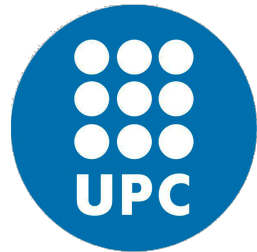


ETSI PDL

Proof of Concept Framework



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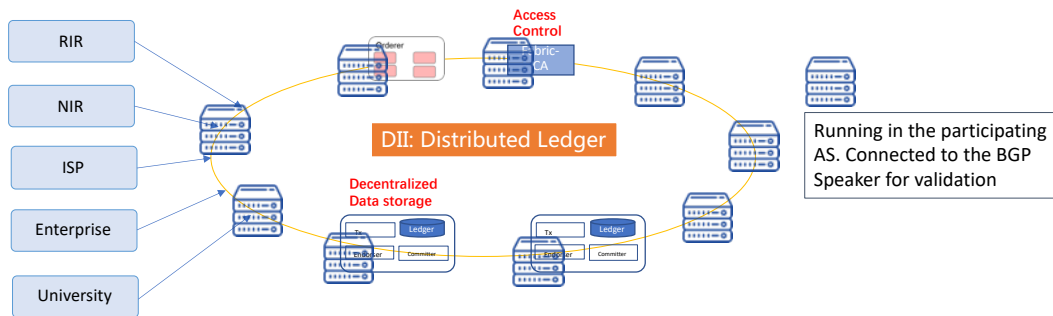
PoC Status

Prof. Albert Cabellos

January 2021

ETSI PDL – Proof of Concept Summary

Blockchain for Inter-Domain Security



Store IP Ownership, ROA and AS Neighbor Info in world state.

IP Ownership

IP	Owner	Exp date
----	-------	----------

1.1.1.1/32	ISP1	18/10
------------	------	-------

ASN Ownership

ASN	Owner	Exp date
-----	-------	----------

AS100	ISP1	18/10
-------	------	-------

ROA (IP->ASN)

IP	Maxlength	ASN
----	-----------	-----

1.1.1.1/32	32	100
------------	----	-----

AS Neighbor(ASN->ASN)

Source	Target
--------	--------

AS100	AS200
-------	-------

AS200	AS300
-------	-------

AS Business Relationship(ASN->ASN)

Source	Target	Type
--------	--------	------

AS100	AS200	P2P
-------	-------	-----

AS200	AS300	P2P
-------	-------	-----

Inter-Domain Security

Protects against the following attacks

- Prefix Hijack
- Path Hijack
- Route Leak

Proof-of-Concept Testbed

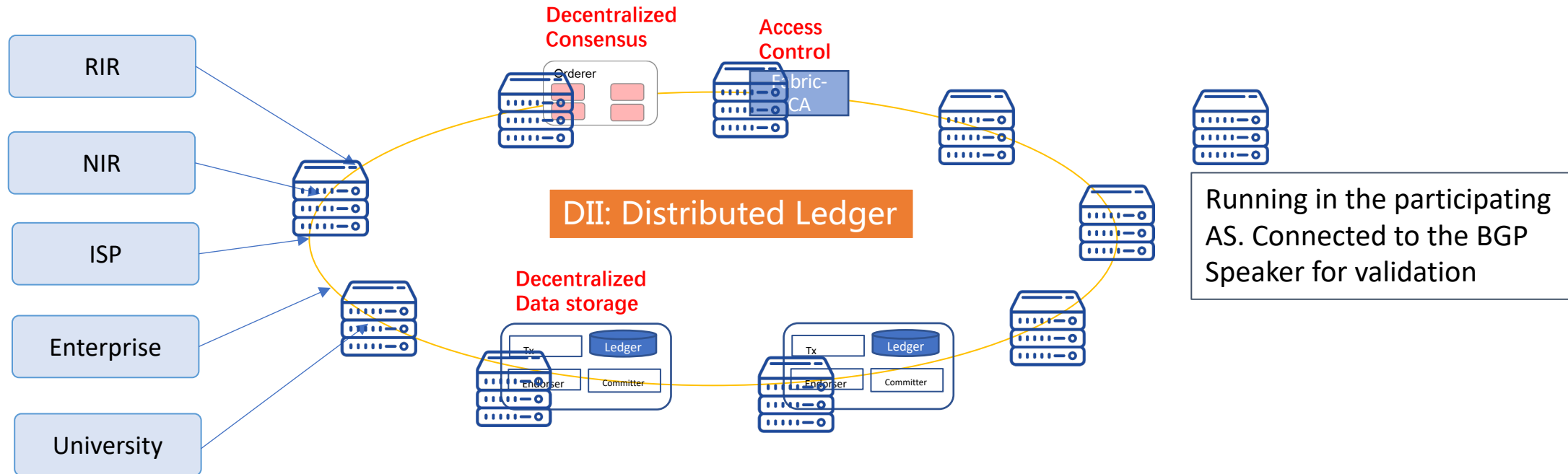


Proof of Concept Stages and Milestones

- Project Start: 01/07/2020
- PoC Demo 1: ETSI BrighTalk 15/09/2020
 - <https://www.brighttalk.com/webcast/12761/433364>
- PoC Demo 2 and 3: Cancelled due to COVID (see note 1 and 2 on original proposal)
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Proof-of-Concept

