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Data Flow Aggregation for Smarter Network Security

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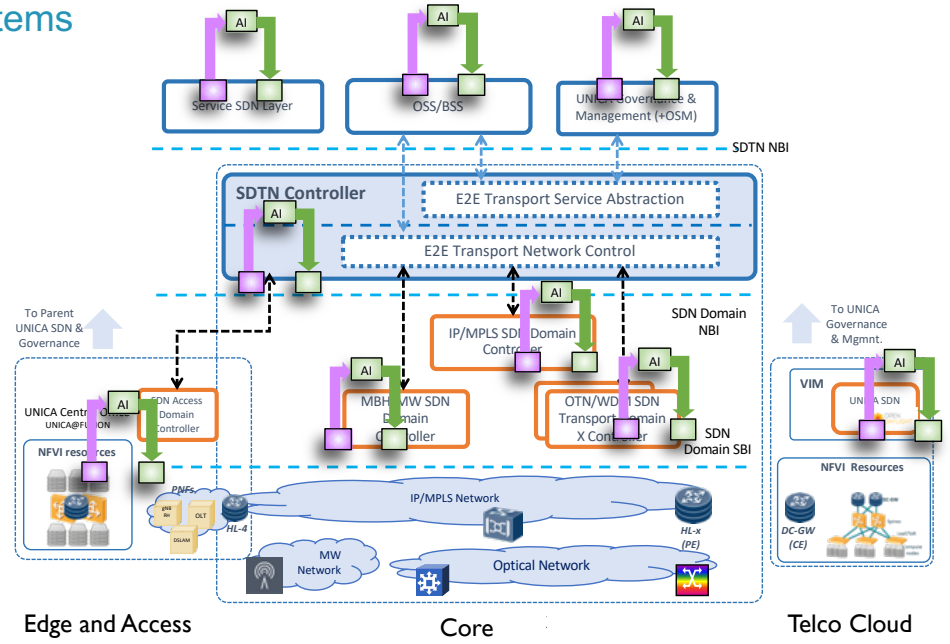
The Autonomous Security Aspiration

- Security is one of the key areas for applying Autonomous Network technologies
- Based on a definition of policies and goals
  - Security intents
  - Policy enforcement and propagation
- Detect and deter miscreants
  - Dynamic identification
  - Adaptable response
- Based on closed loop technologies
  - Around for a long time
  - With AI to derive further insights and improve policy mapping

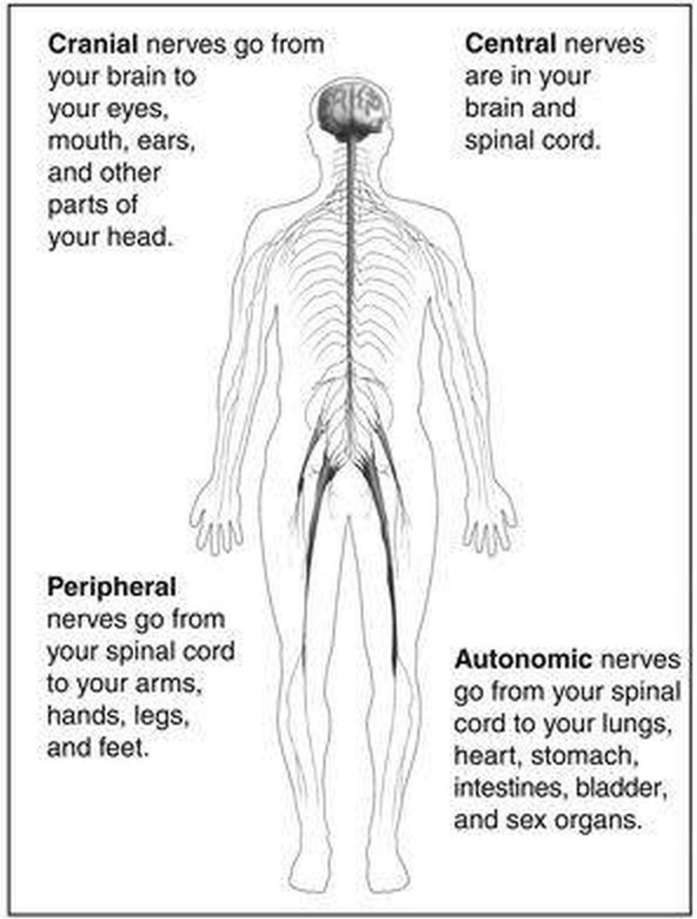
The Architectural Mapping

- Networks are critical and naturally distributed systems
  - A distributed AI for managing them
- The nature of distribution
  - Aggregation of knowledge
  - Accumulation of decisions
  - Cooperative vs independent vs selfish
  - Fixed vs mobile vs roaming
- Protocols
  - Specific knowledge and policy exchanges
  - Reuse stream mechanisms
  - Apply good-ole BGP and others of its kin
- Topologies
  - The mapping on the network topology
  - Depth and breadth
  - Nervous system approaches



