SAV Open Playground
& the Real Path Discovery Protocol

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Problem with SAV Research

When researching SAV, we find that we, and maybe the entire SAV community, is in need of:

	Goals & Requirements
A reference/starter project	For development of new SAV technologies
	Ideally built with open-source software router with high scalability
An experimentation environment	For network operators to test their configurations
	Container-based virtual network topologies
A visualization tool	For networking professionals to understand different SAV mechanism
	Ideally a web application
An education platform	For reproducible SAV experiments
	For students to learn about SAV

SAV Open Playground（SAVOP）

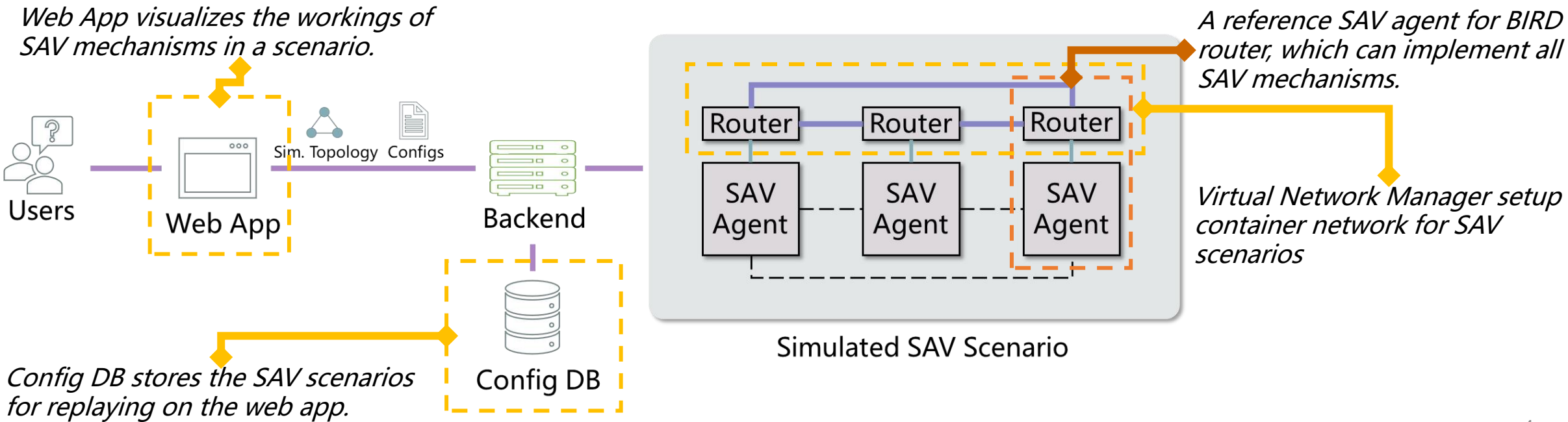
- A development and simulation platform for new SAV technologies
- An experimentation environment for network operators to test their configuration
- A web application that helps networking professionals understand different SAV mechanism
- An education platform for students to learn about SAV

SAV Open Playground (SAVOP)

- We develop SAV Open Playground (SAVOP) project to close these gaps.
- SAVOP is open-source: https://github.com/SAV-Open-Playground/savop
- Four core components:

