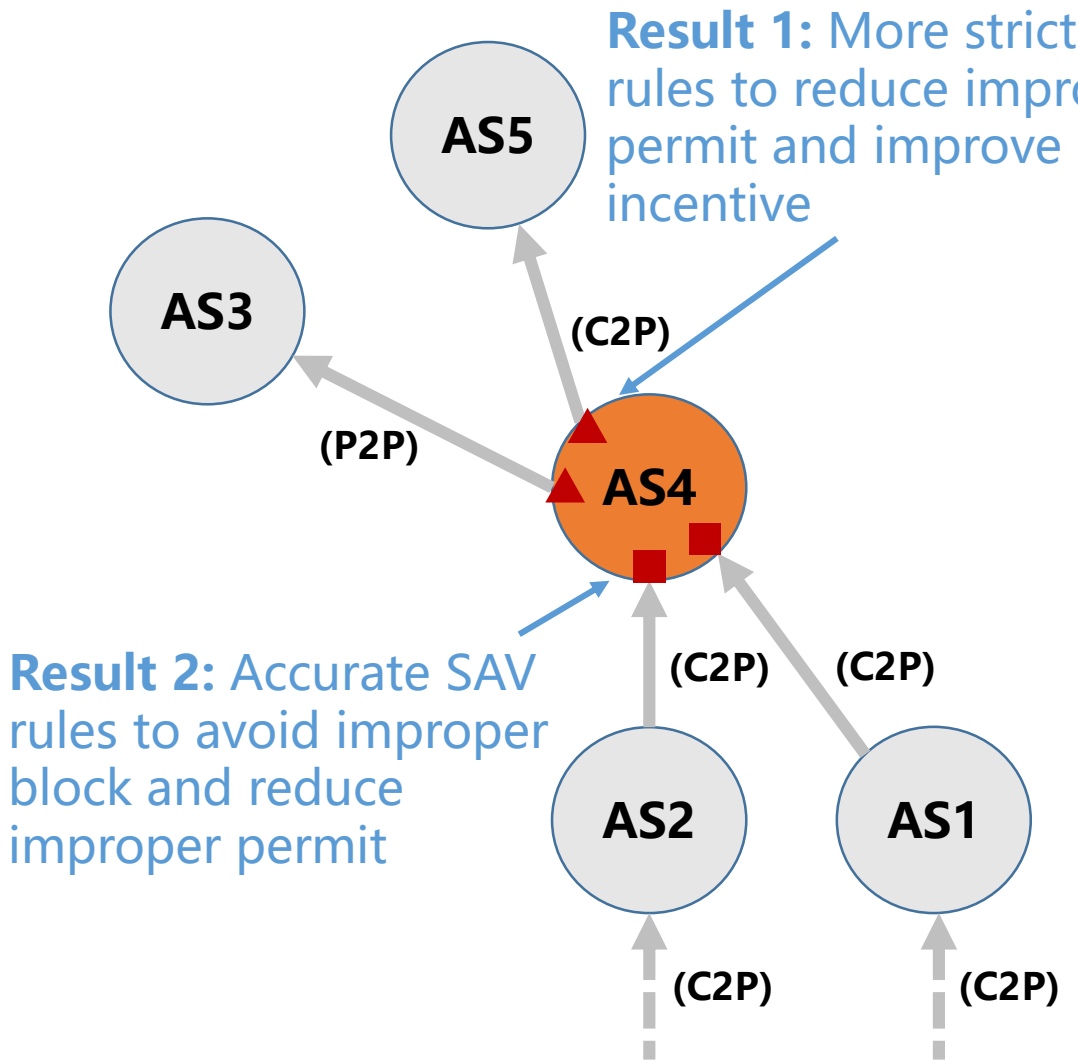
More details in [draft-wu-savnet-inter-domain-problem-statement-02] and [draft-qin-savnet-incentive-01]

How to Narrow the Gaps

- **How to narrow the gaps?**
  - Generate **accurate** SAV rules at **all directions** of the validation AS

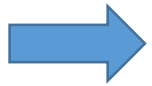
Key point 1: accurate SAV rules

Key point 2: at all directions

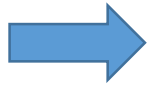


Challenges

- **Validation AS** needs three steps to generate SAV rules for an **origin AS**
  - **Step 1**: get all source prefixes of the origin AS
  - **Step 2**: obtain the incoming directions of the packets of the origin AS
  - **Step 3**: bind source addresses to valid incoming interfaces, i.e., SAV rules



- **Challenge 1**: how to get **accurate and complete** set of source prefixes of the origin AS?



- **Challenge 2**: how to get **accurate and complete** incoming directions of the origin AS?

