KIRA – Scalable Zero-Touch Routing for Control Planes

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KIRA – Motivation

- Goals
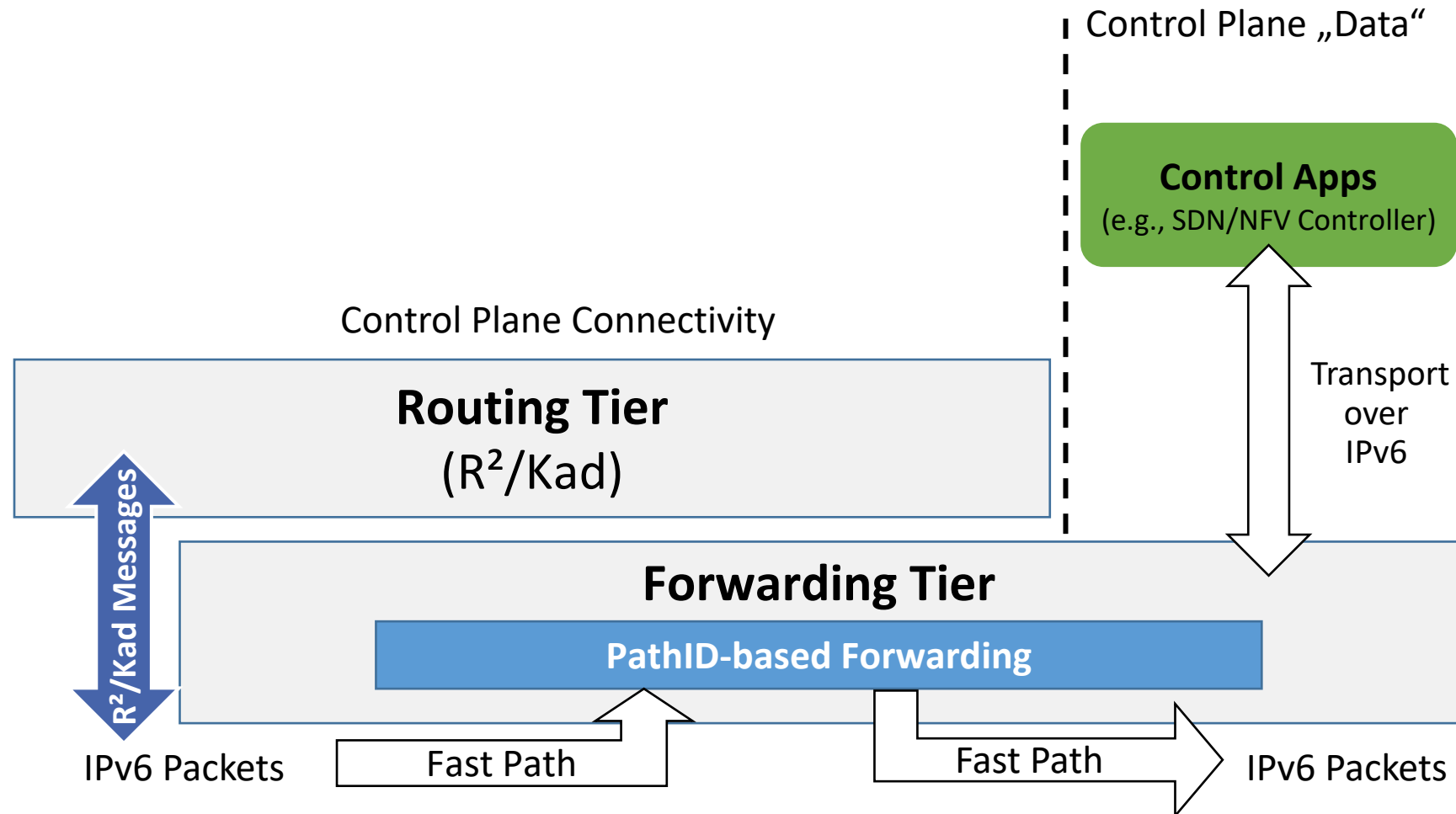   - resilient control plane connectivity
        - e.g., for SDN, NFV, VIM, AI-based Control, Intent-based NM, OAM, …
    - avoid circular dependencies
    - support for inband, out-of-band, hybrid management/control
    - guarantee controllability of every networked device (even virtual ones)

- Existing solutions not scalable, zero-touch, or topology specific
- KIRA could be an alternative routing protocol for ANIMA's ACP (Autonomous Control Plane)
    - Offering advantages over RPL-ACP

