Bearers, Attachment
Circuits, SAPs, & Slicing

draft-boro-opsawg-teas-common-ac
draft-boro-opsawg-teas-attachment-circuit
draft-boro-opsawg-ntw-attachment-circuit

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“An SDP may be abstracted as a Service Attachment Point (SAP) [I-D.ietf-opsawg-sap] for the purpose of generalizing the concept across multiple service types and representing it in management and configuration systems.”
Background

- **Service Attachment Points (SAPs)** are network reference points where services can be (or are being) delivered to customers
  - SAPs may be provisioned *prior or during the activation* of a service instance
  - SAPs may be *multiservice (e.g., slice, L3VPN) or specific to a single service*
    - E.g., A dedicated service type is defined for network slices ("network-slice")

- SAPs are connected to a customer device (e.g., unmanaged CEs, ASBRs, Network Functions) via logical constructs called: **Attachment Circuits**
  - Setting up an AC may require *L2, IPv4/IPv6 address/prefix assignments, static/dynamic routes, OAM features* …
  - One or more ACs can be bound to the same SAP
  - The same AC can be terminated by one or more peer-SAPs
  - A SAP and a peer-SAP can share one or multiple ACs

- ACs are built over **bearers**
  - Bearers may be wireless, wired, et.
  - Bearers can be seen as the required underlying connection for the provisioning of an attachment circuit
  - The same bearer can host one or multiple ACs
Some Observations

• Recent service models make *hidden/inaccurate assumptions* about the AC
  – This limits the applicability of these service models
• Some models *overload* some concepts set in the SAP model
  – E.g., peer-sap-id to identify a logical connection
• **Lack of consistency**: the structure of the AC in some recent models is not aligned with the one used in existing RFCs
  – This deviation makes the mapping with network models **difficult** to achieve
  – E.g., L3SM and slicing may be provided over the same AC, but they don’t have the same AC structure. Distinct logics to translate a slice service into L3NM will be needed, which is **suboptimal**
• **Lack of a standard programmatic interface** to manage bearers and attachment circuits-as-a-service
• The SAP model **does not expose the ACs** that it terminates
The AC Effort

• An AC library with reusable types, identities, and groupings: \textit{ac-common}

• A model for managing ACs as a service: \textit{ac-svc}
  – Does \textit{not make any assumption about the internal structure} or even the nature or the services that will be delivered over an AC
  – Accommodates both \textbf{integrated and separate provisioning models}
    • Includes \textbf{reusable groupings} for use by other service models
    • Exposes AC \textbf{references} that can be used in other service placement requests. \textit{The AC/service glue is achieved using the AC references.}
  – Favor the approach of completely relying upon the AC service model \textit{instead of duplicating data nodes into specific modules} of advanced services that are delivered over an AC

• A network model for the AC management: \textit{ac-ntw}
  – Augments the SAP model with required AC data nodes
  – Network-view of ACs
Applicability to Network Slicing
A Sample Slicing Example
A Sample Slicing Example

```
{
"ietf-ac-svc:attachment-circuits": {
  "ac": [
  {
    "name": "ac1",
    "description": "Connection to site1 on vlan 100",
    "requested-start": "2023-12-12T05:00:00.00Z",
    "l2-connection": {
      "encapsulation": {
        "type": "ietf-vpn-common:dot1q",
        "dot1q": {
          "tag-type": "ietf-vpn-common:c-vlan",
          "cvlan-id": 100
        }
      },
      "bearer-reference": "bearerX@site1"
    },
    "ip-connection": {
      "ipv4": {
        "local-address": "192.0.2.2",
        "prefix-length": 30,
        "address": [
          {
            "address-id": "1",
            "customer-address": "192.0.2.1"
          }
        ]
      }
    },
    "routing-protocols": {
      "routing-protocol": [
        {
          "id": "1",
          "type": "ietf-vpn-common:static-routing",
          "static": {
            "cascaded-lan-prefixes": {
              "ipv4-lan-prefixes": [
                {
                  "lan": "198.51.100.0/24",
                  "next-hop": "192.0.2.1",
                  "lan-tag": "primary_UP_slice"
                }
              ]
            }
          }
        }
      ]
    }
  }
},
```

---

[Diagram of network topology showing VLANs and IP addresses]

```
...{
  "name": "ac2",
  "description": "Connection to site2 on vlan 200",
  "requested-start": "2023-12-12T05:00:00.00Z",
  "l2-connection": {
    "encapsulation": {
      "type": "ietf-vpn-common:dot1q",
      "dot1q": {
        "tag-type": "ietf-vpn-common:c-vlan",
        "cvlan-id": 200
      }
    },
    "bearer-reference": "bearerY@site2"
  },
  "ip-connection": {
    "ipv4": {
      "local-address": "192.0.2.6",
      "prefix-length": 30,
      "address": [
        {
          "address-id": "1",
          "customer-address": "192.0.2.5"
        }
      ]
    }
  },
  "routing-protocols": {
    "routing-protocol": [
      {
        "id": "1",
        "type": "ietf-vpn-common:bgp-routing",
        "bgp": {
          "neighbor": [
            {
              "id": "1",
              "peer-as": 65550
            }
          ]
        }
      }
    ]
  }
}
Bind Slice Services to ACs

```json
{
    "ietf-network-slice-service:network-slice-services": {
        "slo-sle-templates": {
            "slo-sle-template": [
                {
                    "id": "low-latency-template",
                    "template-description": "Lowest latency forwarding behavior"
                }
            ]
        },
        "slice-service": [
            {
                "service-id": "Slice URLLC_UP",
                "service-description": "Dedicate TN Slice for URLLC-UP",
                "slo-sle-template": "low-latency-template",
                "status": {},
                "sdps": {
                    "sdp": [
                        {
                            "sdp-id": "sdp1",
                            "ac-svc-name": ["ac1"]
                        },
                        {
                            "sdp-id": "sdp2",
                            "ac-svc-name": ["ac2"]
                        }
                    ]
                }
            }
        ]
    }
}
```
Summary

• NSSI to focus on network slice service specifics
• AC-related matters to be factorized among multiple services; including NSS
  – AC-as-a-Service Model
• Binding a network slice service to a list of ACs is done by means of AC references
  – New features added to the AC models will be available to the service models
  – No need to update the service models themselves
Appendix
Methodology

• **Adhere** as much as possible to the automation framework set in RFC 8969
  – Ease mappings between service/network models
  – Ease the mapping between network and device models

• **Leverage** L3SM (RFC 8299), VPN Common (RFC 9181), L3NM (RFC9182), L2NM (RFC9192), and SAP (draft-ietf-opsawg-sap)

• **Adjust** the structure as appropriate to accommodate cloud-specific deployments