Network Digital Twin and Agentic AI based Architecture for AI driven Network Operations

draft-wmz-nmrg-agent-ndt-arch-03

IETF 125 Meeting 03/16/2026

on behalf of Authors Team (Qin Wu,
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Agentic AI Evolution: Moving from Automation to Autonomy

AN Level Evolution pace

Level 3 (before 2024)

Machine-assisted network automation

Phrase 1 of Level 4 (2025 to 2027)

Closed loop of single-domain network autonomy enabled by agents

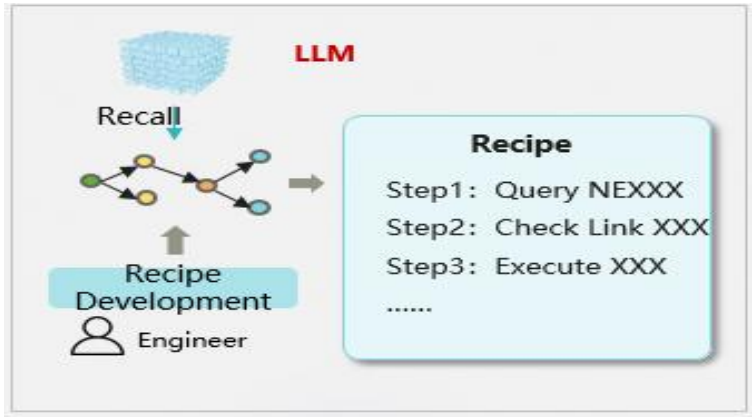
Phrase 2 of Level 4 (2028 to 2030)

Multiple agents collaborate with each other for E2E closed loop autonomy.

We are here

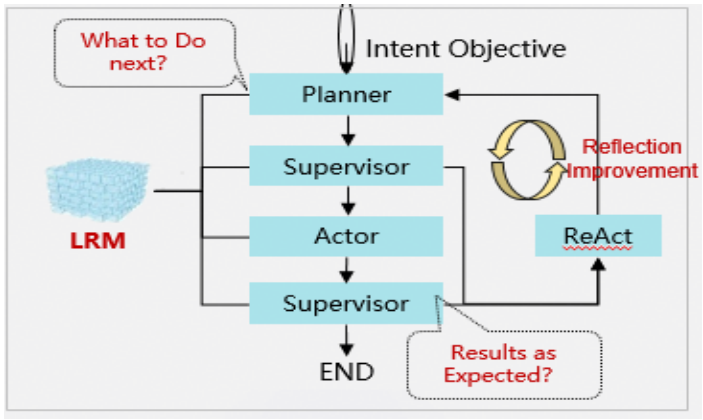
Agentic AI Evolution pace

Agent 1.0



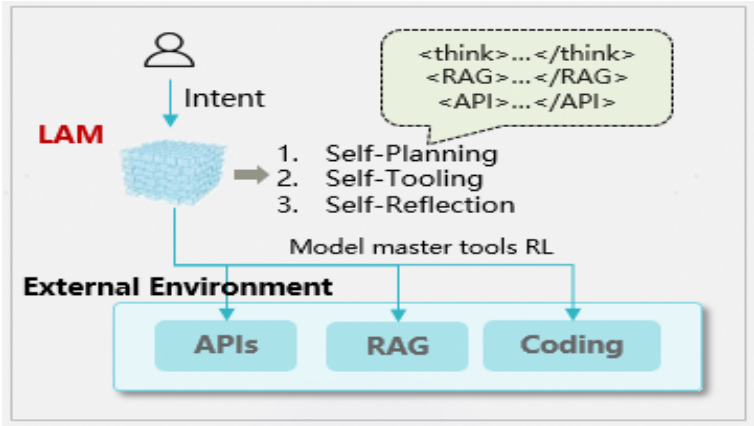
1.Support Recipe/API retrieval, & parameter filling
2.Supports document parsing and Q&A.