SDN: Software Defined Networking,
NFV: Network Function Virtualization,
VIM: Virtual Infrastructure Management,
NM: Network Management,
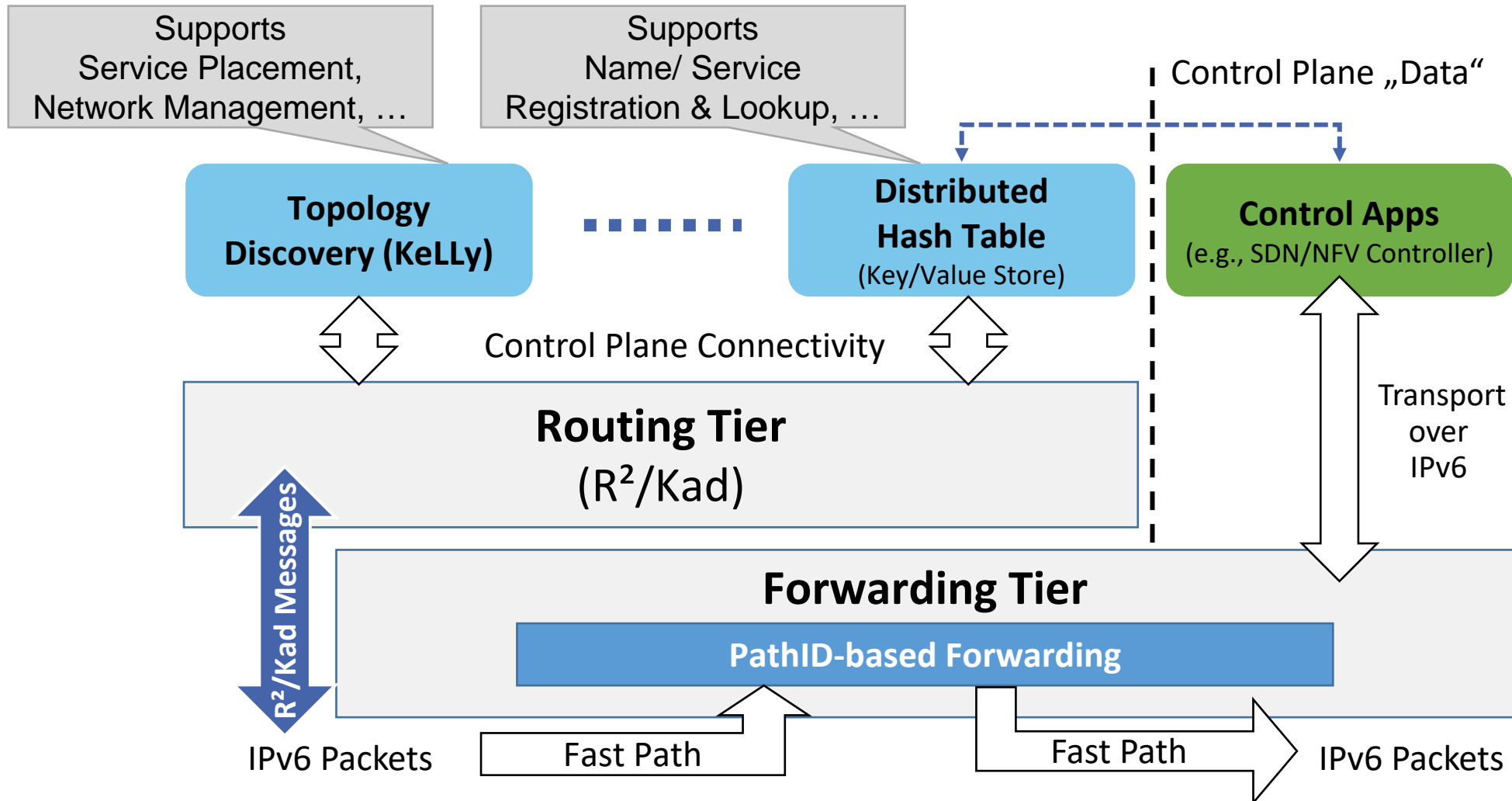OAM: Operations Administration, and Maintenance

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KIRA – Features

- Scalable: connect 100,000s of nodes
  - ID-based, flat (i.e., no hierarchy or aggregation), no locators (no mapping!)
  - Trade-off: stretch (some routes longer than shortest path), tunable
    - Shortest paths to contacts in routing table
- Zero-touch: no configuration, self-organizing
  - Self-assigned addresses, no dependencies
  - Resilient control plane connectivity (IPv6)
    - Loop-free even during convergence
- Works well in and across various topologies (sparse and "dense")
- Path-based forwarding (e.g., supports multi-path routing)

Architecture

Control Plane „Data"

Control Apps
(e.g., SDN/NFV Controller)

Control Plane Connectivity

Routing Tier
(R²/Kad)

Transport over IPv6

R²/Kad Messages

Forwarding Tier

PathID-based Forwarding

IPv6 Packets

Fast Path

Fast Path

IPv6 Packets

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Architecture

Supports
Service Placement,
Network Management, …

Supports
Name/ Service
Registration & Lookup, …

Control Plane „Data"

**Topology
Discovery (KeLLy)**

**Distributed
Hash Table**
(Key/Value Store)

Control Apps
(e.g., SDN/NFV Controller)

Control Plane Connectivity

Routing Tier
(R^2/Kad)