Proof-of-Concept: Architecture



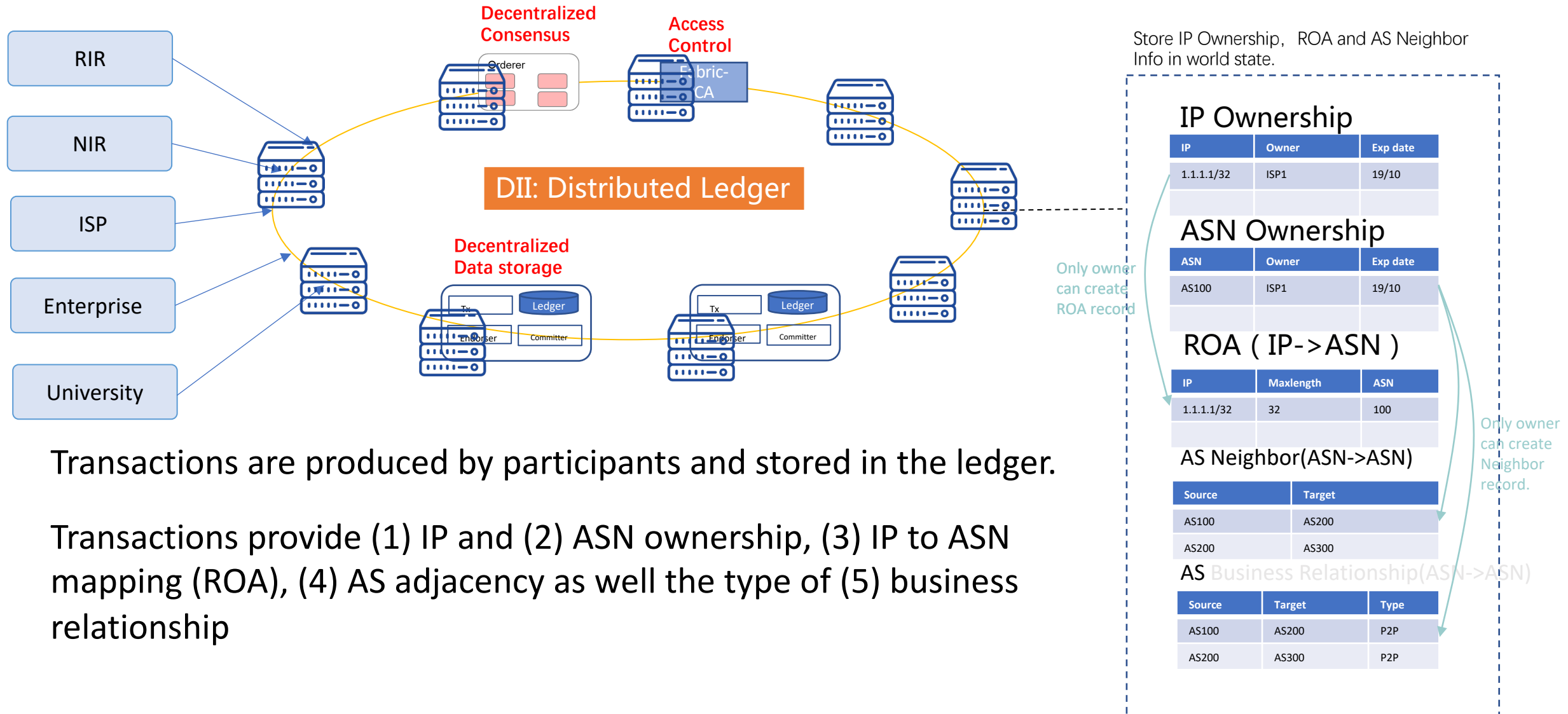
Distributed Ledgers: Participants are RIRs, NIRs, ISPs, Enterprise and Universities, in general IP-prefix and ASN holders participating in BGP.

Decentralized Data Storage: Data is distributed among participants.

Access control: Only authenticated participants can read/write in the ledger.

Distributed Consensus: Participants agree on adding a new transaction to the ledger.