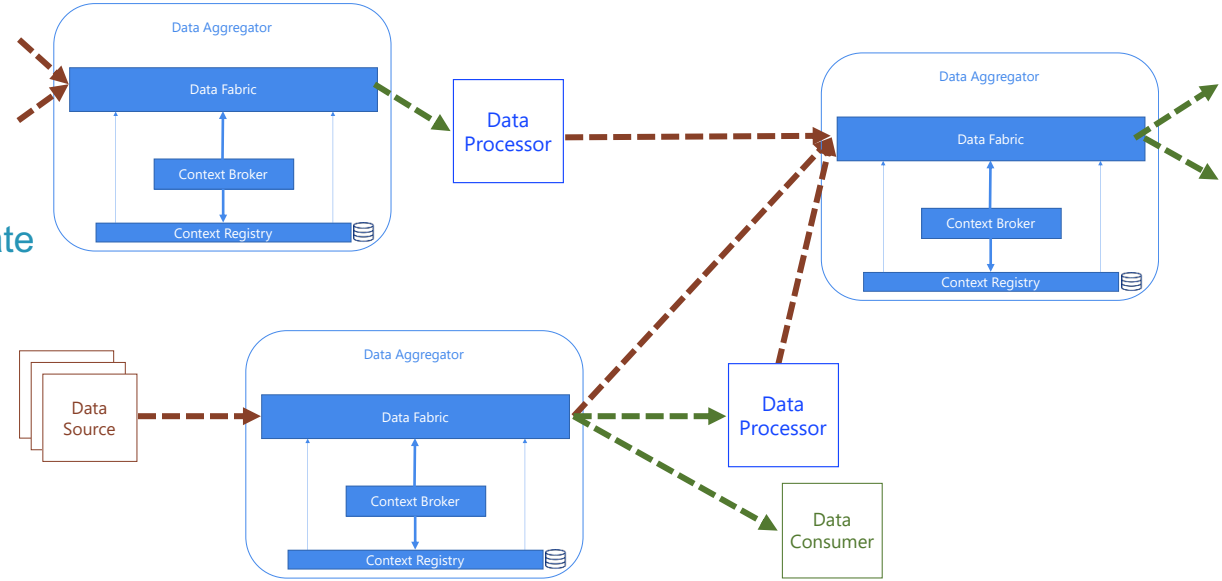
The Nervous System Paradigm

- Combine distributed architectures and holistic approaches
- Local loops
  - Detailed analysis
  - Fast response
  - Dynamic deployment
- Central loop(s)
  - Cumulated analysis
  - Integral view
  - Explainabiliity
  - Local loop orchestration
- All using a common impulse for all kind of interactions
  - Central elements receive and process aggregate information
  - A common data infrastructure for forwarding and aggregation

