KIRA – Scalable Zero-Touch Routing

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KIRA – Motivation

Goals

- resilient control plane connectivity
  - e.g., for SDN, NFV, VIM, AI-based Control, Intent-based NM, OAM, Quantum Internet Control Plane, …
- 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
What KIRA provides…

Link Layer Topology

Resource Element (e.g., Switch, Router, Base Station, Server, …)

L2 Link
What KIRA provides…

Control Plane Fabric

Link Layer Topology

Resource Element (e.g., Switch, Router, Base Station, Server, …)

constructed by KIRA (provides connectivity between all resources)

L2 Link
What KIRA provides…

- **Control Plane Fabric**
- **Controller** (e.g., SDN controller, 5G/6G SBA entities, K8s controller, PCE,…)
- **Control Connection** (e.g., Openflow, Netconf, REST, ssh)
- **Resource Element** (e.g., Switch, Router, Base Station, Server,…)
- **L2 Link**

constructed by KIRA (provides connectivity between all resources)
What KIRA provides...

Control Plane

Data Plane

Link Layer Topology

Data Plane Fabric

OSPФ

KIRA: 1. (resilient) connectivity, 2. route efficiency

constructed by OSPФ, BGP, SDN, …: shortest path routing
Use Case – 6G Control Plane

- Non-terrestrial Networks (Drones, Satellites) → dynamic and mobile
- Nomadic Networks → autonomous, self-organizing control plane
- $10^7$ of base stations in China in a single provider network → scalability
DC + Network

- Data Center 1
- Data Center 2
- Data Center 3
- Data Center 4

Denser Network
Sparse Network
Mobility

- KIRA uses IDs as topological independent addresses
  - Should work out-of-the-box, but...optimizations possible
- End-system mode is more lightweight, so end-system mobility will also cause no churn in the routing system
- Satellite Networks → not investigated yet
- (Mobile) Ad-hoc Networks → not investigated yet
KIRA – Domain Scope

- Domain Scopes
  - Global, Organizational, Topological
  - KIRA nodes keep their NodeID!
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- Domain Scopes
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Path stays inside AS j
Architecture

Supports Service Placement, Network Management, ...

Supports Name/Service Registration & Lookup, ...

Topology Discovery (KeLLy)

Distributed Hash Table (Key/Value Store)

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

Control Plane Connectivity

Routing Tier (R²/Kad)

Fast Path IPv6 Packets

Forwarding Tier

PathID-based Forwarding

Fast Path

IPv6 Packets

Transport over IPv6

Control Plane „Data“

IPv6 Packets

R²/Kad Messages

R²/Kad Messages
Ready for Standardization…

- **First Internet-Draft**
  - 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?

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Roland Bless – KIRA (Side meeting, IETF 118, Prague)