Applicability of Abstraction and Control of Traffic Engineered Networks (ACTN) to Enhanced VPN
draft-lee-rtgwg-actn-applicability-enhanced-vpn-03

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Enhanced VPN has the following key requirements

1. Isolation between VPNs
   › Hard and soft isolation
2. Guaranteed Performance
   › Low latency,
   › Low packet drop,
3. Customized Control Plane
   › Simple creation, deletion and modification of the services.
   › Control over VPN
4. Seamless integration of both physical and virtual network and service functions
IETF YANG Models (Ref: RFC 8309)

- Customer (CNC)
- Service Orchestrator (MDSC-H)
- Network Orchestrator (MDSC-L)
- Network Element
- Device Configuration Model
- Network Configuration Model
- L1/2/3 Service Model, VN Model, TE & Service Mapping Model
- L0/L1/L2/L3 tunnel Model, L0/L1/L2/L3 topology Model
- L0/L1/L2/L3 tunnel Model, L0/L1/L2/L3 topology Model

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IETF ACTN & YANG: Progress

Topography Model:
- L3 (Network Topo)
  - I2RS
  - L3 Topo
    - L2 Topo
    - OTN Topo
    - WSON Topo
    - Flex-grid Topo
- L2
  - TE Topo
  - I2RS
- L1
  - TEAS
  - OTN Topo
  - Flex-grid Topo
  - CCAMP
- L0
  - TEAS
  - CCAMP

Tunnel Model:
- L3 (TE Tunnel)
  - OTN Tunnel
  - WSON Tunnel
  - Flex-grid Tunnel
  - CCAMP
- CCAMP

Service Model:
- L3SM
- L2SM
- L1CSM
  - L3SM
  - L2SM
  - L1CSM
  - ACTN VN/VNS
  - TE Service mapping
  - TEAS

OAM Model:
- TEAS
- CCAMP
- TEAS
- L0
  - PM telemetry

ACTN Reference Architecture

Customer Network Controller

Multi-domain Service Coordinator (Orchestrator)

Provisioning Network Controller (Domain Controller)

CMI

MPI

SBI

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ACTN Architecture Principles: Virtual Network

Providing network virtualization services to customer so that customers can dynamically control and operate their own virtual network slices according to their own service intent, application requirements.

CNC (Customer Network Controller) can be Service Orchestrator, VNO Controller, Service Portal, etc.
**ietf-actn-vn yang module**


```yang
module: ietf-actn-vn
  +--rw actn
    +--rw ap
      |  +--rw access-point-list* [access-point-id]
      |     +--rw access-point-id uint32
      |     +--rw access-point-name? string
      |     +--rw max-bandwidth? te-types:te-bandwidth
      |     +--rw avl-bandwidth? te-types:te-bandwidth
      |     +--rw vn-ap* [vn-ap-id]
      |      +--rw vn-ap-id uint32
      |      +--rw vn? -> /actn/vn/vn-list/vn-id
      |      +--rw ltp? te-types:te-tp-id
    +--rw vn
      +--rw vn-list* [vn-id]
      |  +--rw vn-id uint32
      |  +--rw vn-name? string
      |  +--rw vn-topology-id? te-types:te-topology-id
      +--rw vn-member-list* [vn-member-id]
        +--rw vn-member-id uint32
        +--rw src
          |  +--rw src? -> /actn/ap/access-point-list/access-point-id
          |  +--rw src-vn-ap-id? -> /actn/ap/access-point-list/vn-ap/vn-ap-id
          |  +--rw multi-src? boolean {multi-src-dest}?
          +--rw dest
            |  +--rw dest? -> /actn/ap/access-point-list/access-point-id
            |  +--rw dest-vn-ap-id? -> /actn/ap/access-point-list/vn-ap/vn-ap-id
            |  +--rw multi-dest? boolean {multi-src-dest}?
          |  +--ro oper-status? identityref
          |  +--ro if-selected? boolean {multi-src-dest}?
          +--rw admin-status? identityref
          +--ro oper-status? identityref
          +--rw vn-level-diversity? vn-disjointness
```

- **Creation of VN id and linking to TE abstract node**
- **Linking to connectivity matrix of te topology to allow VN to configure type 2**
TE VN+ Requirements

• From a customer perspective:
  › Create dynamically their virtual network and operate it (create/modify/delete) without having to understand transport underlay details.
  › Monitor KPI for their VN.

• From a provider perspective:
  › Map and translate customer virtual network models (e.g., L1/2/3 VPN, VPN+) against TE constrained paths in transport network.
  › Provision and manage end to end paths per VN instance.
  › Monitor performance of slice at various levels: customer level, orchestration level and domain level.
  › Provide deterministic performance guarantee for both latency and bandwidth (Hard Isolation).
TE & Service Mapping Model

- VPN/TE Selection Policy
  - New VN/Tunnel Binding – Customer could request a VPN service with a new VN/Tunnel not shared with other existing services
    - Hard Isolation with deterministic characteristics
    - Hard Isolation: This is similar to the above case without deterministic characteristics.
    - Soft Isolation: Customer would request an VPN service using a set of MPLS-TE tunnel which cannot be shared with other VPN services.
  - VN/Tunnel Sharing with existing VNs/Tunnels
    - resource multiplexing
    - resource partition
    - ultra resource partition
  - VN/Tunnel Modify - This mode allows the modification of the properties of the existing VN/tunnel (e.g., bandwidth) when VN/Tunnel Selection Mode is applied.