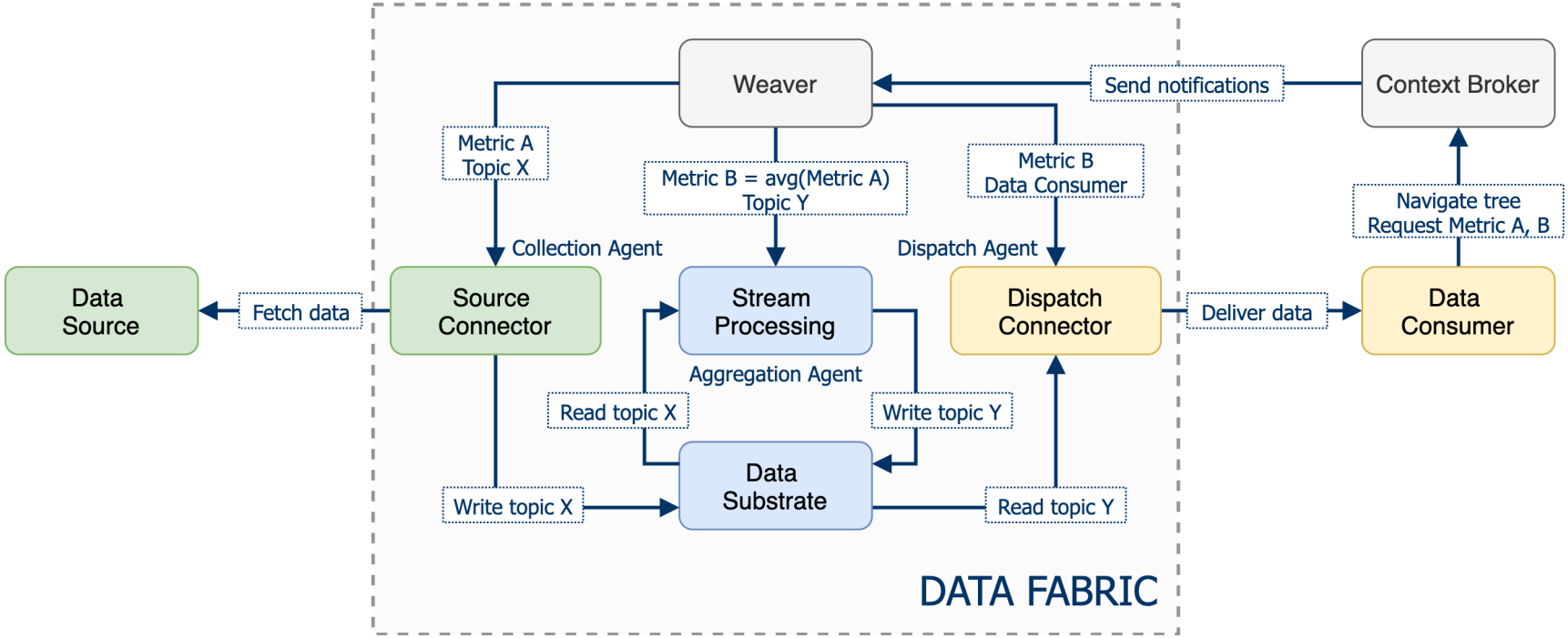


Building the Nervous Data Infrastructure

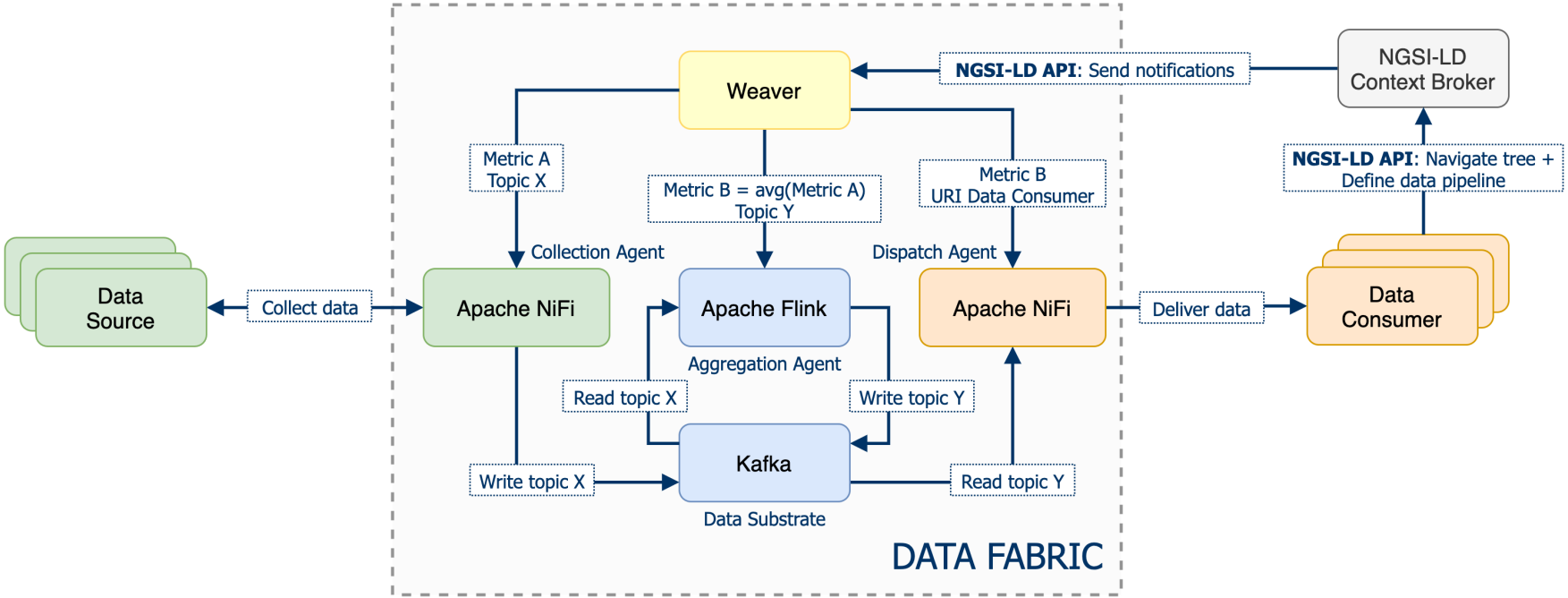
- Rely on aggregation nodes
  - Sources feed data
  - Consumers receive them
  - Aggregators map and integrate
- Based on metadata
  - Dynamic composition
  - Transport protocol agnostic
  - Telemetry data models
  - Knowledge ontologies
- Compositional patterns
  - Any element can play any role
  - AI / ML supported anywhere