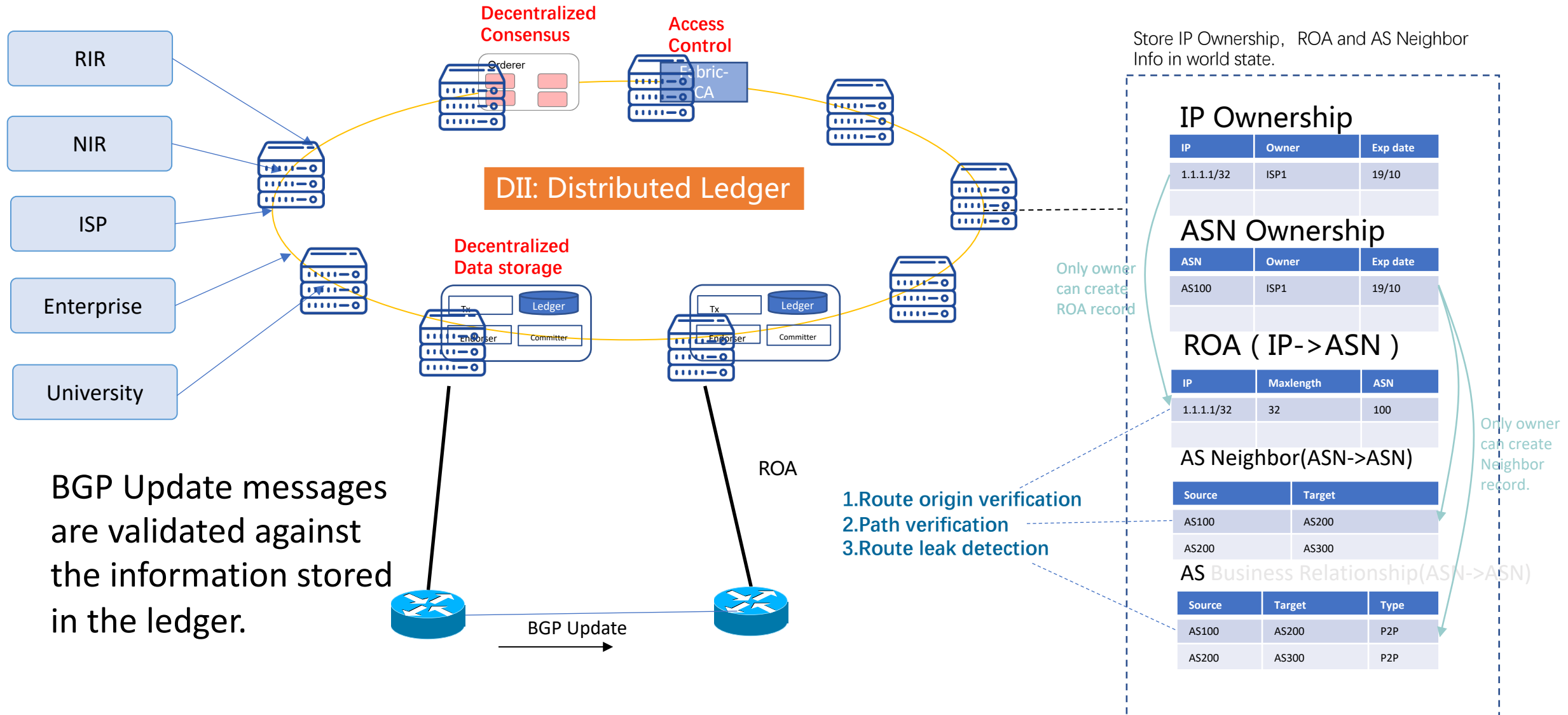
Information stored in the ledger



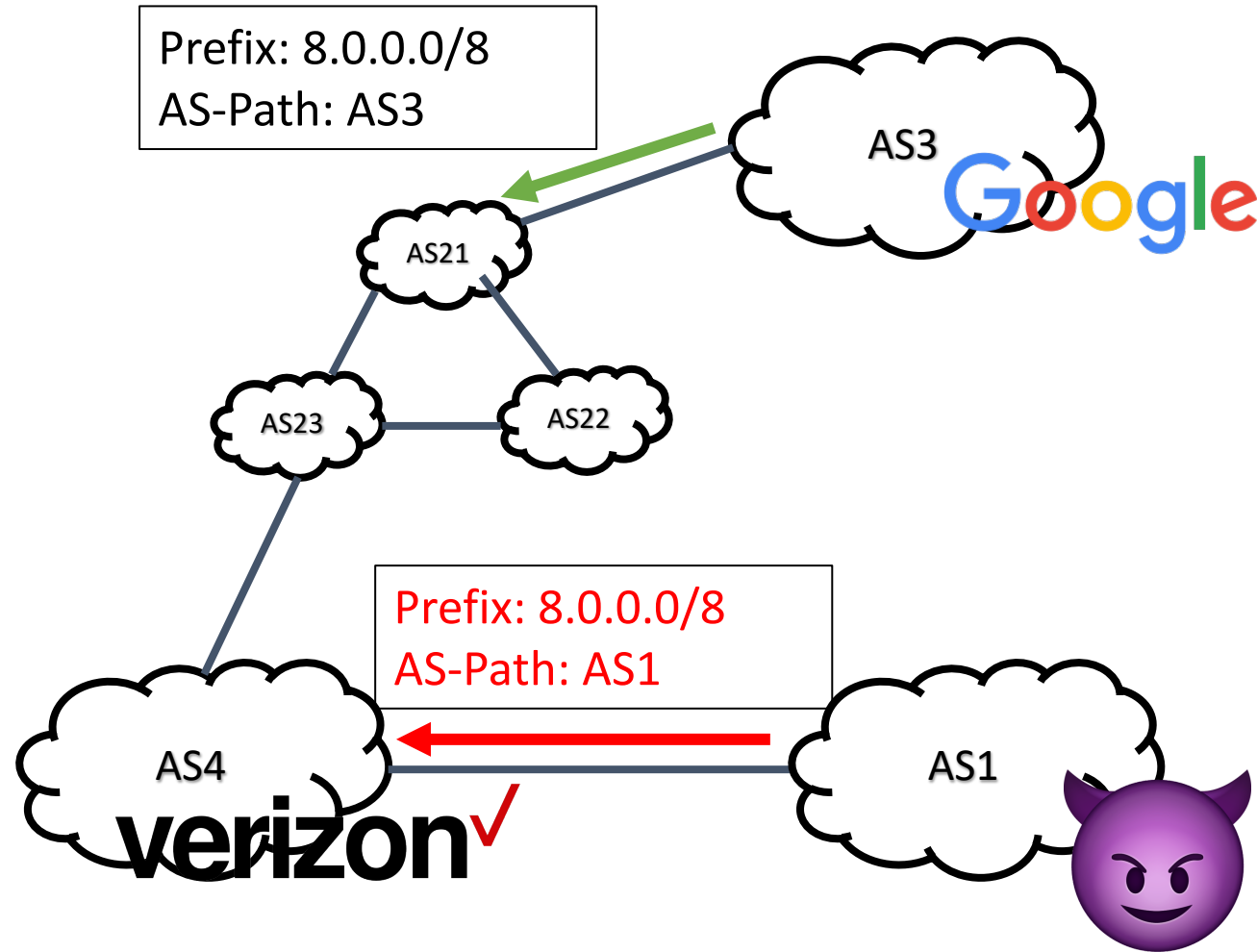
Transactions are produced by participants and stored in the ledger.

