IPv6 Network Deployment Monitoring and Analysis

draft-pang-v6ops-ipv6-monitoring-deployment-00

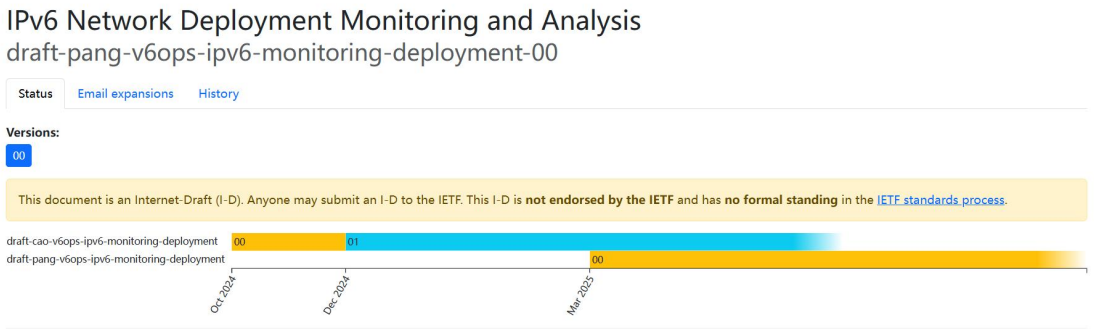
Ran Pang(China Unicom), Jing Zhao(China Unicom), Mingshuang Jin(Huawei), Shuai Zhang(China Unicom)

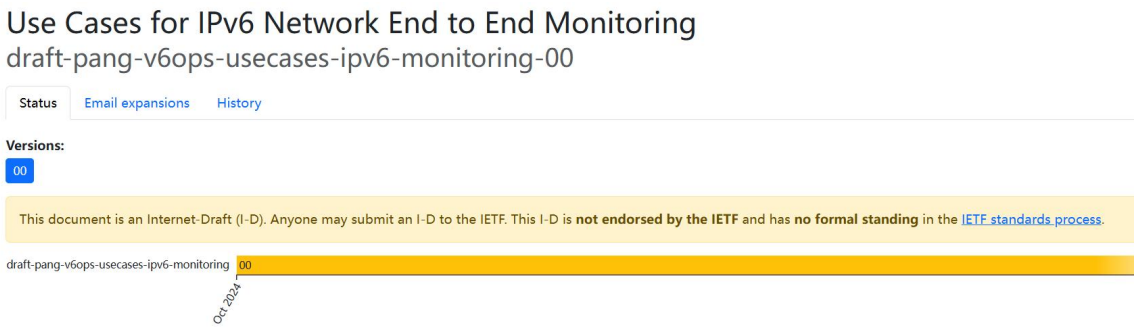
v6ops, IETF 122

Background

- **Purpose:** The objective is to drive the growth of IPv6 traffic and unearth the shortcomings in IPv6 deployment.
- **Current issues:** Current IPv6 network deployment analyses often highlight technical gaps in IPv4 to IPv6 transition, yet a significant gap in IPv6 support status exists in different network scenarios. The absence of comprehensive tools for end-to-end IPv6 deployment monitoring and analysis across clouds, networks, edges, and terminals hinders multi-dimensional and in-depth monitoring and analysis.
- **Integration of Existing Drafts**

  draft-cao-v6ops-ipv6-monitoring-deployment-01 + draft-pang-v6ops-usecases-ipv6-monitoring-00





Updates since last time

- **In Section2: Problem Statement**
  - Add a summary of the Current Approaches to Monitoring IPv6 Deployment
- **In Section3: IPv6 Network Deployment End to End Monitoring and Analysis**
  - Proposed an IPv6 end-to-end monitoring and analysis system

2.1. Current Approaches to Monitoring IPv6 Deployment

Existing IPv6 deployment monitoring approaches include (Maybe not all are covered):