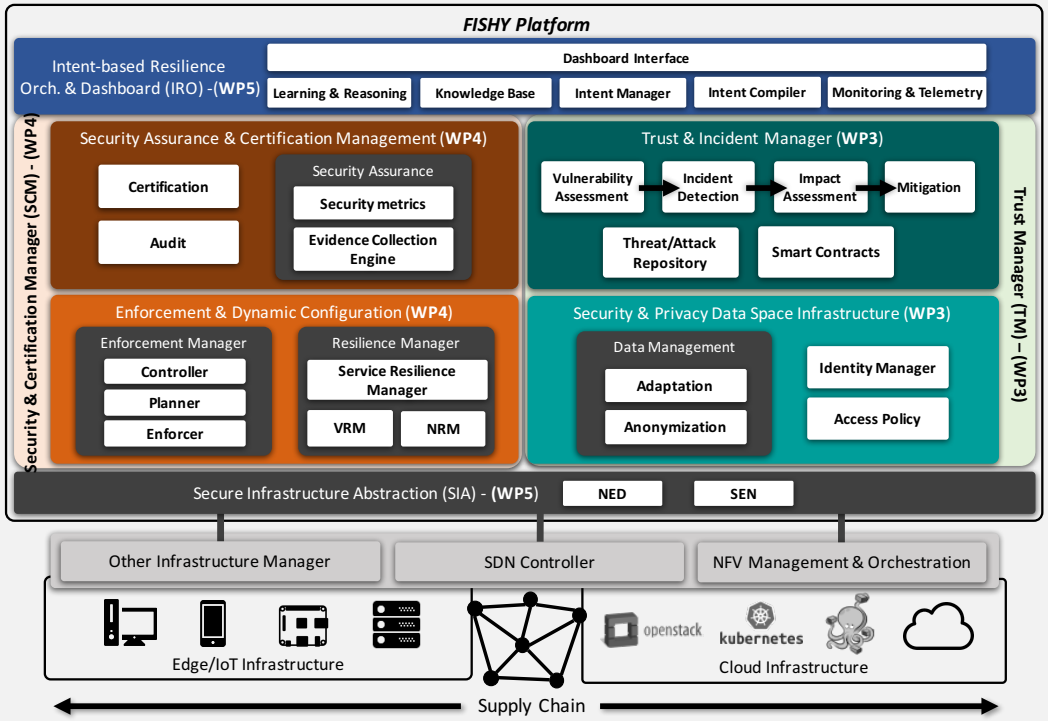
The Core Element: 5Growth Data Aggregator



Implementing the 5Growth Data Aggregator



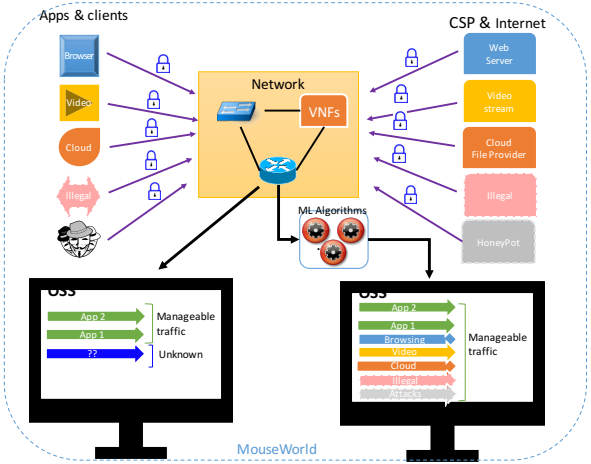
ICT Supply Chain Security: The FISHY Architecture



- Data consumers and processors
  - Intent-based Orchestrator and Dashboard
  - Assurance and Dynamic Configuration
  - Trust and Incident Management
- Two layers of data aggregators
  - Security Data Space Infrastructure
  - Secure infrastructure Abstraction (SIA)