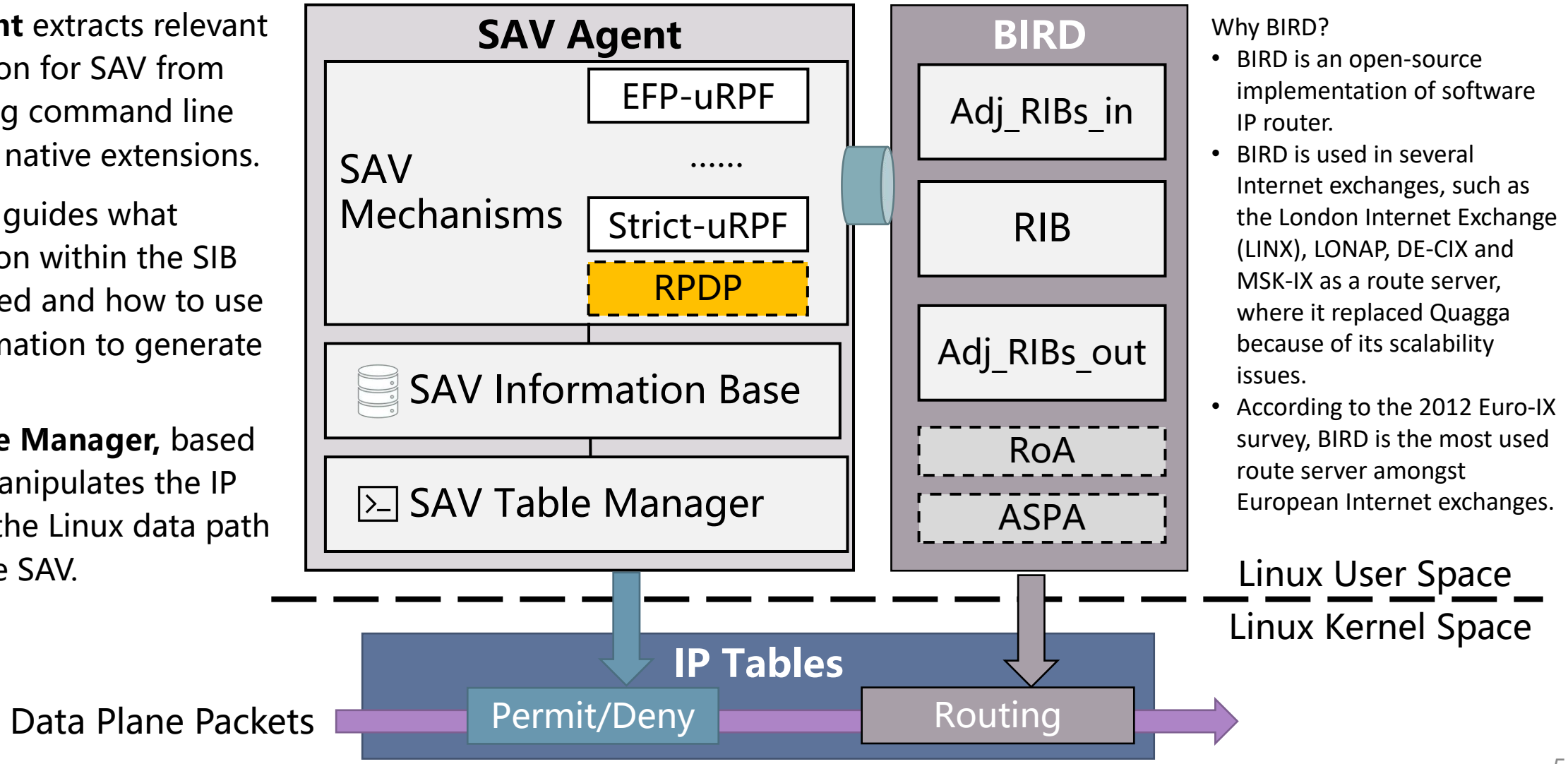
SAV Reference Router | Virtual Network Manager | Browser-based Visualization | Scenario Replay

SAVOP Architecture



SAV Agent with BIRD

- **SAV Agent** extracts relevant information for SAV from BIRD using command line and BIRD native extensions.
- **SAV App** guides what information within the SIB will be used and how to use the information to generate SAV rules
- **SAV Table Manager,** based on SIB, manipulates the IP tables in the Linux data path to achieve SAV.