Transactions provide (1) IP and (2) ASN ownership, (3) IP to ASN mapping (ROA), (4) AS adjacency as well the type of (5) business relationship

Interface with the Data-Plane

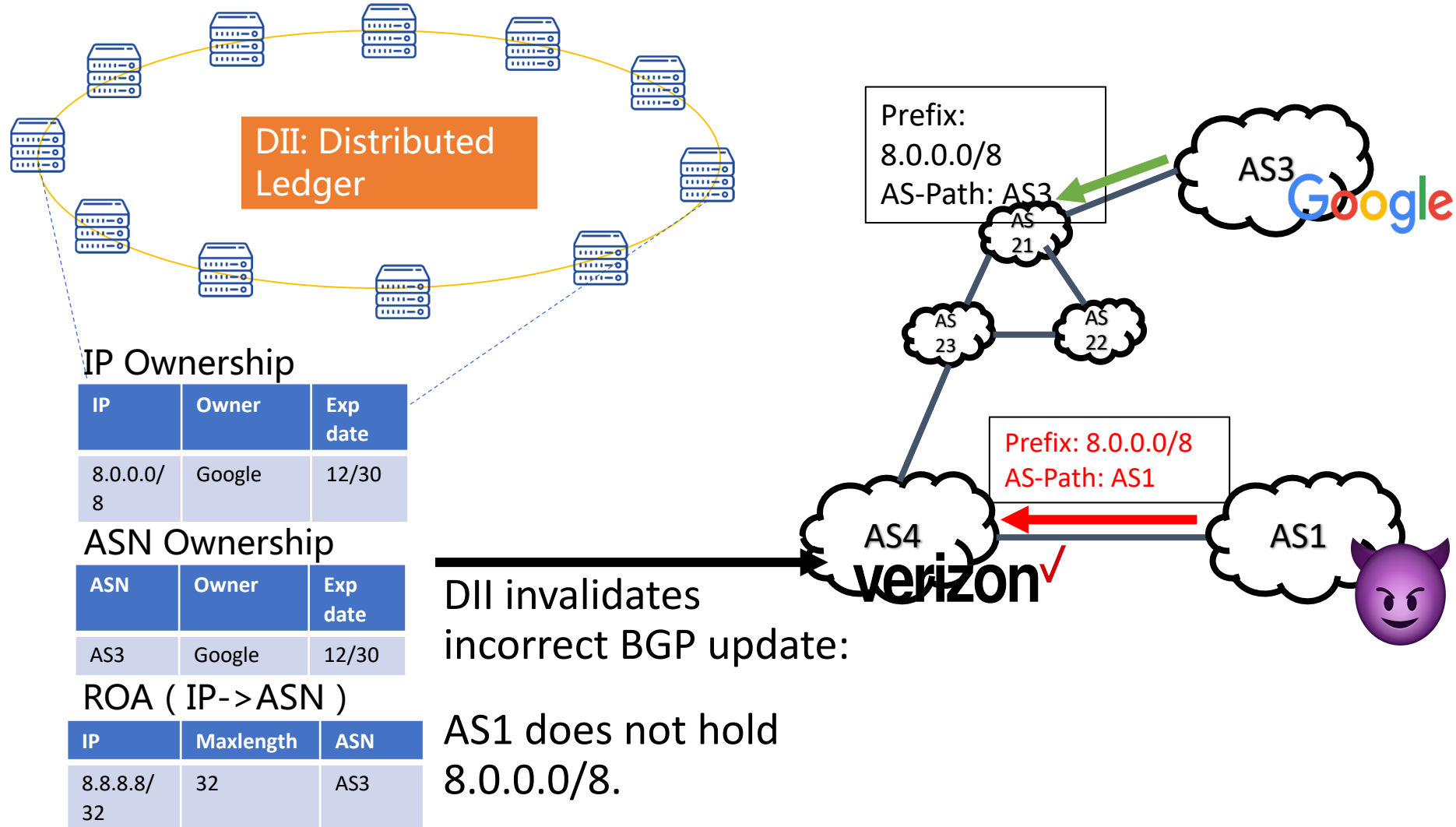


Prefix Hijack

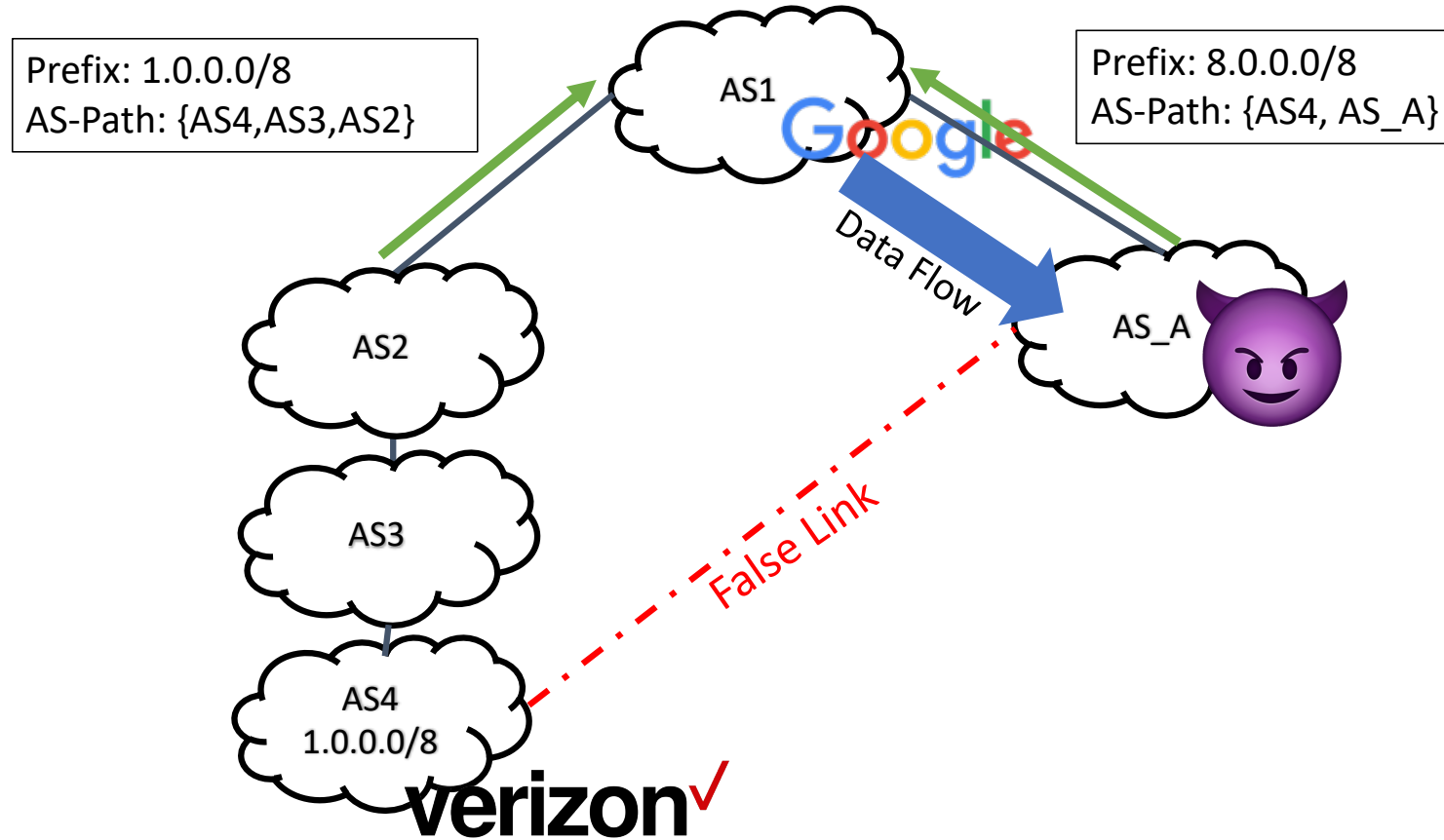


- A Prefix Hijack occurs when an AS announces a prefix that it does not hold
 - The attacker AS impersonates the victim AS
 - Attracts traffic intended to the victim's AS
- *December 2017: Eighty high-traffic prefixes normally announced by Google, Apple, Facebook, Microsoft, Twitch, NTT Communications, Riot Games, and others, were announced by a Russian AS, DV-LINK-AS (AS39523)*
- We need to **authenticate** the mapping between AS Number (identifies the **holder**) and the prefix (the **resource holder**)