Main idea to address the challenges: exchange extra information between ASes

Source Prefix Advertisement (SPA) Process

(To address challenge 1: get source prefixes of origin AS)

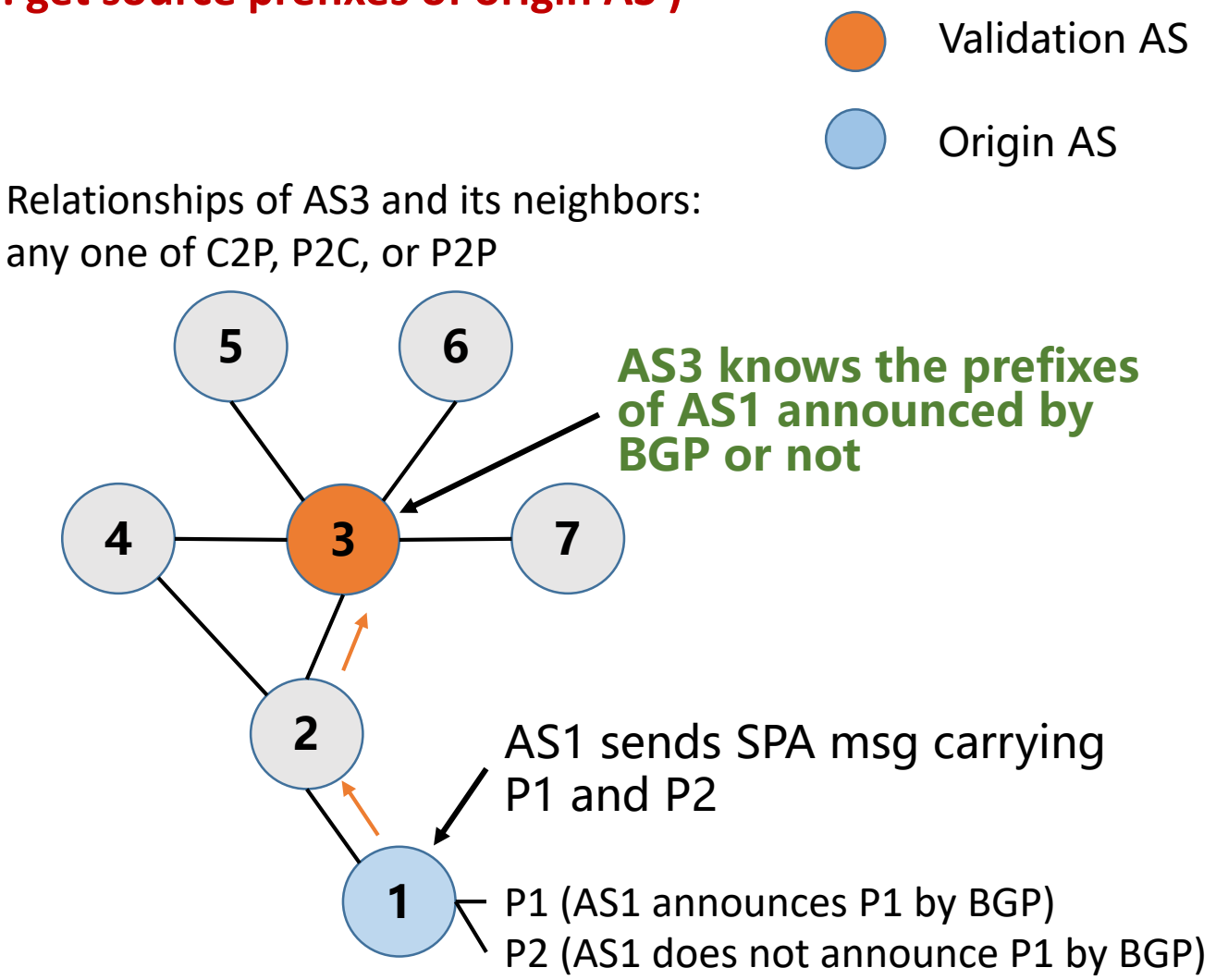
Main Idea

- Origin AS can announce source prefix by SPA messages **as a complementary to BGP**

SPA process illustration

- AS1 sends an SPA message to tell AS3 that P1 and P2 should be considered when generating SAV rules

Possible scenario: Direct Server Return (DSR)



Source Path Discovery (SPD) Process

(To address challenge 2: get incoming directions of origin AS)

