Traffic Engineering in CATS and DetNet

Some personal thoughts

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What is Traffic Engineering

- Let's take some advice from draft-ietf-teas-rfc3272bis

  That aspect of network engineering dealing with the issues of performance evaluation and performance optimization of operational networks.

  The application of technology and scientific principles to the measurement, characterization, modeling, and control of Internet traffic

- And what does that mean?
  - Network planning and operation
  - Control of network resources
  - Direction of traffic

- Why?
  - To make the best use of network resources
    - To carry more traffic
    - To enable more services
    - To make more money!
  - To meet specific service requirements
    - Reliability
    - Throughput
    - Path quality

Timescales for TE

- Proactive or reactive
- Offline planning
  - Weeks or days
  - Input is a network map, planned traffic demand matrix, predicted changes to network
- Routing control and management protocols
  - Days to milliseconds
  - Reports network status updates, alarms, and OAM
  - Responds to node and link failures, changes in traffic load, changes in link quality
- Packet-level processing
  - Milliseconds or less
  - Next hop forwarding decisions
  - Report alarm and OAM information back to control/management plane

Elements of TE

- A TE system relies on all three elements to some extent

Debate remains about whether a solution can truly be called TE if it does not include all of these elements. For the sake of this document, we assert that all TE solutions must include some aspects of all of these elements.

- Policy
  - Selection of paths (including next hops) based on information beyond basic reachability
  - E.g., BGP Flowspec

- Path steering
  - The ability to forward packets using more information than just knowledge of the next hop
  - E.g., RSVP-TE, SR, SFC

- Resource management
  - Provides resource-aware control and forwarding, such as bandwidth, buffers, and queues, all of which can be managed to control loss and latency
  - E.g., DiffServ, MPLS-TE, GMPLS
  - Divides into…
    - Resource reservation is the control aspect of resource management
    - Resource allocation is the data plane aspect of resource management

What does CATS ask of TE?

Computing-Aware Traffic Steering

- CATS is about Traffic Steering
  - That is not path steering
  - It is an edge policy
- The ingress edge directs traffic towards a chosen egress edge
  - Egress must provide access to the desired compute function
  - Compute function is "available"
  - Network path to egress edge meets service requirements
- Assumptions
  - CATS is an overlay
  - Network status information must be collected
  - Compute status information must be collected
  - Traffic is steered
    - Towards a chosen egress edge
    - Onto a suitable path
- Underlay _might_ use TE
  - Personally, I probably would
  - But it is not an essential feature of CATS

Is DetNet Traffic Engineering?

- The DetNet forwarding sub-layer provides forwarding assurance (low packet loss, bounded latency, and in-order delivery) functions using resource allocations and explicit route mechanisms
  - Sounds like TE
- DetNet can be seen as a specialized branch of TE
  - It sets up explicit optimized paths with allocation of resources as requested
  - A DetNet application can express its QoS attributes or traffic behavior using any combination of DetNet functions described in sub-layers
  - Traffic behaviors are distributed and provisioned using well-established control and provisioning mechanisms adopted for traffic engineering

Enhanced TE for DetNet?

- This is a debate for the DetNet working group
- *Additional requirements for enhancements?*
  - *"Provide the packet treatment for data plane to achieve DetNet QoS in large-scale networks"*
  - *"The existing TE mechanisms for resource allocations and explicit routes are not sufficient for enhanced DetNet"*
  - *"The TE mechanisms should consider the queuing-based or time-based resources"*
- May need much more clarity about
  - What needs to be achieved
  - Why it can't be done with existing tools