- Internet Society Pulse: Curating information about levels of IPv6 adoption in countries and networks around the world.
- Akamai IPv6 Adoption Visualization: Reviewing IPv6 adoption trends at a country or network level.
- APNIC IPv6 Measurement: Providing an interactive map that users can click on to see the IPv6 deployment rate in a particular country.
- Cloudflare IPv6 Adoption Trends: Offering insights into IPv6 adoption across the Internet.
- Cisco 6lab IPv6: Displaying IPv6 prefix data.
- Regional or National Monitoring Platforms: Examples include the NZ IPv6, the RIPE NCC IPv6 Statistics, and the USG IPv6 & DNSSEC External Service Deployment Status, among others.

3. IPv6 Network deployment End to End Monitoring and Analysis

As a network operator, we specify an architectural framework for IPv6 end-to-end monitoring and analysis systems, defining a standardized methodology for cross-domain data correlation, multidimensional traffic analysis, and quality assessment across cloud-network-edge-device ecosystems.

The framework establishes key performance indicators (KPIs), monitoring interfaces, and analyzing procedures to address IPv6 deployment challenges in heterogeneous network environments.

This framework addresses these gaps through standardized data collection methods and multidimensional analysis techniques.

3.1. Framework

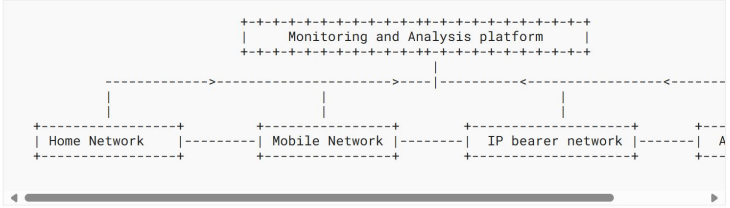


Figure 1: IPv6 Network End to End Monitoring and Analysis Platform

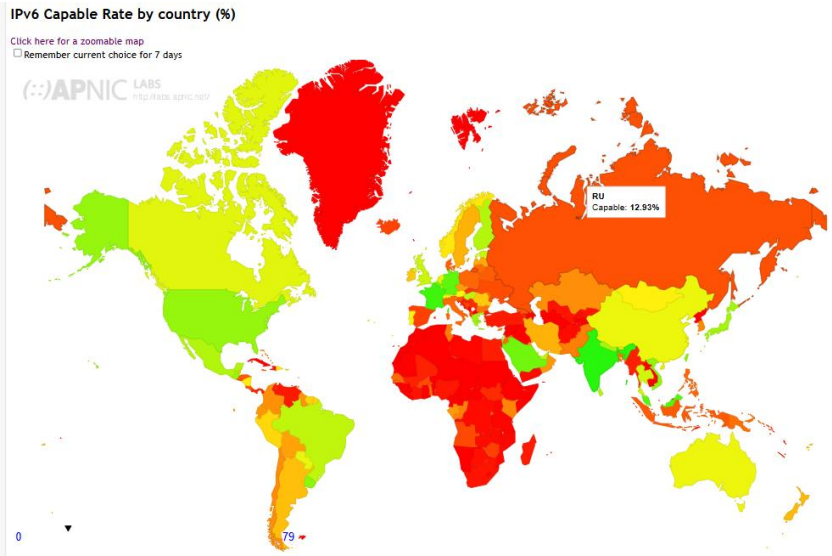
Current Approaches to Monitoring IPv6 Deployment

Current System(Statistics+Visualization)

- Internet Society Pulse\Akamai IPv6 Adoption Visualization\APNIC IPv6 Measurement\Cloudflare IPv6 Adoption Trends\Cisco 6lab IPv6
- Regional or National Monitoring Platforms: Examples include the NZ IPv6, the RIPE NCC IPv6 Statistics, and the USG IPv6 & DNSSEC External Service Deployment Status, among others.

vs.