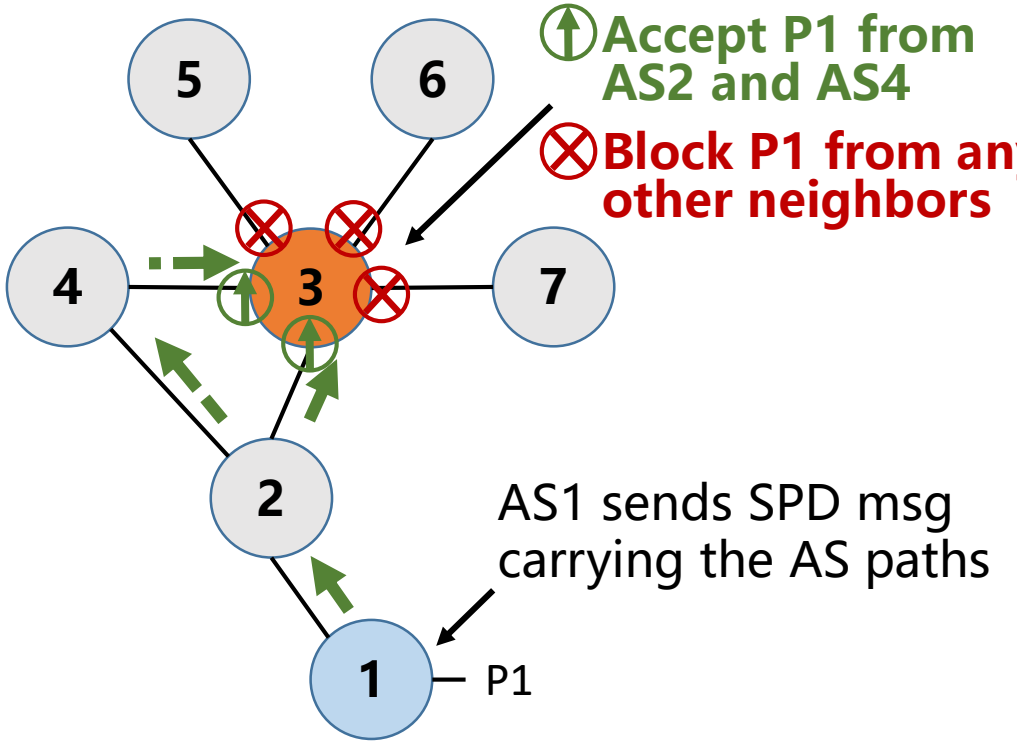
Main idea

- Origin AS advertises its preferred AS paths to validation ASes by SPD messages
- Validation AS knows the incoming directions of origin AS through SPD messages

SPD process illustration

- AS1 selects AS path [AS1, AS2, AS3] and [AS1, AS2, AS4, AS3]
- AS1 sends an SPD message to tell AS3 the path
- AS3 learns AS2 and AS4 are the valid direction, and all other neighbors are invalid

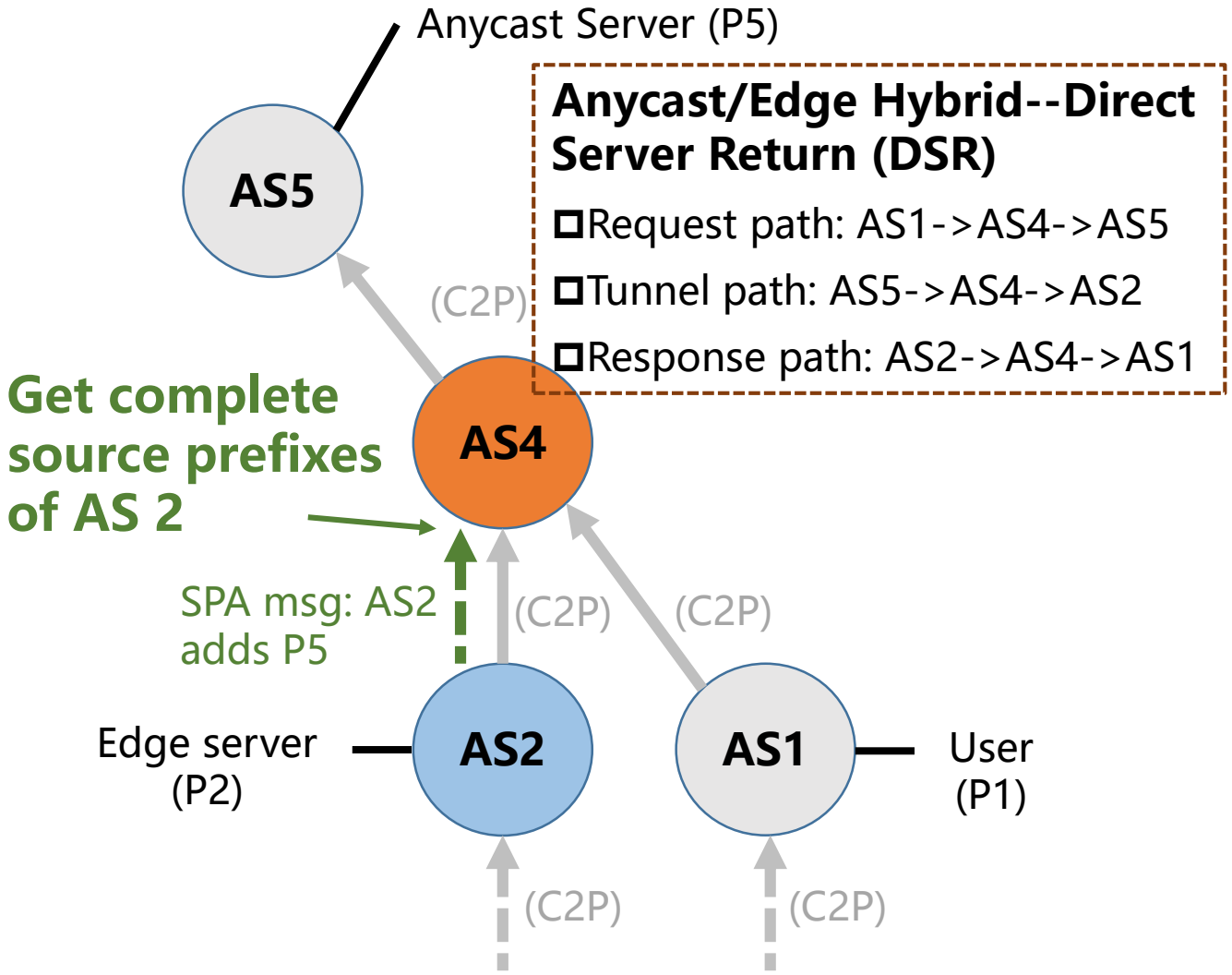
Relationships of AS3 and its neighbors:
any one of C2P, P2C, or P2P



