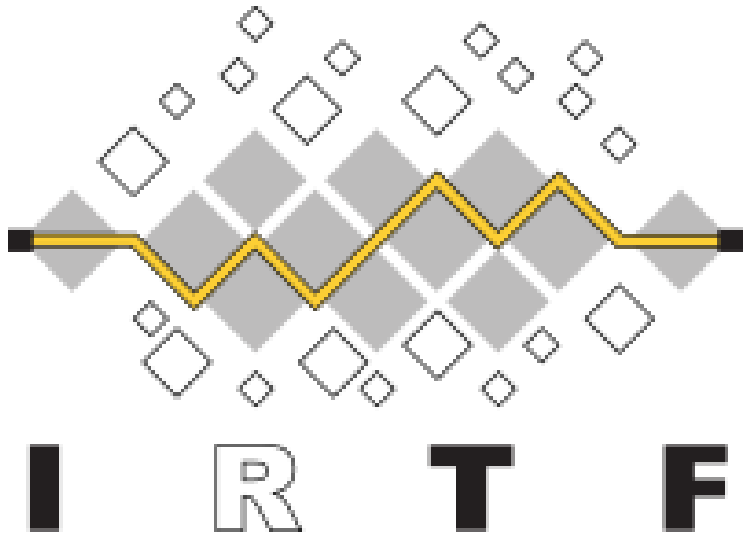
Sustainability holistic API for Path Energy Evaluation (SHAPE)



draft-amalj-sustain-shape-01

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SUSTAIN, Shenzhen, March 2026

History

- Initial work was proposed in GREEN WG for defining an API capable of retrieve energy-related metric for a given network path (PETRA API) ***[draft-petra-green-api]***
- Augmentations were proposed to SUSTAIN RG to include additional parameters and aspects not fitting GREEN charter ***[draft-malja-sustain-petra-augmented]***
- Work re-shaped for being better oriented towards the SUSTAIN RG goals ***[draft-amalj-sustain-shape]***

