Concepts of Digital Twin Network (DTN)

draft-zhou-nmrg-digitaltwin-network-concepts-02

Cheng Zhou (China Mobile, Co-presenter)
Hongwei Yang (China Mobile)
Xiaodong Duan (China Mobile)
Diego Lopez (Telefónica I+D, Co-presenter)
Antonio Agustín Pastor Perales (Telefónica I+D)
Major Updates from version -00

Table of Contents

1. Introduction .................................................. 2
2. Definition of Digital Twin Network .......................... 3
   3.1. Lower the cost of network optimization ................. 4
   3.2. More intelligent for network decision making .......... 5
   3.3. High efficient for network innovation .................. 5
3.4. Privacy and Regulatory Compliance ......................... 6
3.5. Customize Network Operation Training ....................... 6
5. Challenges to build Digital Twin Network .................... 9
6. Summary .......................................................... 10
7. Security Considerations ........................................ 10
8. TANA Considerations ............................................ 10
9. References ........................................................ 10
   9.1. Normative References ...................................... 10
   9.2. Informative References .................................... 10
Authors' Addresses .................................................. 10

A fifth element added: Orchestration
Two new benefits analyzed
New section for reference architecture of DTN
The Fifth Element

- **Orchestration**
  - Control the data and action flows
  - Applies dynamic lifecycle management
  - Based on network models

- **Supporting**
  - **Repeatability**
    - Replicate network conditions on demand
  - **Reproducibility**
    - Replay successions of events
    - Controlled variations
Additional Potential Benefits

- Privacy preservation
  - Avoid any use of personal data for management decisions
  - Synthetic and aggregated sources
  - And a better fit to the trend on E2E encryption

- Training
  - Under controlled conditions
  - As close as possible to real operations
  - A/B evaluation
  - Cyber-ranges
Reference Architecture of DTN

Three-layer DTN system

- **Bottom Layer: Physical Network**
  - Various network domains
  - Exchange data and control with Network Digital Twin

- **Middle Layer: Network Digital Twin**
  - Core layer of DTN system
  - 3 key subsystems;

- **Top Layer: Network Application**
  - Both conventional and innovative applications.
  - Provide requirement to Network Digital Twin entity;
Reference Architecture of DTN (cont.)

Three Sub-systems in Network DT layer

- **Data Sharing Repository**
  - Various network domains
  - Exchange data and control with Network Digital Twin

- **Service Mapping Models**
  - **Basic Models**: network elements and network topology;
  - **Functional Models**: various data models such as network analysis, simulation, diagnosis, prediction, assurance, etc.

- **Digital Twin Entity Management**
  - Life-cycle management entity;
  - Visualizes and controls various elements, including topology, model, security, etc.
Next Steps

● To consider dynamic data collection through day-N orchestration
  • SPIDER project: https://spider-h2020.eu

● To analyze requirements on flow provenance
  • INSPIRE-5Gplus project: https://www.inspire-5gplus.eu

● To investigate more use cases and requirements of DTN.

● To define basic southbound and northbound interfaces of DTN system.

● Welcome to join our work, and any comments are welcome!