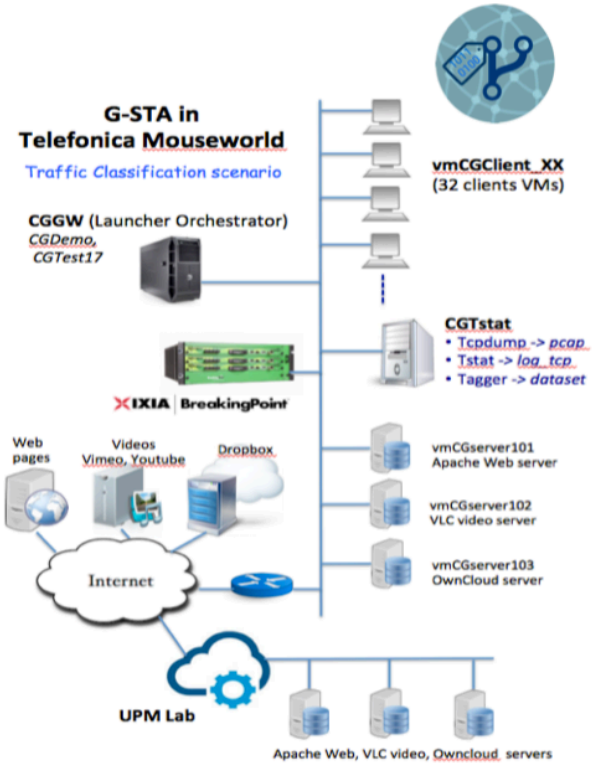
Trustworthy Datasets

- A serious lack of usable datasets
  - For training or validation
  - Data as an asset
  - Privacy concerns
  - None or limited tagging
- Generation of synthetic datasets
  - Traffic samples generated in a controlled way
  - Configurable mixes of synthetic and real traffic
- And metadata management
  - Different scenarios, from high loads to security threats
  - Training and validation loops
- Rely on the Data Infrastructure
  - Repeatability and reproducibility
  - Controlled variations



The *Mouseworld* – Synthetic Traffic and Beyond

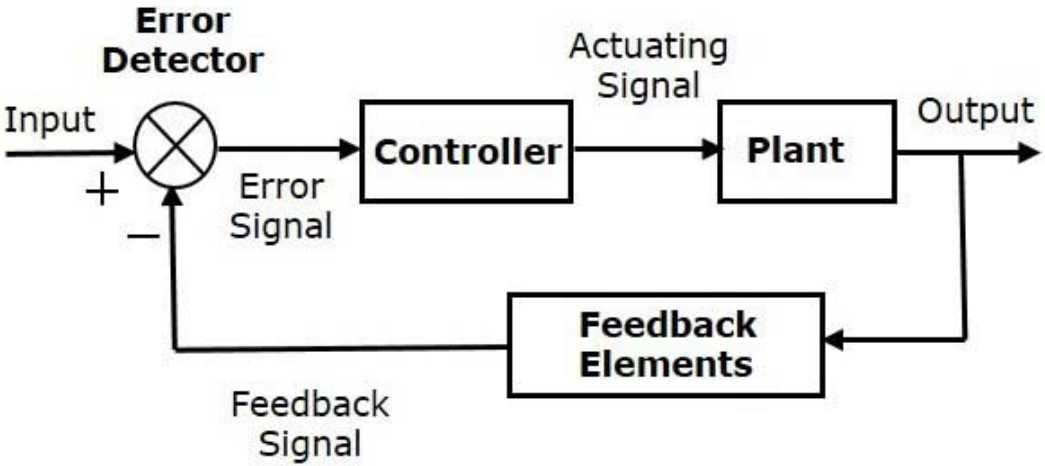
INSPIRE-5Gplus



- Traffic at all network segments
- Clients, servers, middleboxes and network functions of many natures
  - Plus raw traffic captures and other external sources
- Traffic analysis to produce (labelled) datasets
  - Flow aggregation and composition
- Train and validate
  - ML solutions, supervised and unsupervised
  - Data-driven modules (AI, Analytics…)
- Repeatable and controlled conditions and variants
  - SDN/NFV
  - Data infrastructure orchestration

Making the Autonomous Closed-Loop Feasible

- Signal flows in network architectures
  - Matching controllers to plants
- Beware the network differential facts
  - Topology (and geometry!) awareness
  - The conservation principle
  - Openness
  - Integrity and auditability
  - Isolation
- A few steps ahead
  - Metadata distribution
  - Aggregator orchestration
  - The application to the other kind of signals (an *Action Infrastructure*?)



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