Transport
over
IPv6

R^2/Kad Messages

Forwarding Tier

PathID-based Forwarding

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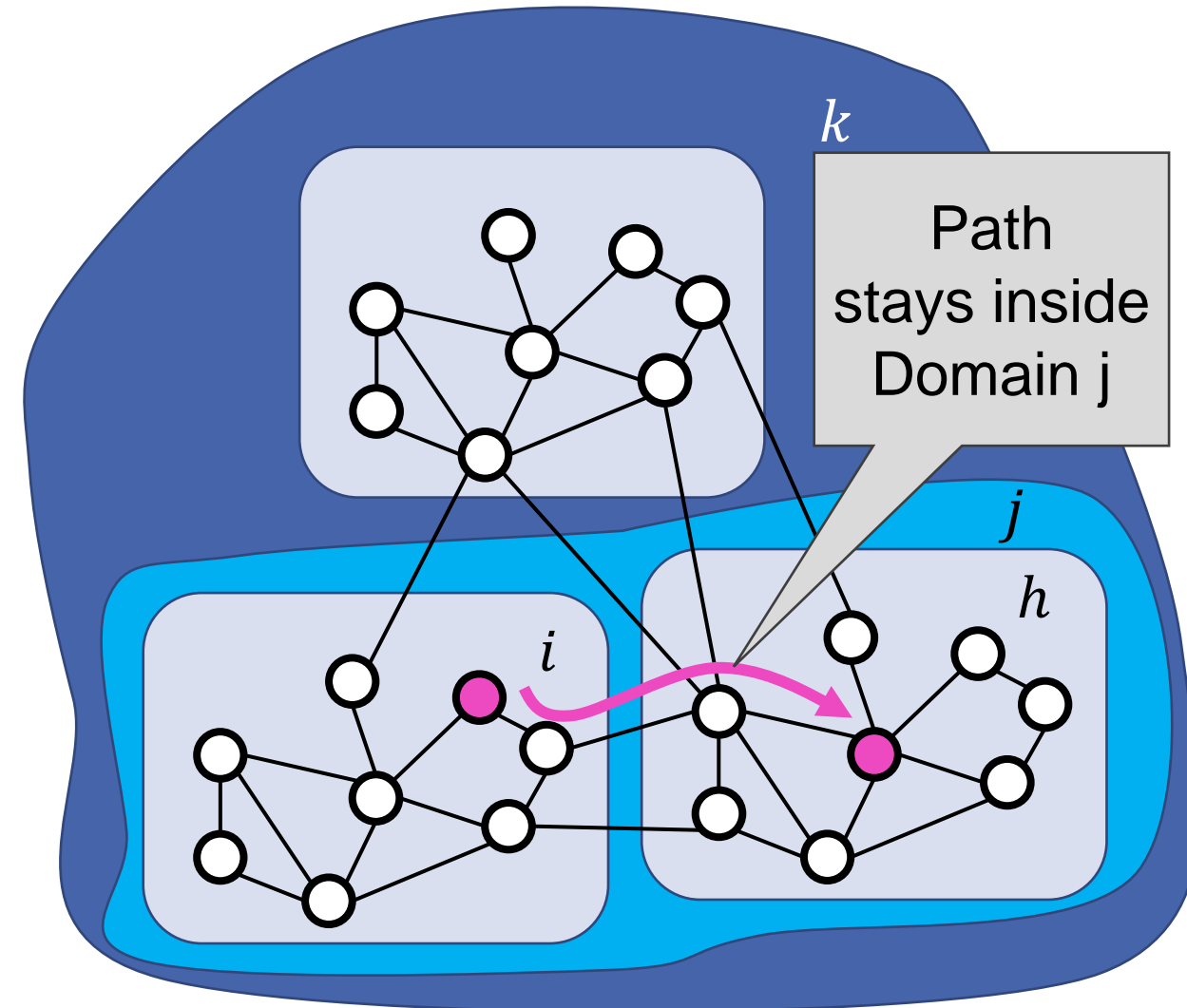Roland Bless – KIRA (RTGWG, IETF 118)
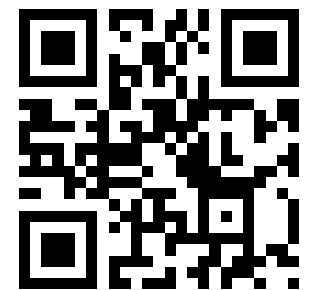
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KIRA – Further Features

- Domain Scopes
  - Global, Organizational, Topological
  - KIRA nodes keep their NodeID!
- End-system Mode
- Ongoing: Security

Path stays inside Domain j

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Ready for Standardization…

- First Internet-Draft https://datatracker.ietf.org/doc/draft-bless-rtgwg-kira/
  - Update will follow
- Running Code (going to be released soon)
  - Large Scale Simulations
  - SDN-based Application for Ryu SDN Controller (Python)
    - Forwarding Tier uses OpenvSwitch
  - Native Routing Daemon Linux (Rust)
    - Forwarding Tier uses nftables
- Want IETF expertise
  - WG Draft?
  - BOF?
- Side meeting/BarBOF Wednesday Nov 8th, 19.00–20.00h, Karlin 4
  - KIRA use cases, Q&A, collaboration, next steps towards standardization

https://s.kit.edu/KIRA