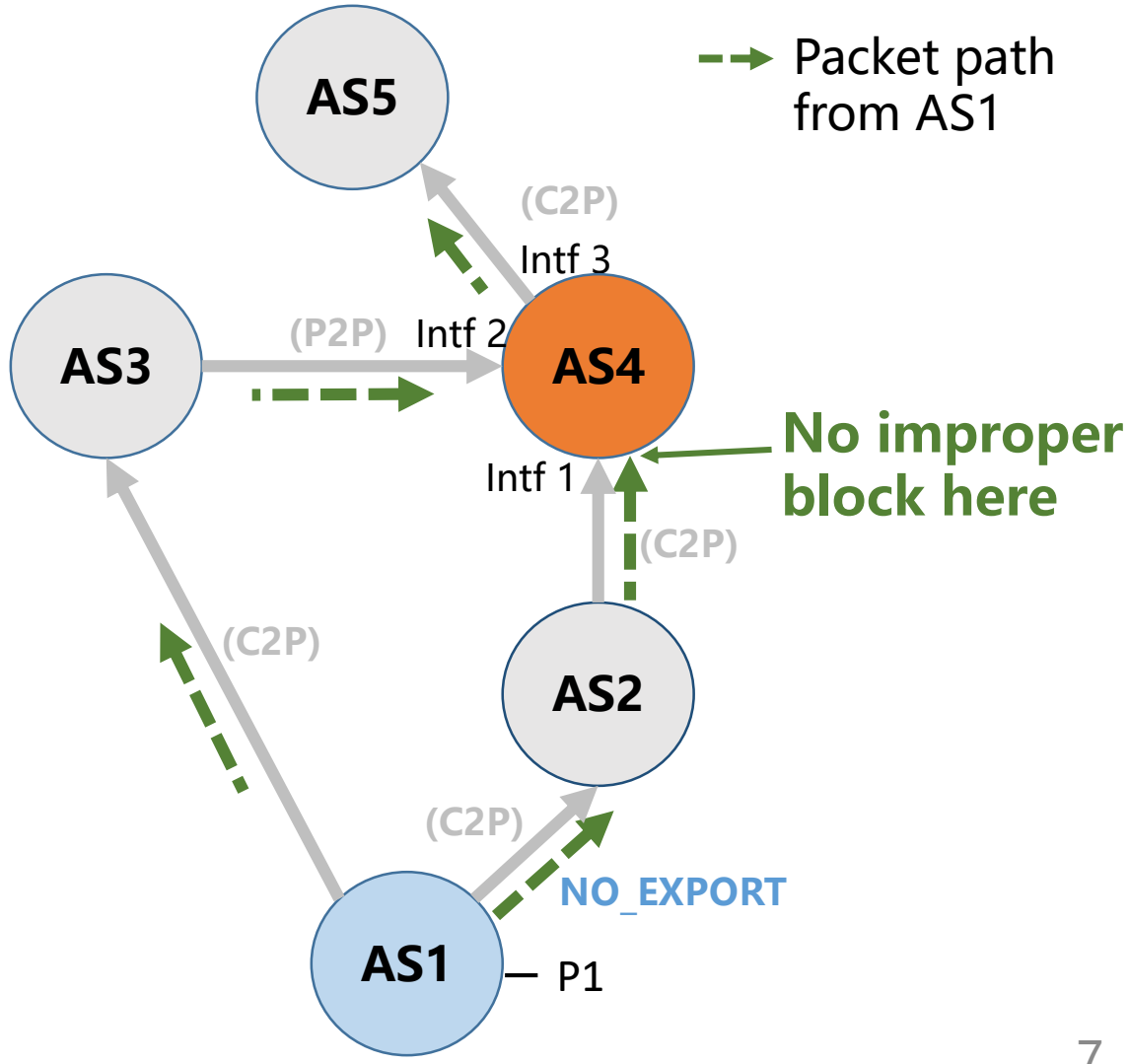
AS path from AS1 to AS3:
[AS1, AS2, AS3] and [AS1, AS2, AS4, AS3]

