An Auto-deployment Mechanism for Resource-based Network Services

draft-dang-anima-network-service-auto-deployment

Joanna Dang (dangjuanna@huawei.com)

Sheng Jiang (jiangsheng@huawei.com)

Zongpeng Du (duzongpeng@chinamobile.com)

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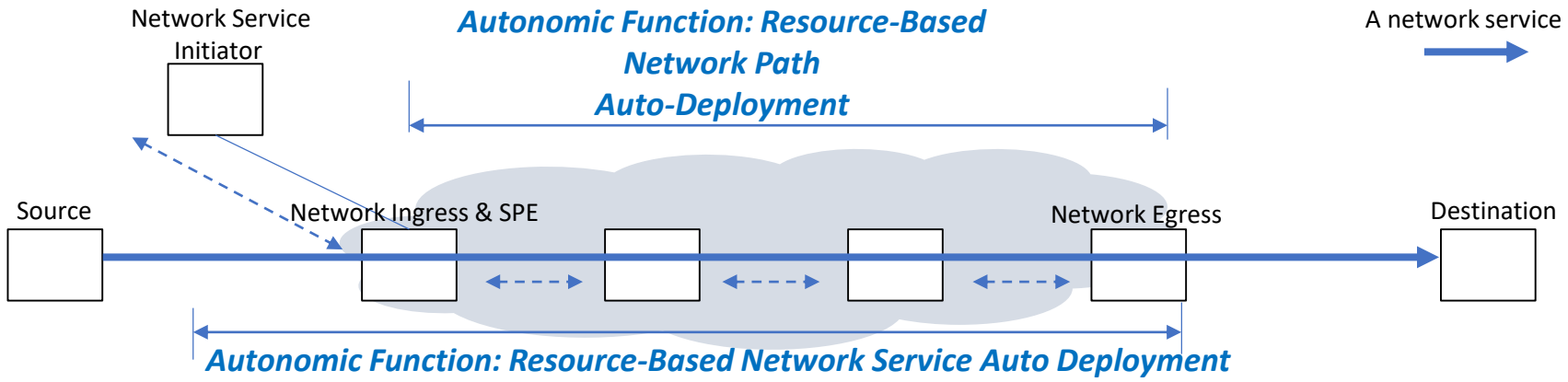
Introduction

- **This document specifies an auto-deployment mechanism that deploys resource-based network services through the Autonomic Control Plane (ACP) in an Autonomic Network. This mechanism uses the GRASP defined in [RFC8990] to exchange the information among the autonomic nodes so that the resource among the service path can be coordinated.**
- **Service**
  - A unicast or multicast flow which has the source (where it starts) and the destination (where it terminates).
- **Network Service**
  - A unicast or multicast flow which has reference points termed “Network Ingress” (where a Network service starts) and “Network egress”(where a network service ends).
  - A network service flow contains one or more (aggregated) service flows (N:1 mapping).
- **Resource-based Network Services**
  - A network service flow has the resource requirement which are extremely assured minimum bandwidth, assured maximum end-to-end delivery latency, and so on.
- **Resource-based Network Path**
  - A Network Path, which has the definite Ingress node and Egress node, can deliver a network service.
  - A resource-based network path can satisfy the resource requirement of network service.
  - Encapsulated Type: VxLAN, or GRE, or MPLS, or SR, etc.