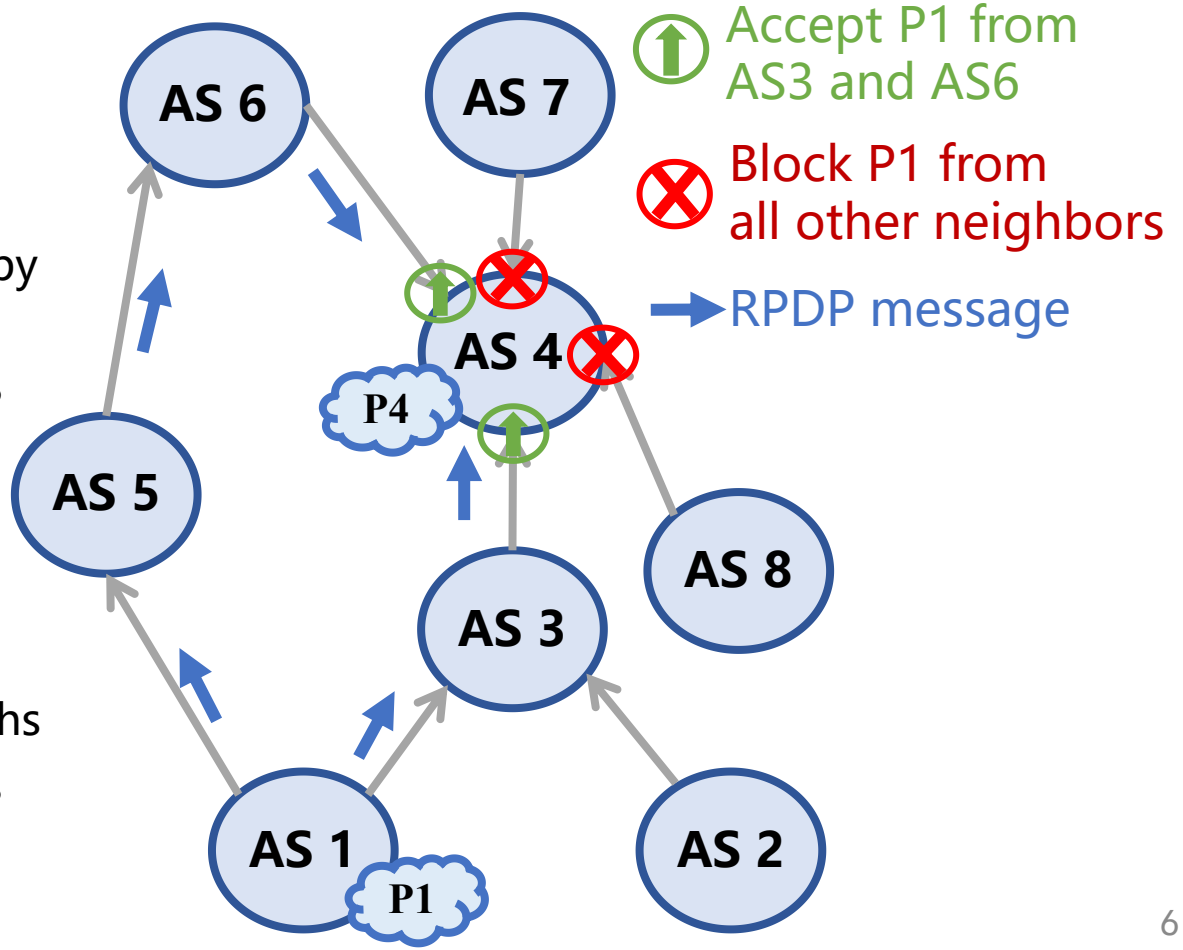
Why BIRD?

- BIRD is an open-source implementation of software IP router.
- BIRD is used in several Internet exchanges, such as the London Internet Exchange (LINX), LONAP, DE-CIX and MSK-IX as a route server, where it replaced Quagga because of its scalability issues.
- According to the 2012 Euro-IX survey, BIRD is the most used route server amongst European Internet exchanges.