Improvements Compared with Existing Mechanisms

Improvement 1: eliminate improper block

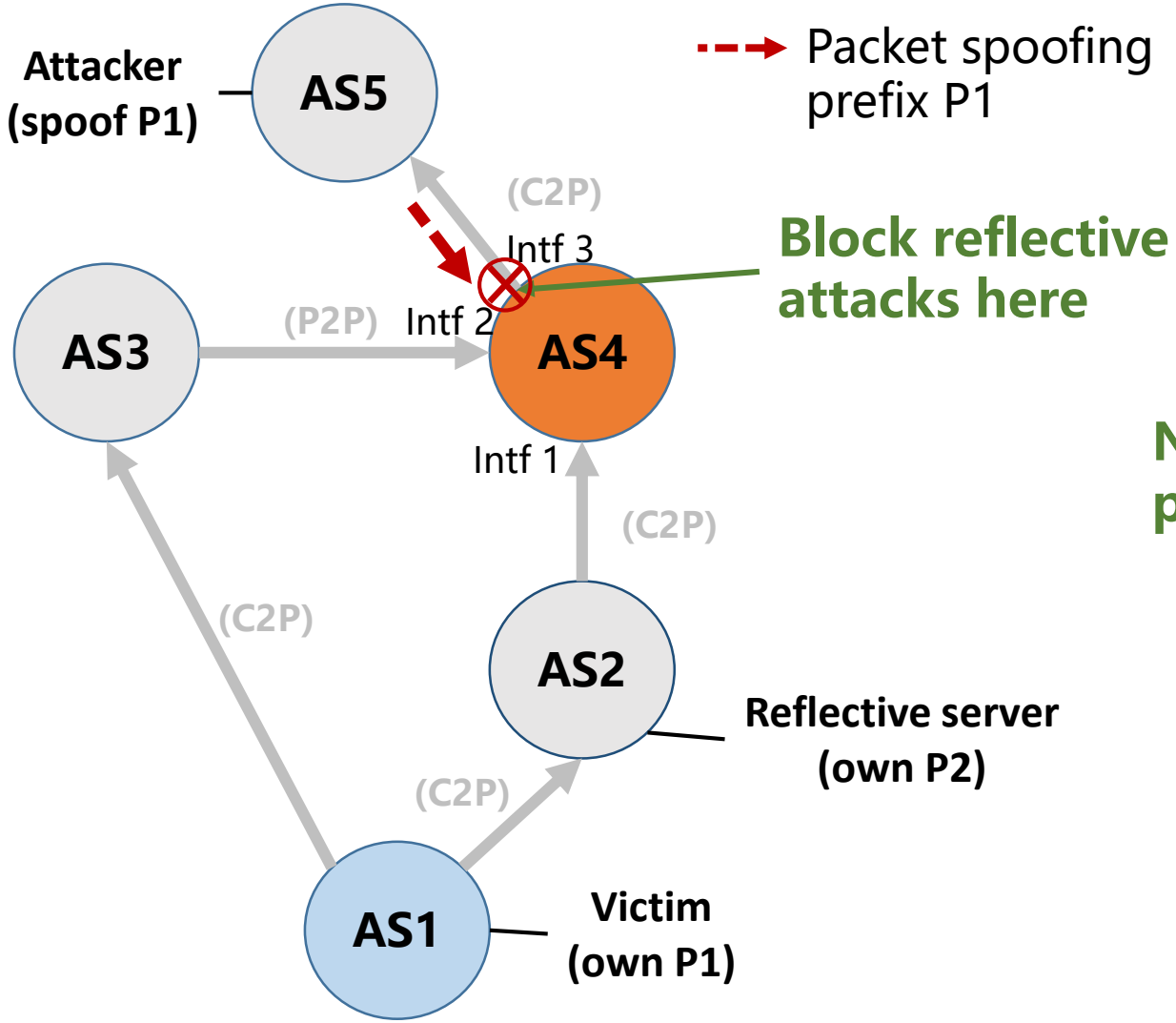


Improvement 2: eliminate improper block

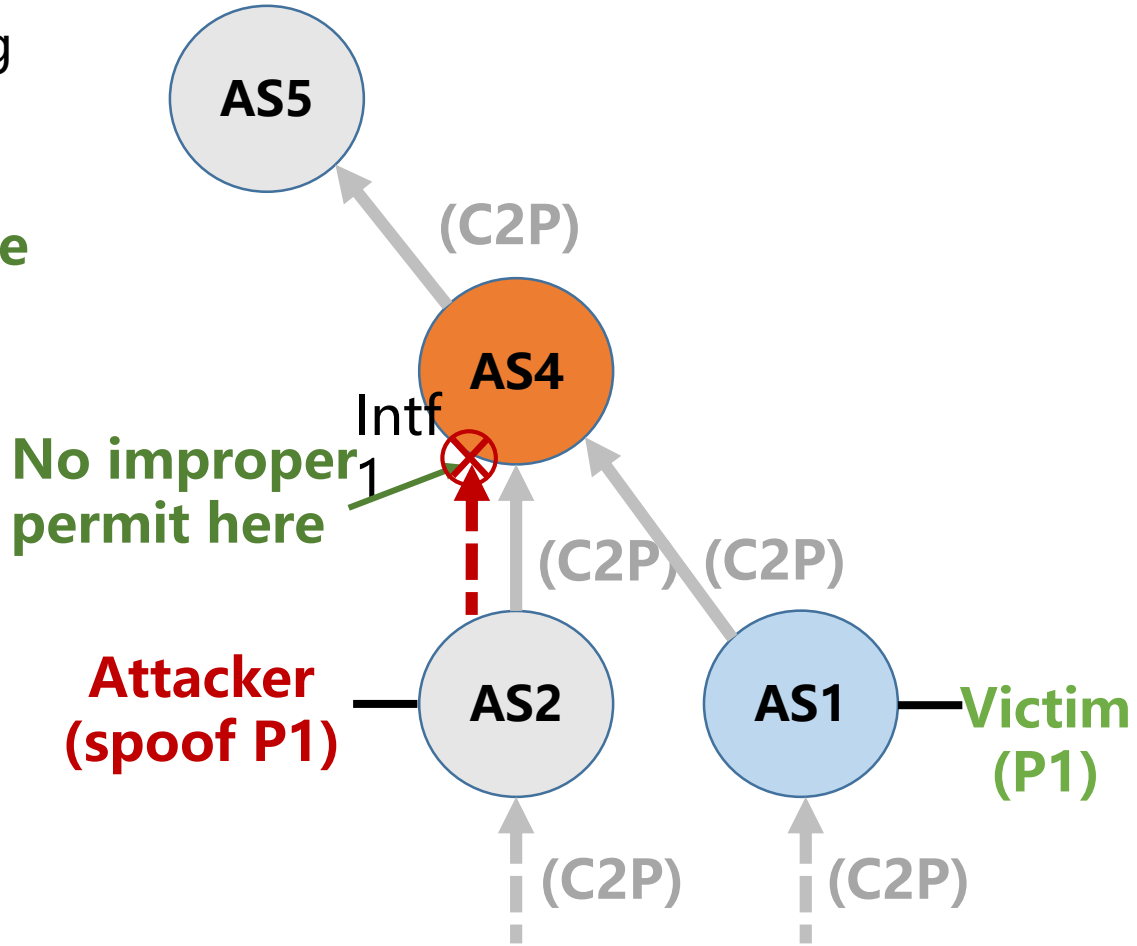


Improvements Compared with Existing Mechanisms

Improvement 3: reduce improper permit and improve incentive

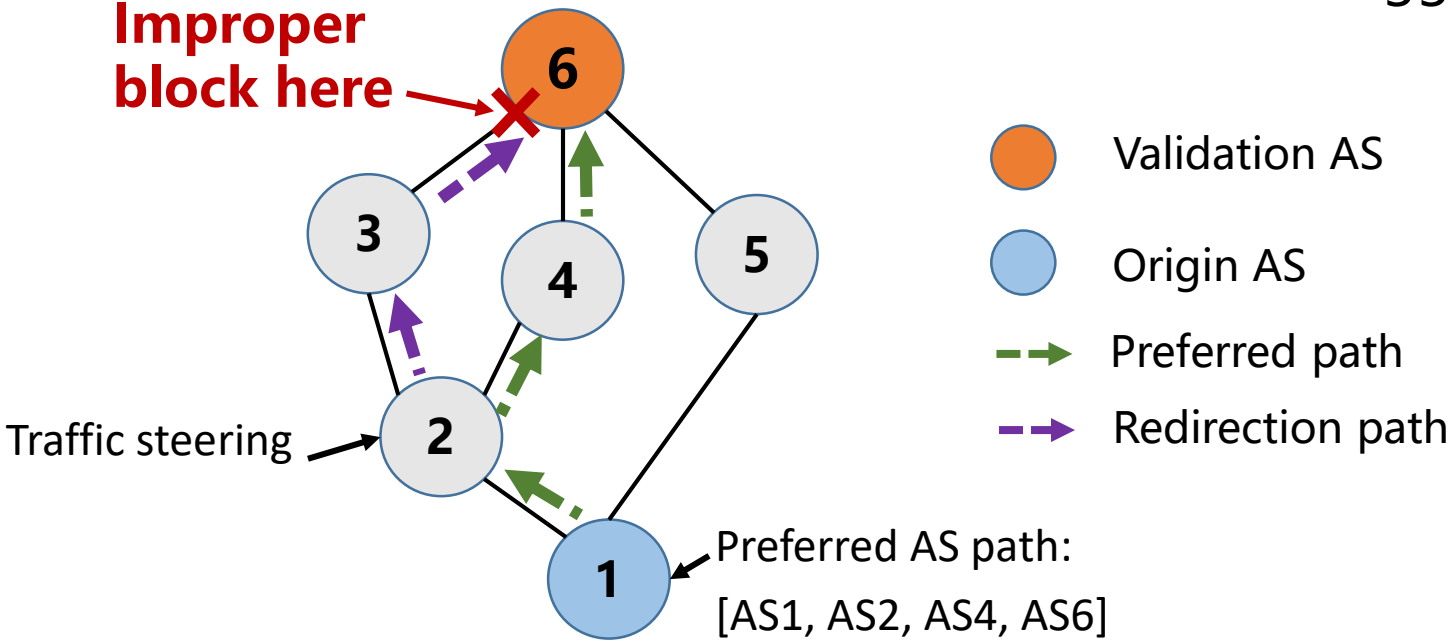


Improvement 4: reduce improper permit and improve incentive



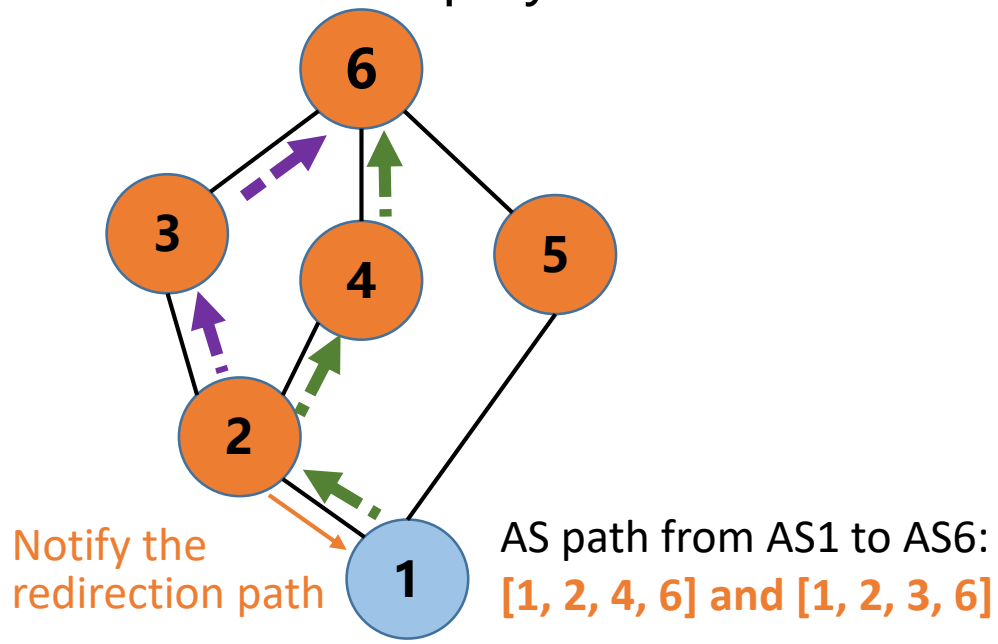
AS Path Inconsistency of Control and Data Plane

- AS path inconsistency may appear due to traffic redirections
  - The real AS path is different from the path preferred by the origin AS!