Protection against prefix hijack

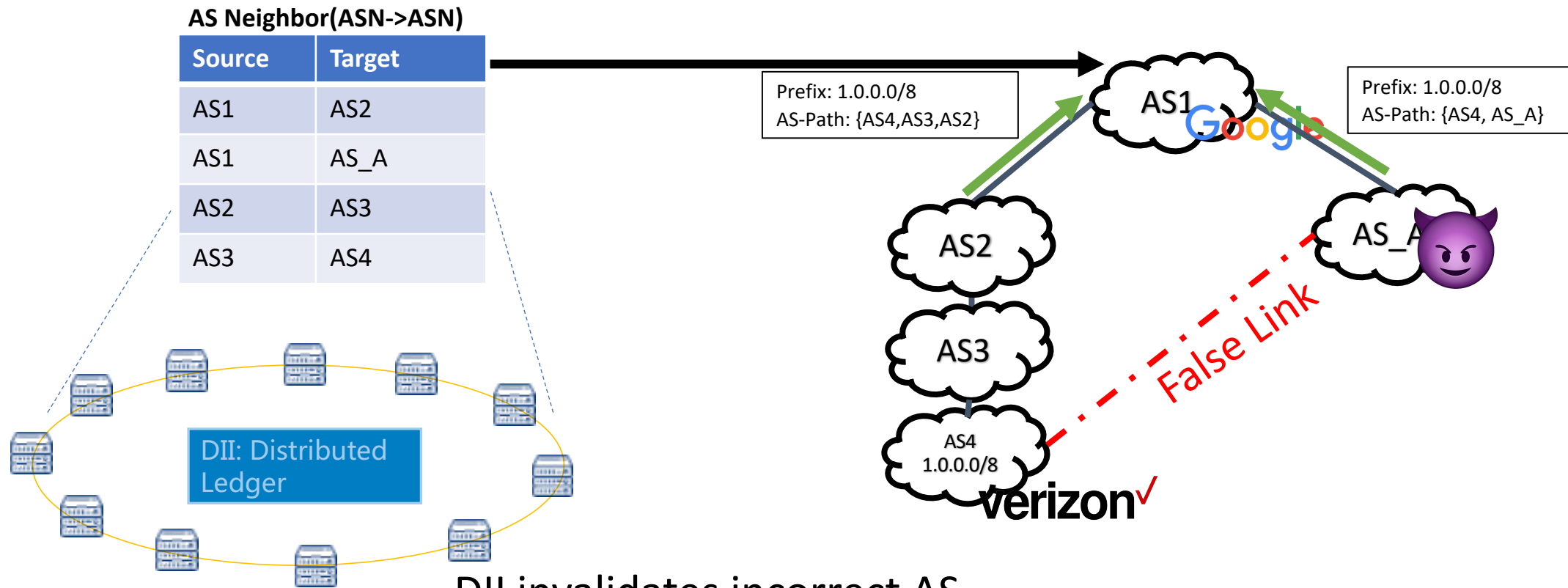


Path Hijack



- A Path Hijack occurs when an AS announces an incorrect path or link
- We need to **authenticate** AS adjacencies
- AS4 is not connected to AS_A