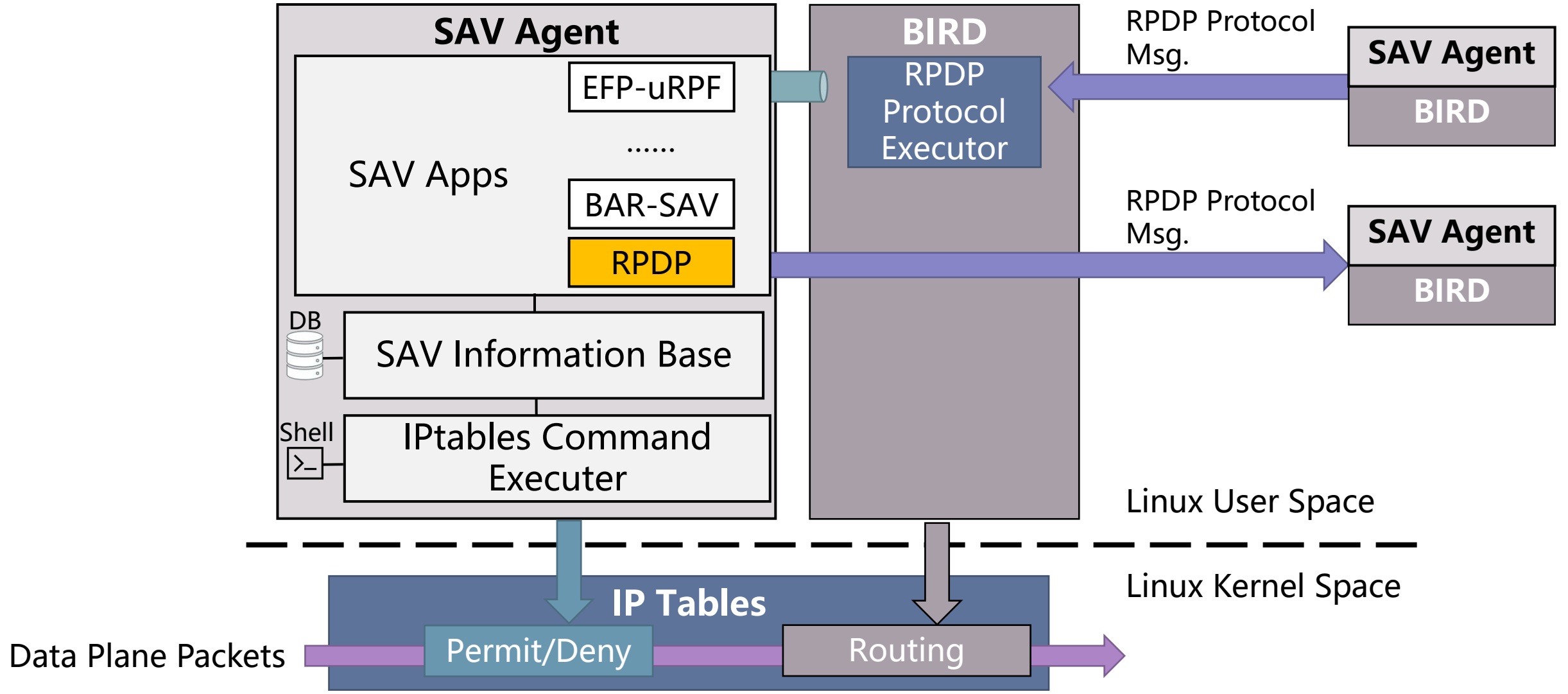
Real Path Discovery Protocol (RPDP)

- SAV agent enables quick development of new SAV mechanisms.
  - Real Path Discovery Protocol (RPDP) is a good example.
- Main idea
  - RPDP is A hop-by-hop SAV information propagation protocol.
  - Origin AS advertises its preferred AS paths to other ASes by RPDP messages
  - Other ASes learn the incoming directions of the origin AS through received RPDP messages
- The illustration of RPDP process
  - AS1 selects AS paths [AS1, AS3, AS4] and [AS1, AS5, AS6, AS4] to P4
  - AS1 sends RPDP messages hop by hop to tell AS4 the paths
  - AS4 learns that AS3 and AS6 are valid incoming directions for P1, and all other neighbors are invalid