Example: AS Path Inconsistency

- Preliminary Idea
  - ASes advertise redirection AS paths to origin AS; Origin AS sends SPD messages carrying the redirection AS path
  - Suggest cone-based deployment



Cone-based deployment

Considerations

- Convergence: Source prefix change and AS path change
  - Preliminary idea: fast new SAV rule installing but slow SAV rule removing
- Deployment:
  - Preliminary idea: suggest cone-based deployment
- Security: Session security and content security
  - Preliminary idea: follow BGP security mechanisms

Conclusion

- Goal: Validation AS generates accurate SAV rules at all peering interfaces
  - Avoid improper block, reduce improper permit, and improve incentive
- SPA process: Origin AS announces specific prefixes to validation AS
  - Validation AS obtains accurate and complete source prefixes of origin AS
- SPD process: Origin AS advertises the AS paths reaching validation AS
  - Validation AS gets accurate and complete incoming directions of origin AS packets
- The architecture is protocol-independent. Extensions of routing protocols are not the focus of this document.

Thanks!

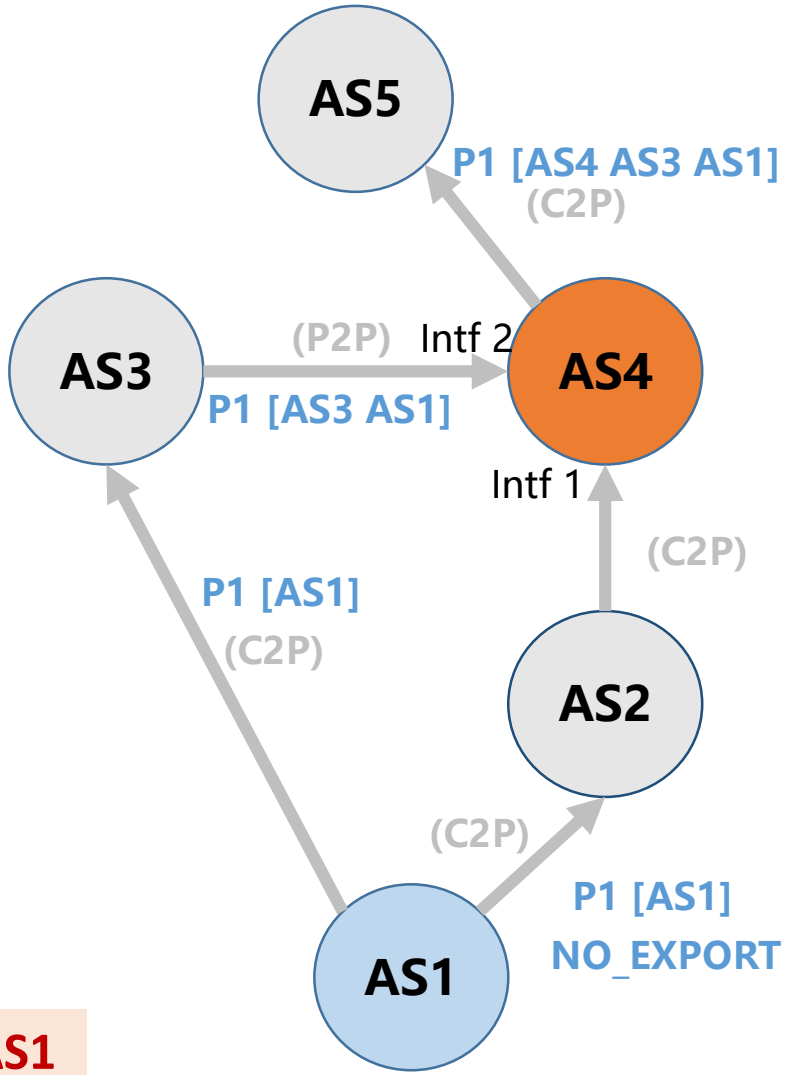
Backup Slides

An Example: No-export Scenario

- Scenario description
  - AS1 advertises P1 to AS2 with no-export
  - AS1 advertises P1 to AS3, and AS3 propagates it to AS4

