TVR (Time-Variant Routing) Applicability
draft-wqb-control-schedule-framework-00

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Applicability of TVR to real networks

• The TVR Charter includes the following milestone:
  • Applicability Statement
    • “This document should provide an applicability statement on how the information and data models may be used”
      • https://datatracker.ietf.org/wg/tvr/about/

• Depending on the use case to apply TVR YANG, additional IETF YANG models are also required.
  • Which functional components will configure TVR entities and how they interact needs consideration.
  • Several additional process and messaging mechanism also need to be decided.
A Framework for the Control Scheduling of Network Resources

• The authors created a new I-D:
  • “A Framework for the Control Scheduling of Network Resources”
  • draft-wqb-control-schedule-framework

• This document provides functional components to service a time variant scenario
  • It will describe the entities involved in requesting scheduled changes of network resources
  • It discusses the additional challenges such as conflict resolution, priority handling, and synchronization of scheduled tasks.

• This I-D is intended to provide an applicability statement on how TVR YANG and ancillary YANG models may be used.
Components for Network Schedules

• What basic functional components are required for the control and scheduling of network resources?
  • Scheduled Service Requester: The entity making the scheduling requests of network events, policies, services and resources.
  • Schedule Service Responder: The entity accepting and reacting the scheduling Requests from Schedule Service Request.
    • Resource Manager: Manages the network resources that are subject to scheduling.
    • Schedule Manager: Handles creation, modification, deletion, and querying of schedules.
    • Conflict Resolver: Detects and resolves scheduling conflicts based on predefined policies and priorities.
    • Policy Engine: Enforces scheduling policies and rules, ensuring compliance with organizational requirements.
TVR Tidal Traffic Use Case (1/2)

• Tidal Network Example
  • Traffic on the network has an obvious tidal period, including heavy-traffic periods and light-traffic periods
    • Network topology change caused by specific traffic pattern.
  • The time duration of heavy traffic and light traffic are clearly identifiable
    • Students or employees work specific hours
    • Network change will occur twice per day
  • The switching time between the heavy-traffic period and the light-traffic period is well established
    • Working time and day of week are predictable

Tidal effect of traffic in campus network
Benefits of time variant approach for Tidal Network

- The low tide topology requires less bandwidth to support fewer users
- Devices and port can be shut down or put to sleep to save energy

Topology at heavy-traffic period
- 14 ports up
- 0 port down/sleep

Topology at light-traffic period
- 10 ports up
- 4 port down/sleep

28% Port Power Consumption is saved
What Process Would Be Required?

- Monitoring of interfaces to build a traffic profile
  - Establishing clear tidal points for lower and upper network traffic
- Running simple algorithm to establish minimum and peak topology to service expected demand
  - Generate low and peak topologies
- Creating network schedule to reflect minimum and peak traffic demands
  - Defining schedules
- Use a mechanism to distribute schedules
  - To be decided and agreed (will be decided for planned Hackathon)
- Executing schedules
  - To be decided and agreed (will be decided for planned Hackathon)
What Entity and Network Data is Required?

• The following IETF YANG models are identified for the Tidal Use Case
  • ietf-interfaces
  • schedule-yang
  • tvr-schedule-yang
    • ietf-tvr-node.yang
    • ietf-tvr-topology.yang

• We will need to Anything else?
  • This may depend on IETF Hackathon (see later slide).
Example Process for Tidal Use Case

1. Request a schedule to shut down N1Port1, N2Port1, N5Port2, N6Port2 from 1 am to 7 am everyday

2. Check schedule conflicts

3. Create a schedule

4. Allocate port resource for this schedule

5. Enforce schedule, generate Yang model

6. Distribute TVR Node Yang Model to specific node with its Port down from 1 am to 7 am everyday

7. Distribute TVR topology Yang Model to all nodes

8. Node execute schedule shut down specific port at the indicated time point

9. Calculate routing tables based on the time variant topology
YANG Code Examples

- Example for Tidal...
  - Node power up from 1th Dec 2025 to 1th Dec 2026;
  - Default state of interface1: unavailable;
  - Default bandwidth of interface1: 1Gbps;
  - Interface1 power up at 7 o’clock every day, and it will last for 18 hours.
  - This schedule for interface 1 will last from 1th Dec 2025 to 1th Dec 2026.
IETF TVR Hackathon

• Based on Tidal Use Cases
  • Show the proposed framework can be used for scheduling scenarios
  • Implementation of the applicable IETF YANG
  • Highlight the YANG code required to service the tidal example
  • Generate JSON examples to show how the YANG is used and encoded

• Next steps
  • Agree scope of hackathon, do we have a good use case?
    • Planning on IETF 121 (Dublin, November 2024)
  • Plan for early implementations of required YANG modules
  • YANG and JSON examples to be generated between hackathon partners and presented to TVR working group
    • Maybe included in Appendix in this document
Next Steps

• Would this be a useful document for TVR?
• Are we missing function or models for the use case?
• Are there willing partners for the TVR hackathon?
• Any other questions or suggestions?