- Optical Transport Network
- MPLS Tunnel
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Optical Bypass Tunnel: PE (D1)-PE (D2)
module: ietf-te-service-mapping

VPN/Tunnel Selection Policy

typedef map-type {
  type enumeration {
    enum "new-hard-isolation-deterministic" {
      description "The new VN/tunnels are binded to the service";
    }
    enum "new-hard-isolation" {
      description "The VPN service selects an existing tunnel with no modification";
    }
    enum "new-soft-isolation" {
      description "The VPN service selects an existing tunnel and allows to modify the properties of the tunnel (e.g., b/w)";
    }
    enum "share" {
      description "Share existing tunnel";
    }
    enum "modify" {
      description "The VPN service selects an existing tunnel and allows to modify the properties of the tunnel (e.g., b/w)";
    }
  }
}

type map-id {
  type uint32
}

typedef l3vpn-ref {
  type string
  description "/l3:vpn-svc/vpn-services/vpn-service/vpn-id"
}

typedef l2vpn-ref {
  type string
  description "/l2:vpn-svc/vpn-services/vpn-service/vpn-id"
}

typedef l1vpn-ref {
  type string
  description "/l1:cs/service/service-list/subscriber-l1vc-id"
}

typedef l3vn-ref {
  type string
  description "/vn:vn/vn-list/vn-id"
}

typedef te-tunnel-ref {
  type string
  description "te:tunnel-ref"
}

typedef te-topology-id {
  type "te-types:te-topology-id"
}

typedef abstract-node {
  type string
  description "/nw:networks/network/node/node-id"
}

typedef actn-ap-ref {
  type string
  description "/vn:actn/ap/access-point-list/access-point-id"
}

typedef actn-vn-ref {
  type string
  description "/vn:actn/vn/vn-list/vn-id"
}

typedef site-ref {
  type string
  description "/l3:vpn-svc/sites/site/site-id"
}

typedef site-id {
  type string
  description "/l2:vpn-svc/sites/site/site-id"
}

module: ietf-te-service-mapping

--- rw te-service-mapping
  --- rw service-mapping
    --- rw mapping-list* [map-id]
      --- rw map-id uint32
    --- rw map-type? map-type
      --- rw (l3vpn)
      --- rw (l2vpn)
      --- rw (l1vpn)
        | --- rw l1vpn-ref? -> /l1:cs/service/service-list/subscriber-l1vc-id
      --- rw (te)?
        | --- rw (actn-vn)
          | --- rw actn-vn-ref? -> /vn:actn/vn/vn-list/vn-id
          | --- rw (te-topo)
            | --- rw vn-topology-id? te-types:te-topology-id
            | --- rw abstract-node? /nw:networks/network/node/node-id
          | --- rw (te-tunnel)
            | --- rw te-tunnel-list* te:tunnel-ref
      --- rw site-mapping
        --- rw mapping-list* [map-id]
          --- rw map-id uint32
        --- rw (service)?
          | --- rw (l3vpn)
            | --- rw l3vpn-ref? -> /l3:vpn-svc/sites/site/site-id
          | --- rw (l2vpn)
            | --- rw l2vpn-ref? -> /l2:vpn-svc/sites/site/site-id
          | --- rw (l1vpn)
            | --- rw l1vpn-ref? -> /l1:cs/access/uni-list/UNI-ID
        --- rw (te)?
          | --- rw (actn-vn)
            | --- rw actn-vn-ref? -> /vn:actn/ap/access-point-list/access-point-id
          | --- rw (te)
            | --- rw ltp? te-types:te-tp-id

PM Telemetry & Network Autonomics


- YANG PUSH mechanism for streaming KPI telemetry at various level:
  - VN
  - E2E Tunnel
  - Domain LSP/Link

- Autonomic traffic engineering scaling intent configuration mechanism on the VN/Tunnel/Link level.

A Virtual network is created to load balance between two DCs.

EP1

EP2

EP3

Domain 1

Domain 2

Domain 3

EP is (Customer) End Point

E2E Tunnel 1

E2E Tunnel 2

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ietf-te-kpi-telemetry model

Auto scale mechanism programmable by the customer per tunnel/VN

Can subscribe PM parameters of interest per tunnel/VN

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Recap: How VPN+ requirements fulfilled by ACTN with L2/3SM and TEAS models

1. Isolation between VPNs
   › Hard and soft isolation

2. Guaranteed Performance
   › Low latency,
   › Low packet drop,

3. Customized Control Plane
   › Simple creation, deletion and modification of the services.
   › Control over VPN

4. Seamless integration of both physical and virtual network and service functions

   L2/3SM + ACTN VN YANG & TE & Svc Mapping.
   L2/3 SM + ACTN VN/TE-tunnels & PM Telemetry
   ACTN VN + TE-topo connectivity matrix
   SF-enable topology model (TEAS)
Next Steps

- Any comments/feedback?
Thank you !