RIB on AS4		
Source Prefix	**Origin AS**	**Preferred AS Path**
P1	AS1	[AS4, AS3, AS1]
P2	AS2	[AS4, AS2]
P3	AS3	[AS4, AS3]
P5	AS5	[AS4, AS5]

According to BGP, AS3 is the only incoming direction of AS1

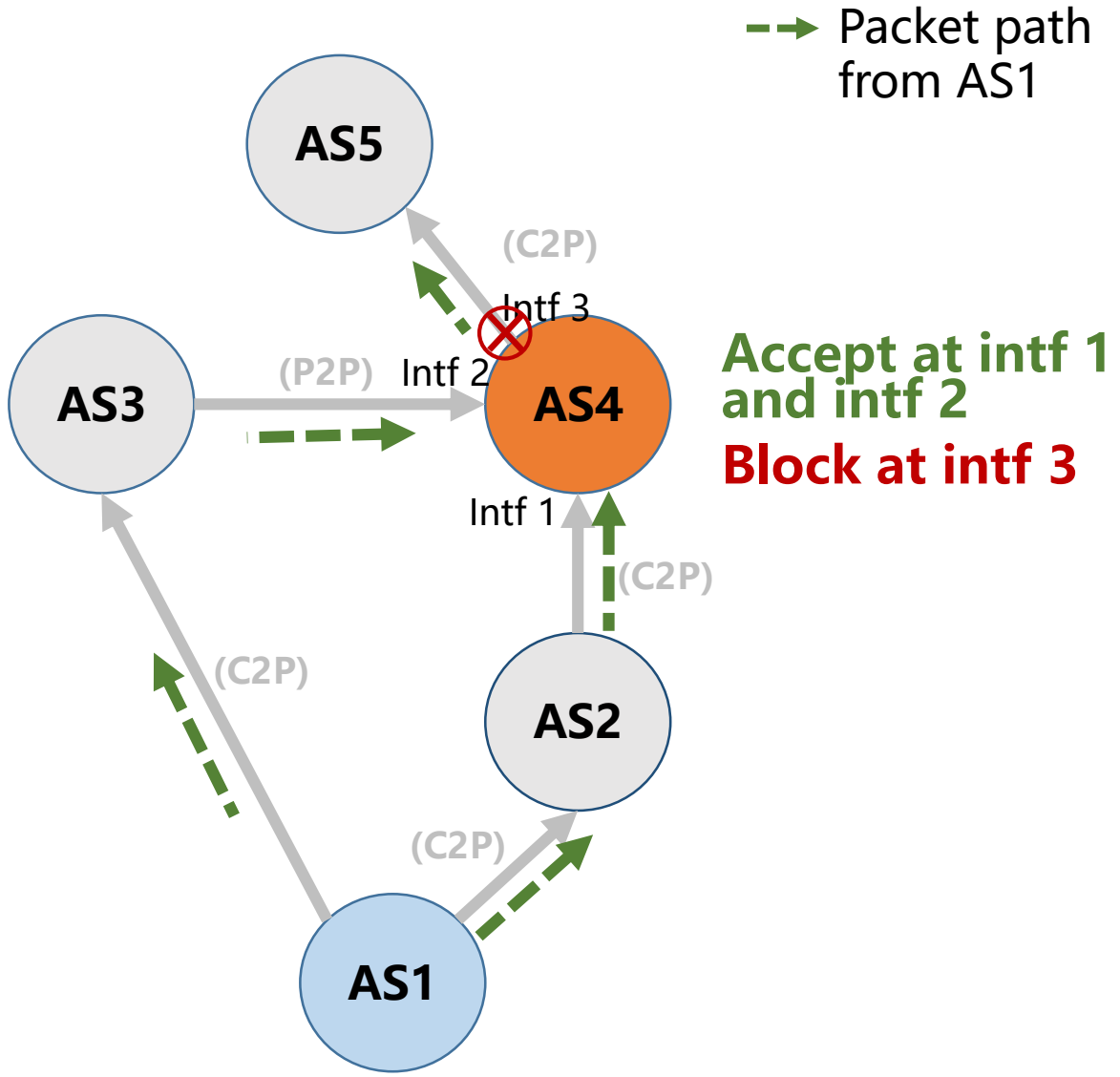


Assume ASx has prefix Px, $x \in \{1,2,3,4,5\}$

SPD Process in the No-export Scenario

- AS1 advertises AS paths to AS4
  - [AS1, AS2, AS4] and [AS1, AS3, AS4]
- AS4 considers AS2 and AS3 are valid directions
  - AS5 is invalid direction

RIB on AS1		
Source Prefix	**Origin AS**	**Preferred AS Path**
P2	AS2	[AS1, AS2]
P3	AS3	[AS1, AS3]
P4	AS4	[**AS1, AS2, AS4**]
P5	AS5	[**AS1, AS3, AS4**, AS5]



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