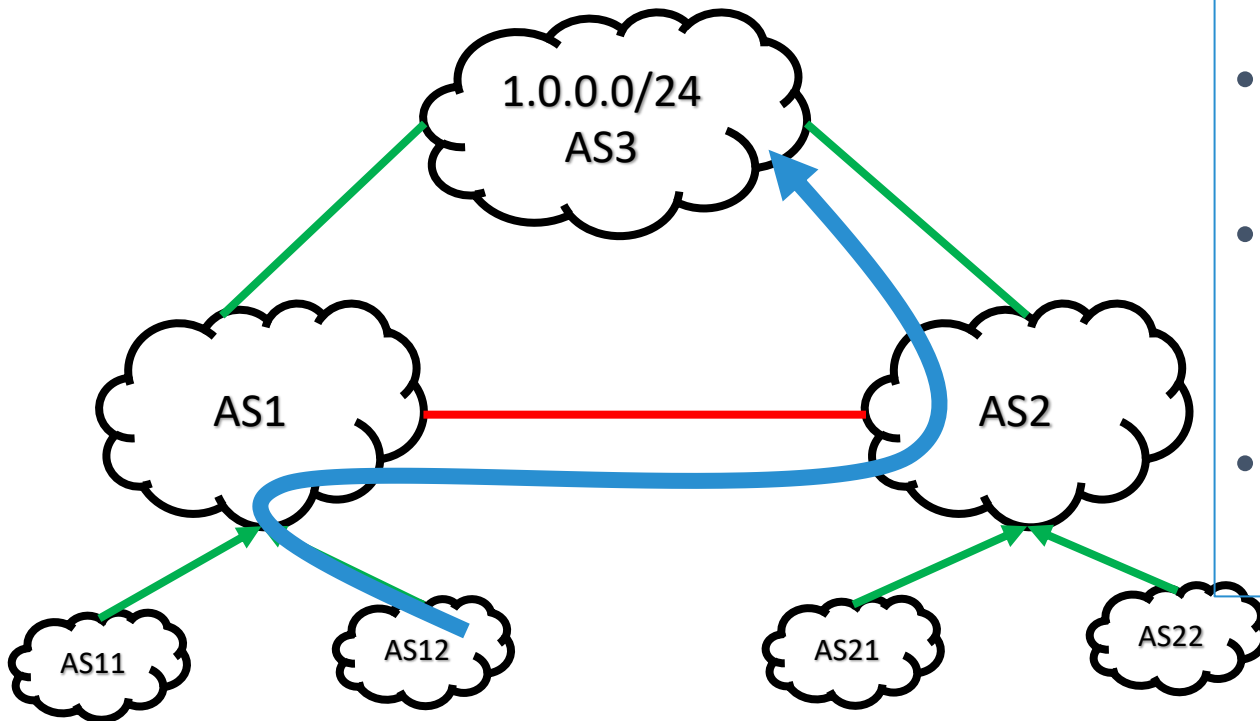
Protection against path hijack



DII invalidates incorrect AS
Path:

AS_A is **NOT** adjacent to AS4

Route Leaks

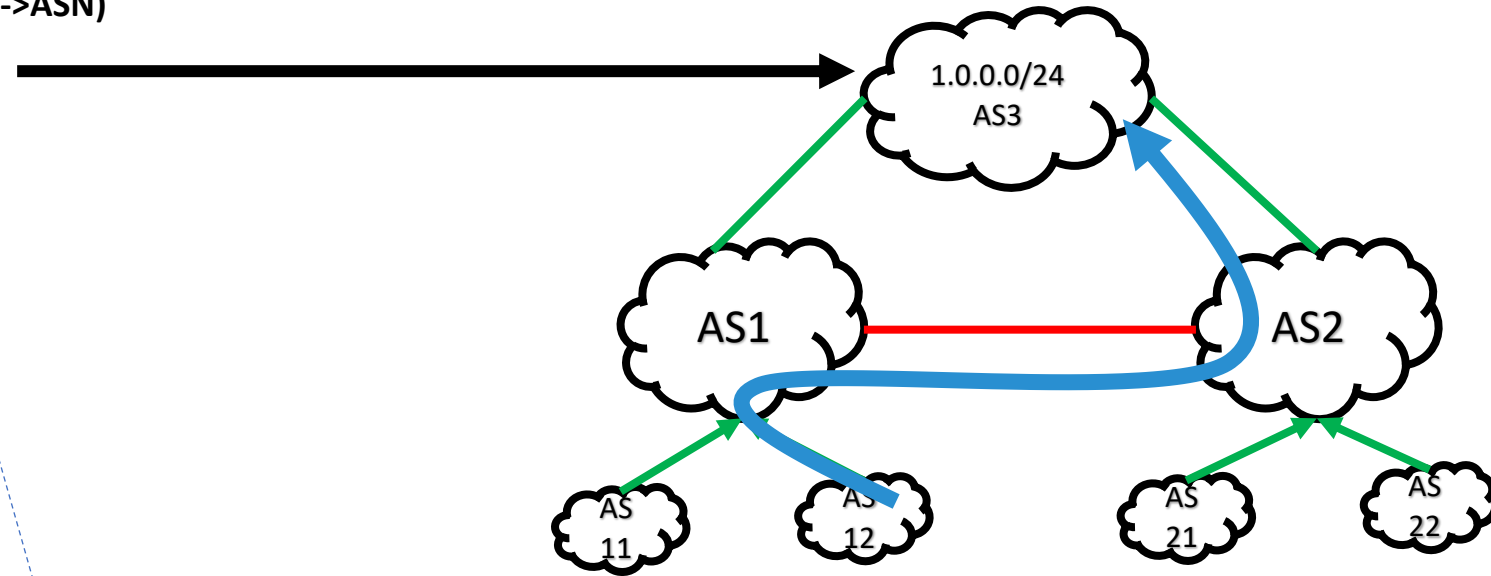
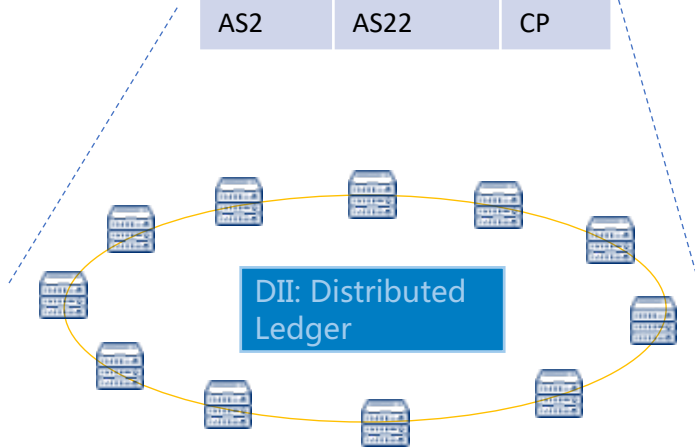


- **Customer Provider** links are typically paid
- The costs of **Peering** links is typically shared
- Routes learnt from upstream customer-provider links are not propagated through peering links
- Otherwise AS2 will offer free **transit** to AS1 (and its customers)

Protection against route leaks

AS Business Relationship(ASN->ASN)