Requirement

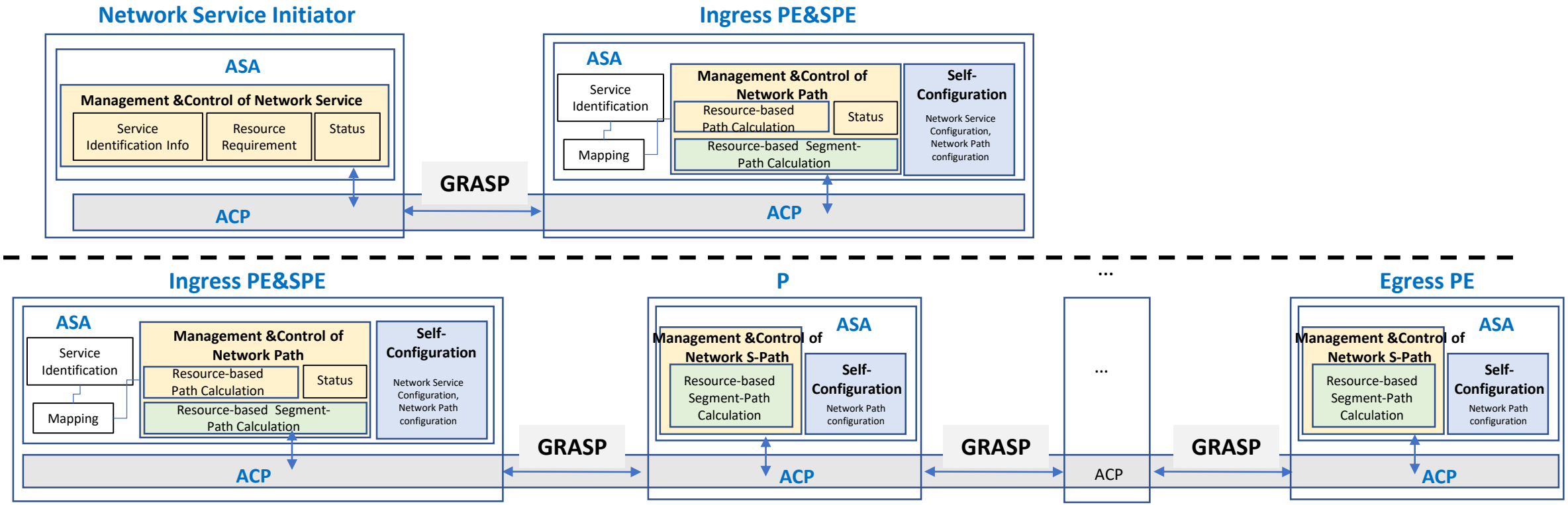


- **Resource-Based Network Service Auto-Deployment**
  - The service initiator issues network service deployment instructions with resource requirements to SPE.
  - The SPE must check whether UNI interface of SPE can meet the requirement this service.
    - If it can, the SPE will create / update a resource-based network path between SPE and Egress.
      - **Resource-Based Network Path Auto-Deployment**
        - If the resource-based network path is successfully established / updated, the SPE will inform the service initiator of the successful service deployment.
        - If the resource-based network path fails to be established, the SPE will inform the service initiator of the failed service deployment.
    - If it can't, the SPE will inform the service initiator of the failed service deployment.

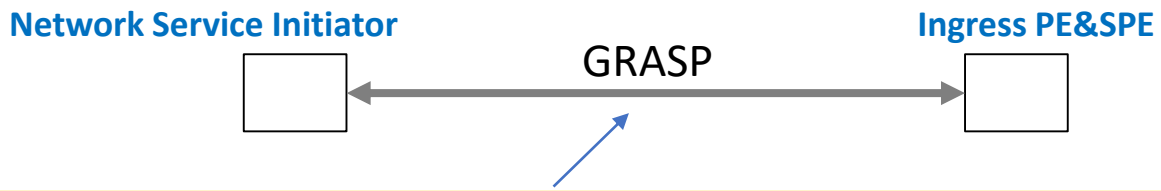
The service / path information with resource need to be exchanged among the network service initiator, Ingress PE&SPE node, PE node and Egress node.

GRASP Extension for Resource-based Network Services Deployment

- According to RFC8993, new GRASP Objectives must be designed for this mechanism.
  - New GRASP Objective Options
    - A GRASP objective option described in RFC8990 is used to identify objectives for the purposes of discovery, negotiation, or synchronization.



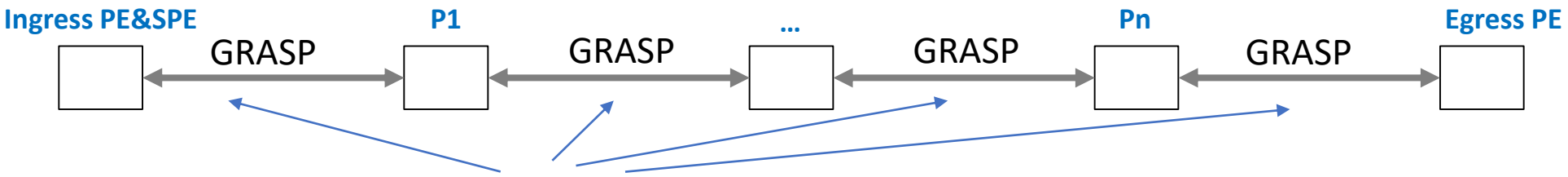
New GRASP Objective Options(1/2)



- **A New GRASP Objective Option**
  - name: s-deployment-value, which is need to be assigned by IANA registration
  - objective-flag: F_DISC and F_SYNCH
  - objective-value: a data structure as follows
    - s-identification, which is used to distinguish different network services
    - s-deployment-type, which indicates that it is new, or updated, or deleted
    - s-resource-information, which are the assured resources of the network service.
      - resource-type, which indicates bandwidth, or latency, etc.
      - resource-value, which indicates the value.
    - s-deployment-status, which indicates deployment success or failure, and the reason for the failure

Thanks Michael Richardson and Brian E Carpenter for the suggestions and comments.