Our System
(Monitoring+Analysis)

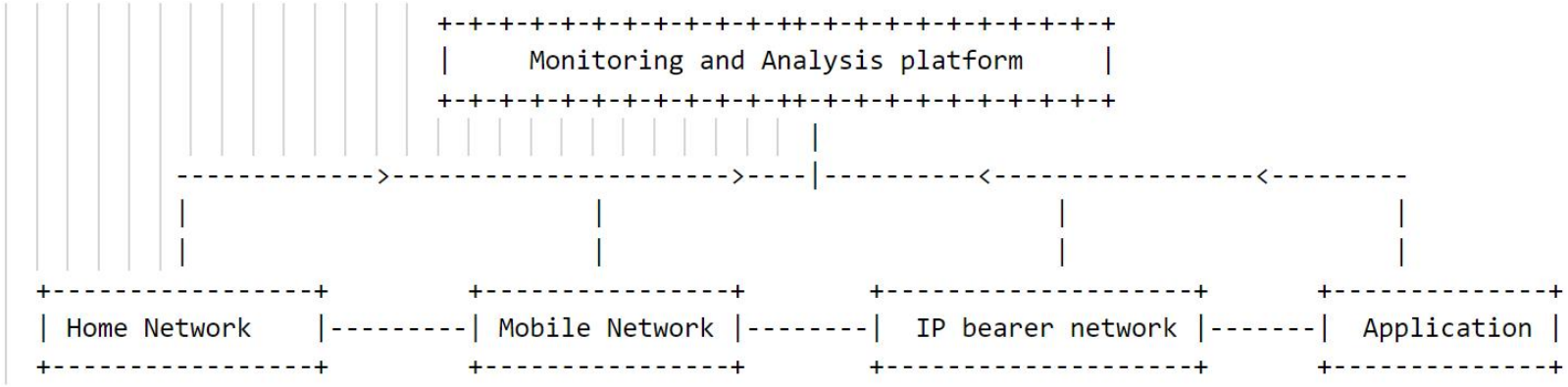


The purpose is different.

The means are different.

Different requirements.

IPv6 End-to-End Monitoring and Analysis System



FIVE Requirements

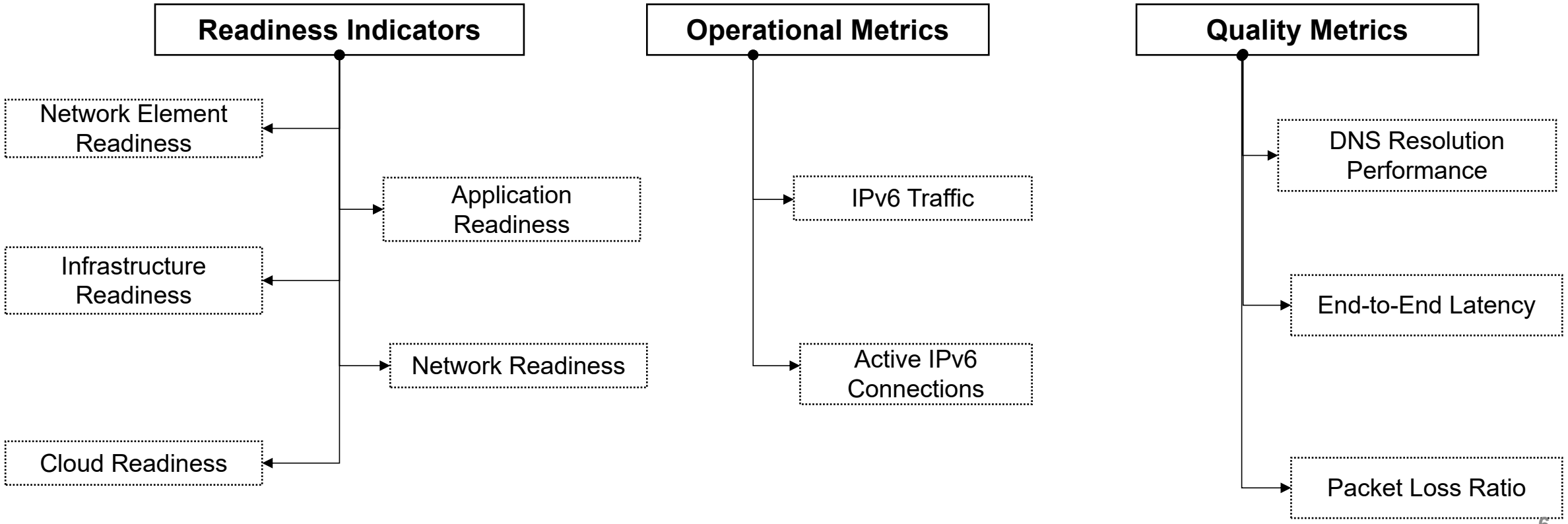
1. **Comprehensive Monitoring Coverage**
2. **Multi-Dimensional Evaluation**
3. **Cross-Domain Correlation Establishment**
4. **Sufficient In-Depth Analysis**
5. **Robust Dynamic Prediction**