Source	Target	Type
AS3	AS1	CP
AS3	AS2	CP
AS1	AS2	P2P
AS1	AS11	CP
AS1	AS12	CP
AS2	AS21	CP
AS2	AS22	CP



DII invalidates incorrect AS announcement:

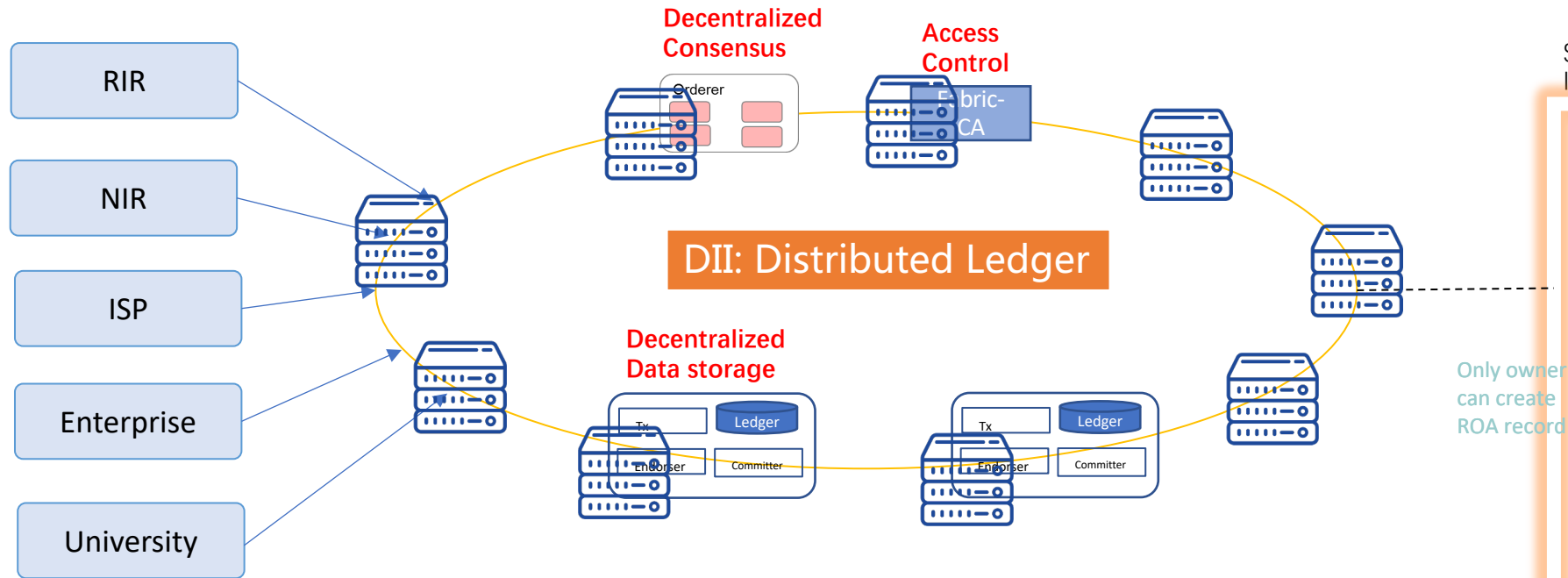
AS1 and AS2 have a P2P relationship.

AS2 should not propagate routes learnt from AS1

DII Global Testbed



ETSI Bright Talk Demo



Store IP Ownership, ROA and AS Neighbor Info in world state.

IP Ownership

IP	Owner	Exp date
200	ISP1	19/10

ASN Ownership

ASN	Owner	Exp date
AS100	ISP1	19/10

ROA (IP->ASN)

IP	Maxlength	ASN
1.1.1.1/32	32	100

AS Neighbor(ASN->ASN)

Source	Target
AS100	AS200
AS200	AS300

AS Business Relationship(ASN->ASN)

Source	Target	Type
AS100	AS200	P2P
AS200	AS300	P2P

Only owner
can create
ROA record

Only owner
can create
Neighbor
record.

In the demo we show:

- (1) Applying for an IP prefix
- (2) Apply for an AS Number

- (3) Specify a ROA (IP-ASN)
- (4) State an AS Adjacency and its type

Status of Proof-of-Concept

Stages and Milestones

PoC Technical Requirements

Requirement of DII	Descriptions	Related Feature of PDL
Permissioned control 	The participants of DII needed to be authorized.	Access Control
Resistance to Single point failure 	The resource management in DII doesn't depend on single authority.	Decentralized consensus protocol Peer-to-peer trust model. Agreement is made by a decentralized consensus protocol, run by all peers.
	The creation of records in DII should be trustable.	
	The records are tamper-resistant.	Decentralized data management Data is maintained by all peer nodes. All data operations are transparent, and data availability is much higher.
Trustable autonomous procedure 	Autonomous procedure can avoid the configuration errors and misbehavior.	Smart contract A Turing-complete computation model to support any decentralized application.
Trustable Transaction Capability 	Trustable transaction capability is important to Internet resource.	Transaction Peer nodes can send transactions between each other, enabling service monetization with inherent trust.

PoC Stages and Milestones

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Thanks!