New GRASP Objective Options (2/2)



- **A New GRASP Objective Option**
  - name: s-p-deployment-value, which is need to be assigned by IANA registration
  - objective-flag: F_DISC and F_SYNCH
  - objective-value: a data structure as follows
    - s-p-identification, which is used to distinguish different network paths
    - s-p-deployment-type, which indicates that it is new, or updated, or deleted
    - s-p-resource-information, which are the assured resources of the network path.
      - resource-type, which indicates bandwidth, or latency, etc.
      - resource-value, which indicates the value.
    - s-p-deployment-type, which indicates deployment success or failure, and the reason for the failure

Process of Network Service Auto-deployment

- **A new/updated network service deployment.**
  - The network service initiator send a SPE a GRASP Request Negotiation message with s-deployment-value, n-s-identification, s-deployment-type filled new or update type, s-resource-information.
  - The SPE first detects whether the UNI interface meets s-resource-information, and then detects whether the network path meets p-resource-information.
    - If they all satisfy the resource-information, the SPE will send back a GRASP Negotiation Message with s-deployment-value, s-identification, s-deployment-type, s-deployment-status filled deployment success.
    - If one of the preceding items does not meet the requirements, the SPE will send back a GRASP Negotiation Message with s-deployment-value, s-identification, s-deployment-type, s-deployment-status filled deployment failure and related reasons.
- **A withdrawal network service deployment**
  - The network service initiator send a SPE a GRASP Request Negotiation message with s-deployment-value, n-s-identification, s-deployment-type filled withdrawal type.
  - The SPE notifies the network nodes along the path to released the related information and releases its own information before sending back a GRASP Negotiation Message with s-deployment-value, s-identification, s-deployment-type, s-deployment-status filled withdrawal success.

Processes of Resource-based Network Path deployment

- **A new/updated network path deployment**
  - The SPE send its own downstream node along the path a GRASP Request Negotiation message with s-p-deployment-value, s-p-identification, s-p-deployment-type filled new or update type, s-p-resource-information.
  - The downstream node continually detects whether the network segment-path meets resource-information.
    - If it satisfies the resource-information, it will send its own downstream node along the path a GRASP Request Negotiation message with s-p-deployment-value, s-p-identification, s-p-deployment-type filled new or update type, s-p-resource-information. If this node is an Egress PE, it will send its own upstream node a GRASP Negotiation Message with s-p-deployment-value, s-p-deployment-type, s-p-deployment-type, s-p-deployment-status filled deployment success.
    - If one of the preceding items does not meet the requirements, the network node will send its own upstream node along the path a GRASP Negotiation Message with s-p-deployment-value, s-p-identification, s-p-deployment-type, p-deployment-status filled deployment failure and related reasons.
- **A withdrawal path deployment**
  - The SPE sends its own downstream node along the path a GRASP Request Negotiation message with s-p-deployment-value, s-p-identification, s-p-deployment-type filled withdrawal type, s-p-resource-information. The network node along will release related resources before sending back a GRASP Negotiation Message with s-p-deployment-value, s-p-identification, s-p-deployment-type, s-p-deployment-status filled withdrawal success.

Resource Process

- Use Case1: Minimum bandwidth
  - The nodes, the outbound interface of the node and the inbound interface of the node along the path must satisfy this parameter. Therefore, the bandwidth parameters carried in a GRASP Request Negotiation message sent by the nodes along the path can all be the same.
- Use Case2: Maximum end-to-end delivery latency
  - It is sum of the forwarding delay and link delay of the nodes along the path. Therefore, the latency resource parameters carried in a GRASP Request Negotiation message sent by the nodes along the path can be the different.

Others

- **Compatibility**
  - In the MPLS scenario, the bandwidth-based path deployment can use the RSVP protocol. The ASA described in this document can also interact with RSVP.
- **Security Considerations**
  - GRASP nodes and messages require full protection. GRASP MUST run within a secure environment such as the ACP [RFC8994].
- **IANA Considerations**
  - The new GRASP Objectives are especially designed for network service deployment. So the objective-name of n-s-deployment-value and s-p-deployment-value need to be assigned.

Next Step

- Welcome to comment, contribute or co-author it!

Thank you!