Core Functions of Our System

- Quantify IPv6 deployment maturity through **key performance indicators**.
- Enable **cross-domain data integration**.
- Adopt a **multidimensional analysis methodology** to perform root-cause analysis.
- Optimize development mechanisms based on analysis result.

Key Performance Indicators

Most of current systems are local-index analyses. In order to more comprehensively show the IPv6 deployment status and analyze the **bottlenecks** and **blocking points** of IPv6 deployment, we have newly defined a complete set of key performance indicators.



Cross-Domain Data Integration

Why is cross-domain integration necessary?

S: IPv6 is not merely an issue concerning networks and terminals; rather, it is an end-to-end problem.

Home Network Domain	Mobile Network Domain	IP bearer network Domain	Application Domain
• Home broadband networking types • End-device IPv6 support Status • Quality	• Traffic • Quality • Applications • End-device IPv6 support Status	• Home broadband and mobile network traffic flow direction • Dedicated line traffic flow direction	• IPv6 service availability

Collection technologies: SFTP\Netflow

Multidimensional Analysis Methodology

Why is Multidimensional Analysis Methodology necessary?

S：Avoids the limitations of single-dimension analysis.

The IPv6 network environment is complex, involving numerous network devices, diverse application services, and a massive number of users. The multidimensional analysis model enables comprehensive monitoring and analysis from multiple perspectives, such as network topology, traffic types, user behavior, and time dimension. This approach allows for obtaining a comprehensive and accurate view of the network status.

Network Traffic Analysis

- Flow pattern recognition and traffic information collection at critical nodes
- IPv6/IPv4 traffic ratio trend
- Subsystem-level attribution analysis

Application-Centred Analysis

- Cross-domain service topology mapping
- Quality-of-Experience (QoE) analysis
- Application-specific traffic

Inter-Network Analysis

- Regional traffic matrix construction
- Flow direction analysis

Restricted Area Analysis

- Formulate a multi-dimensional problem identification program for the network side, the user side and the application side, and investigate possible influencing factors at each level.

Use Case 1 – Home Terminal Traffic Analysis

- Observation: Lower IPv6 traffic in home vs. mobile networks.
- Fine-grained multi-dimensional analysis.
- Root Cause: Insufficient IPv6 support in home routers/terminals.
- What we can do?
  - Highlights the need for device-level IPv6 support upgrades.

Next Step and Discussion

- ✓ **What will the focus of our subsequent improvement?**
  - ✓ The technical implementation details of the system
  - ✓ The effects that the system can achieve
  - ✓ The display of the system interface
  - ✓ etc....
- ✓ **Standardization Direction**: Explore the content of requests and responses for data interaction between network management systems through standardized interfaces.
  - ✓ Yang model
  - ✓ etc....

If you are interested in collaborating or have suggestions on how we can enhance our draft, please reach out to us!

Email: pangran@chinaunicom.cn, zhangs366@chinaunicom.cn, zhaoj501@chinaunicom.cn