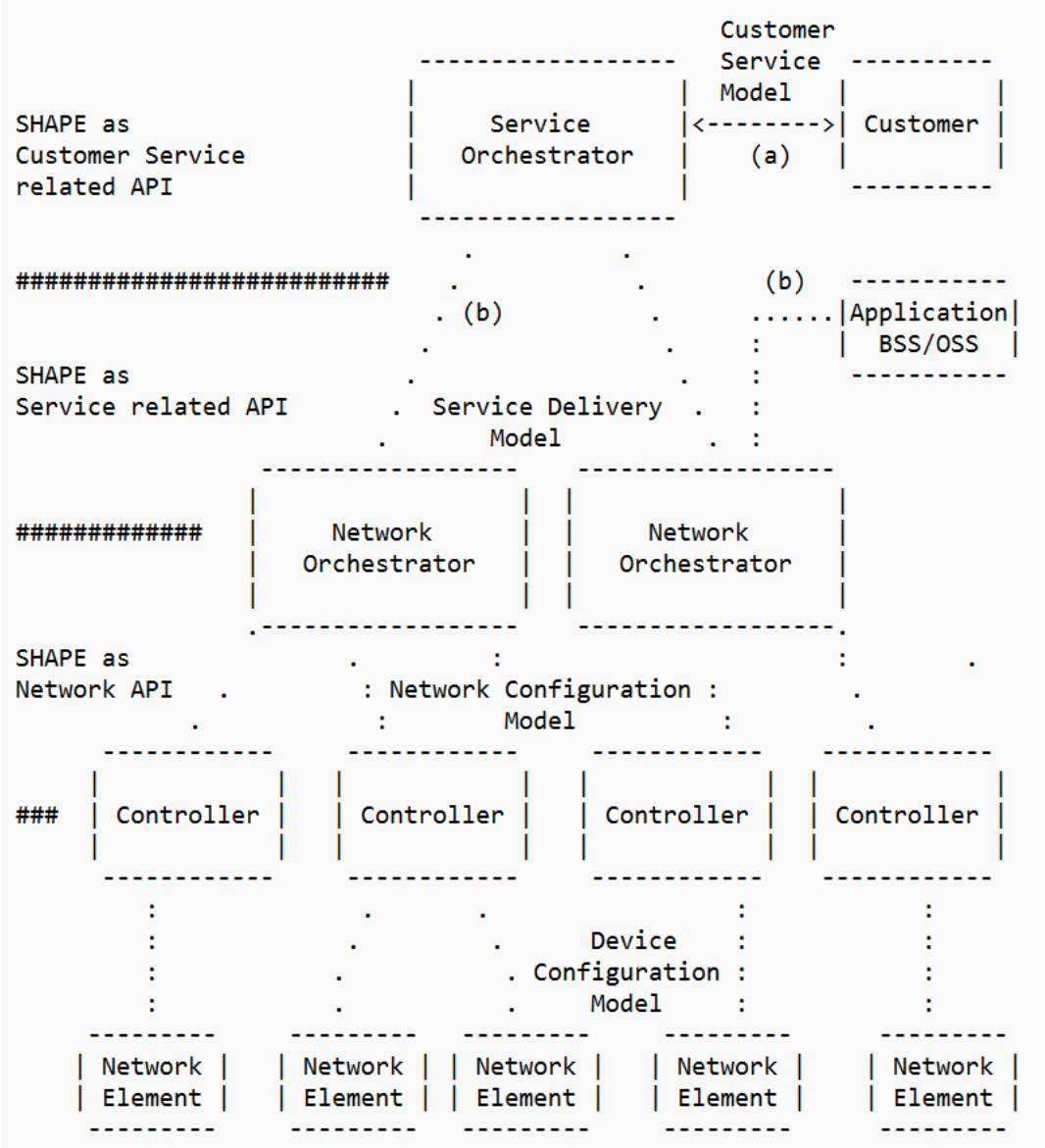
SHAPE Motivation

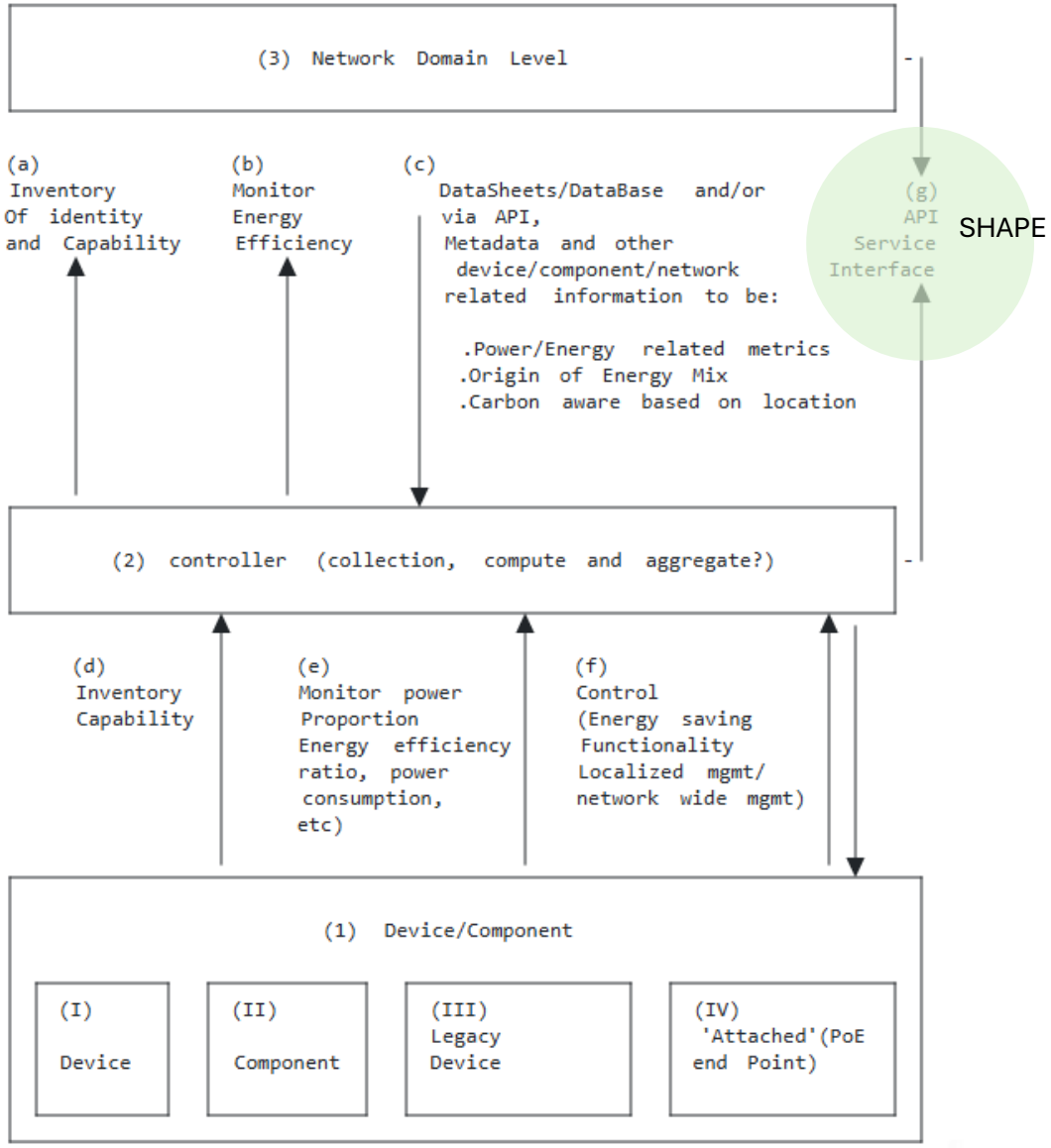
- Definition of an API focusing on sustainability-related information associated to network paths
- Those metrics go beyond power consumption and energy-efficiency, including parameters that could report new sustainability-related metrics (see next slide)
- Import PETRA on the YANG model and expand it
- Expand the API with further use-cases
  - SD-WAN
  - Multilayer Energy Management
  - SLA Negotiation for Green Services
  - Energy-Aware UPF and Edge Selection in 5G
  - Sustainability Reporting Across Leased Backhaul and Network Sharing

Sustainability-related information (defined as optional metrics)

- **Energy Mix (%):** Indicates the share of energy from each source (solar, wind, biomass, nuclear, fossil) used along the path.
- **Greenness Degree (%):** Measures the total percentage of renewable energy consumed along the path.
- **Sustainability Score (0–1):** Combines renewable-energy share and energy efficiency to rate the overall sustainability of a path.
- **Transmission Loss (%):** Percentage of energy lost along the path due to transmission inefficiencies.
- **Idle Energy Draw (Watts):** Amount of energy consumed by the infrastructure when idle or under minimal load.
- **Temporal Carbon Variability (TCV):** Quantifies how much the carbon intensity of the electricity powering the path fluctuates over a given period.
- **Sleep-mode Availability (%):** Indicates how often devices along the path support or enter low-power sleep modes.
- **Sustainability Stability Index (SSI) (0–1):** Measures the temporal stability of sustainability metrics such as carbon intensity or greenness.
- **Trustworthiness Score of Data Sources (TDS) (0–1):** Rates the reliability and consistency of sustainability-related data sources.
- **Variance of Energy Consumption (VEC) (W^2):** Captures how much the path's energy consumption fluctuates during the observation window.
- **Anomaly Factor (AF):** Identifies how much current energy use deviates from historical or statistically expected behavior.
- **Cooling Energy Ratio (CER) (%):** Indicates the proportion of total energy used for cooling relative to actual networking workload.

SHAPE positioning





Next steps

- Gather and incorporate RG feedback
- Explore incentive scenarios
- Keep the link with GREEN WG PETRA