Application-aware IPv6 Networking (APN6)

draft-li-apn6-problem-statement-usecases-01
draft-li-apn6-framework-00

Zhenbin Li       Huawei
Shuping Peng     Huawei
Daniel Voyer     Bell Canada
Chongfeng Xie    China Telecom
Peng Liu         China Mobile
Chang Liu        China Unicom
Kentaro Ebisawa  Toyota
Stefano Previdi  Individual
James Guichard   Futurewei
Motivations – Why APN6?

• The network operators need to be able to provide fine-granularity and even application-level SLA guarantee to achieve better Quality of Experience (QoE) for end users
  - 5G and verticals generates more and more applications with diverse network requirements
  - Revenue-producing apps: online gaming, live video streaming, enterprise video conferencing with much more demanding requirements
• Network operators are typically unaware of which applications are traversing their network, which is because network is decoupled from app
  - Not able to provide fine-granularity traffic operations for specific applications
  - Without corresponding revenue increases that might be enabled by differentiated service prov.
• **Adding application knowledge to the network layer** enables finer granularity requirements of applications to be specified to the network operator (even by app)
• As IPv6/SRv6 is being widely deployed, the programmability provided by IPv6/SRv6 encapsulations can be augmented by conveying app info
Challenges of Traditional Differentiated Service Provisioning

- The packets are not able to carry enough information for indicating applications and expressing their service/SLA requirements
- The network devices mainly rely on the 5-tuple of the packets or DPI
  - 5-tuples used for ACL/PBR matching of traffic
    - Indirect application information and not capable enough for new app identification
  - Deep Packet Inspection (DPI)
    - Introduces CAPEX and OPEX and Security/privacy issues
- SDN-based Solution
  - Orchestrator introduces application requirements so that the network is programmed accordingly
    - The loop is long not suitable for fast service provisioning for critical applications
    - Too many interfaces are involved in the loop introducing challenges of inter-operability
How APN can help?

• APN6 aims to
  • satisfy the application-awareness/visibility requirements demanded by new services
  • provide differentiated service treatment and fine-grained traffic operations

• APN6 uses IPv6/SRv6 network programmability to convey app info in the data plane allowing finer grained requirements from apps to be specified to the network

• APN6
  • conveys the application information into the network infrastructure
    ✓ E.g. application identification, SLA/service requirements
  • allows the network to quickly adapt and perform the necessary actions for SLA guarantees
    ✓ E.g. steer into an SRv6 path with SLA guarantee
APN6 Key Elements

Element 1: Application Info Conveying
- App info conveyed in the data plane through augmentation of existing encapsulations
- SHOULD NOT be enforced but provide an open option for app to decide whether to input this app info into its data stream

Element 2: App info and network capabilities matching
- Open the network capabilities to apps
- According to the app info, appropriate network services are selected, provisioned, and provided to the demanding applications to satisfy their performance requirements

Element 3: Network performance measurement
- According to the measurement to update the match between the app and corresponding network services for better fine-granularity SLA compliance
APN6 Framework

- Optionally add the app information (ID, service requirements) in IPv6 encapsulation
- With APN6, the network is aware of the service requirements specified by applications or derived
- According to the service requirement information in IPv6 packets the network is able to adjust its resources fast in order to satisfy the service requirement of applications
- The flow-driven method also reduces the challenges of inter-operability and long control loop

- According to the carried App Info, steer the packets into an existing path/policy, or trigger to set up new path
- App Info is copied to the outer IPv6 encapsulation

- Optionally add the app information (ID, service requirements) in IPv6 encapsulation on behalf of applications
- Derived from L2 QinQ Info
- Local policies

- According to the carried App Info, adjust the resources locally to guarantee SLA
The advantages of using IPv6 to support APN6

• Simplicity
  • Conveying application information with IPv6 encapsulation can just be based on IP reachability

• Seamless convergence
  • Much easier to achieve since both app and the network are based on IPv6

• Great extensibility
  • IPv6 encapsulation can be used to carry very rich information relevant to applications

• Good compatibility
  • If the application information not recognized, the packet will be forwarded based on pure IPv6

• Little dependency
  • Information conveying and service provisioning are only based on forwarding plane of devices

• Quick response
  • Flow-driven and direct response from devices since it is based on the forwarding plane
APN6 Use Cases

• The use cases that can benefit from the application awareness introduced by APN6
  • Application-aware SLA Guarantee
    ✓ enable to provide differentiated services for various apps and increase revenue accordingly
    ✓ enable network operators to provide fine-granularity SLA guarantees
  • Application-aware network slicing
    ✓ have customized network transport to support some app's specific requirements, considering service and resource isolation
    ✓ serve diverse services and fulfill various requirements of different apps at the same time, e.g. the mission critical app can be provisioned over a separate network slice
  • Application-aware Deterministic Networking
    ✓ Match to a demanding app flow into a specific deterministic path
  • Application-aware Service Function Chaining
    ✓ Match to an app flow into a specific SFC and subsequent steering without the need of DPIs
  • Application-aware Network Measurement
IETF 105 & Next Steps

APN6 Side Meeting @ IETF105
- Thursday Morning @Notre Dame
- Attendee: 50+

Agenda

1. **Admin (Chairs)** [5 : 5/75]
2. **Problem Statement and Requirements** (Zhenbin Li) [10 : 15/75]
3. **Application-aware Information Conveying**
   a) Framework of App-aware IPv6 Networking (Shuping Peng) [10 : 25/75]
   b) Firewall and Service Tickets (Tom Herbert) [10 : 35/75]
   c) SRH Metadata for Simplified Firewall (Jim Guichard) [5 : 40/75]
4. **App-aware Services**
   a) IPv6-based DetNet (Yongqing Zhu) [5 : 45/75]
   b) SRv6 Path Segment (Fengwei Qin) [5 : 50/75]
   c) IPv6-based IFIT (In-situ Flow Information Telemetry) (Haoyu Song) [5 : 55/75]
5. **Shaping Our Discussion** (Chairs and Room) [15 : 70/75]
6. **Wrap Up** (Chairs) [5 : 75/75]

• Next Steps:
  - Setup Mailing list to continue discussions
  - BoF @IETF107

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