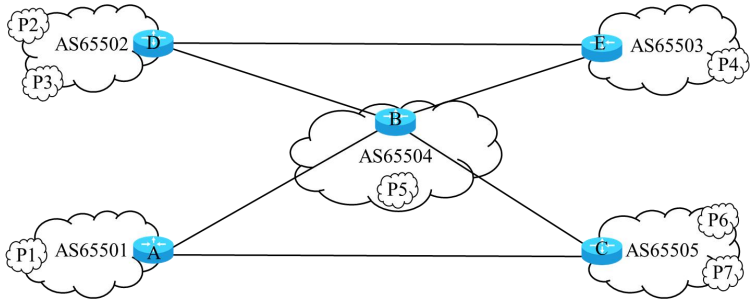
Relationships of AS4 and its neighbors: any one of c2p, p2c, or p2p



Developing RPDP in SAVOP SAV Agent



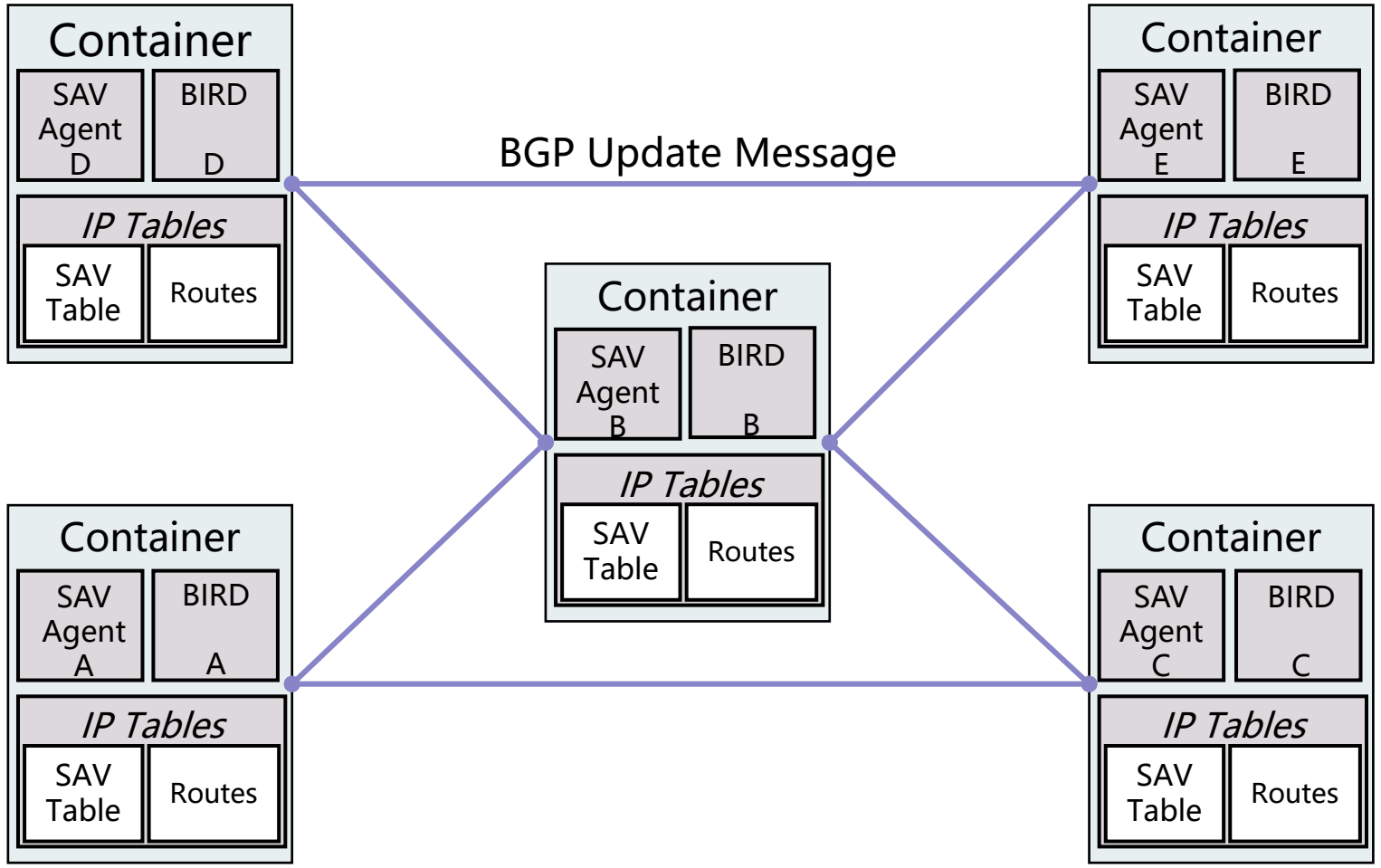
Virtual Network Manager



User Input

Backend

Simulation Initial Settings
- Initial SIB
- Initial SAV Tables
- Static Routes
- SAV Mechanism

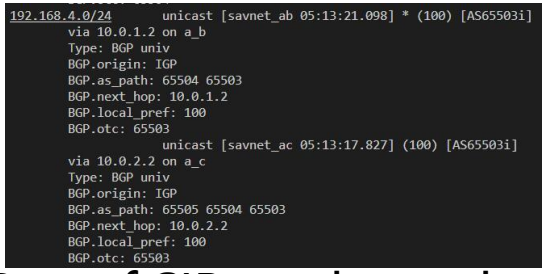


SAV Scenario Simulation

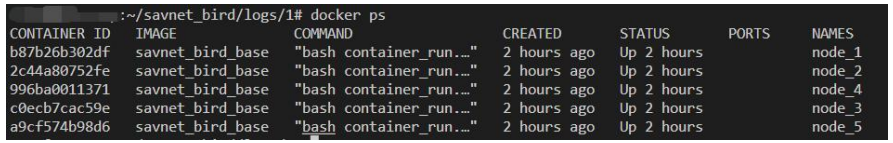
Visualization & Scenario Replay

- Network Model 1: https://ki3.org.cn:45679/#/sav?id=62b075de-41e9-4d2e-b458-db5d84f8ee2a
- Network Model 2: https://ki3.org.cn:45679/#/sav?id=4f69374c-df10-4a59-af46-d9fc7a9ddf81
- The nodes, RIB, FIB, SIB in Network Model 1 are listed below

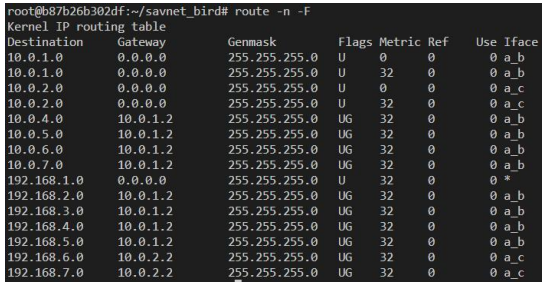
Part of RIB on the node 1



Part of SIB on the node 1



Nodes of network model 1



FIB on the node 1

SAVOP Future Development

- More SAV mechanisms
  - Done: RPDP, strict uRPF, loose uRPF
  - To do: FP-uRPF, VRF uRPF, EFP-uRPF, BAR-SAV, ...
- More protocol extensions
  - Partially done: BGP
  - To do (following WG Charter): BGP-LS, OSPF, ISIS, RIFT
- More routers
  - Open source software router: Quagga
  - Commercial routers: Huawei, H3C, Cisco, etc.

Thanks!