Agent 2.0



1. Support Planning+ReAct
2. Support functioncall+MCP， CodeAct

Agent 3.0



1.Self-planning/tooling/reflection
2.Train Agentic Model with Agentic Capabilities

Key Characteristics of Autonomous Agent

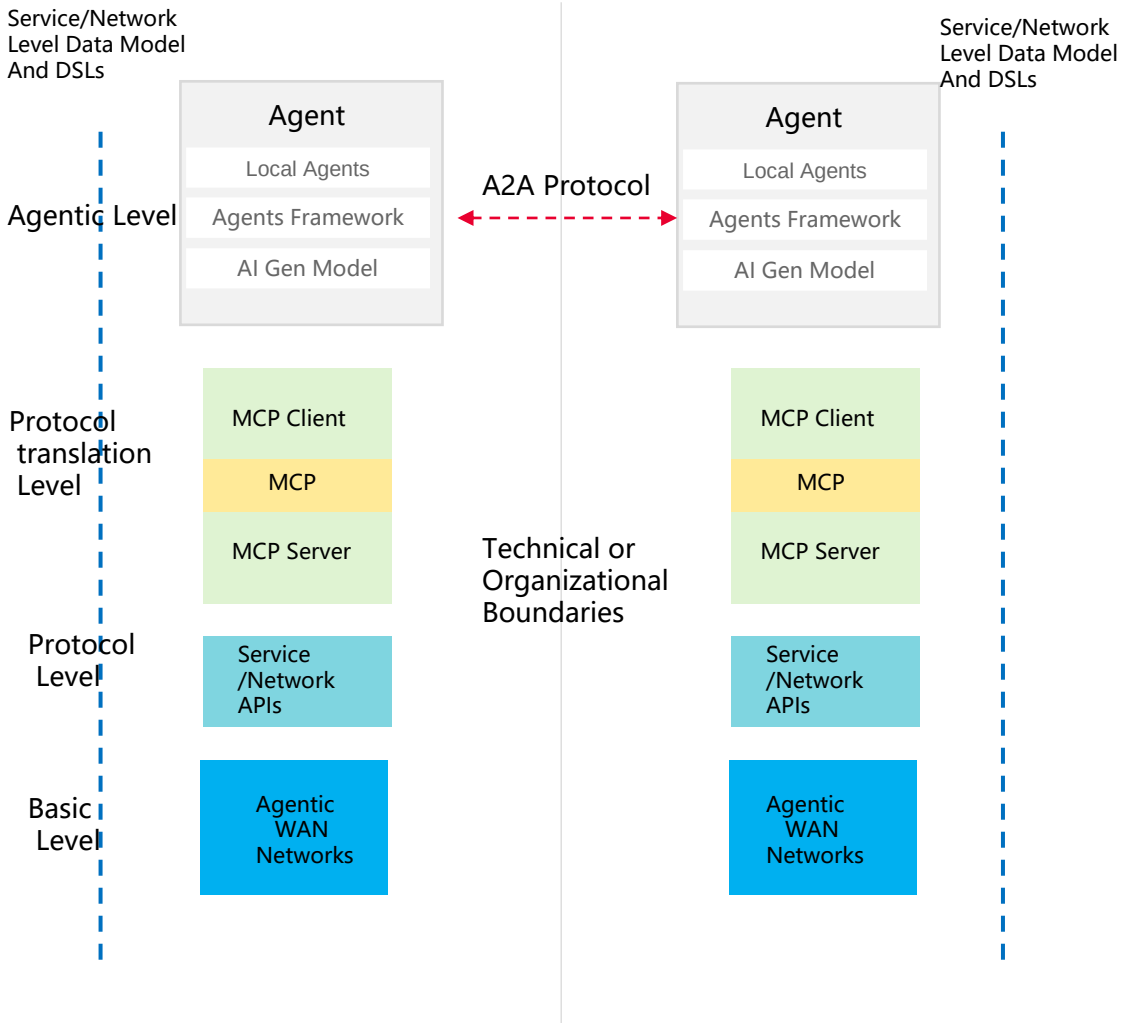
- Fixed Application Scenarios focusing on Network Management automation and Intelligence
  - 20 high value scenarios developed by TM Forum

- Logical framework of single domain autonomy and cross domain collaboration
  - Multi-task collaboration with proactive and reactive modes support
  - These task and operations involve some ambiguity and uncertainty

- Requires AN agents to communicate in a way that
  - Ensure the accuracy and efficiency of structured data for deterministic tasks
  - Support natural language interactions for understanding and handling uncertain or ambiguous tasks

- Compatibility with existing network protocols is essential for seamless integration and operation.

Key Challenges for Agentic AI for IP network Management



Challenge1: DSL for Agents and Models

- Lack Semantic & Contextual info for AI to reason about Intent
- Data Quality and Data Silo
- Significant shortage of professionals with the cross-disciplinary expertise

Challenge2: Trust and Security for Agents

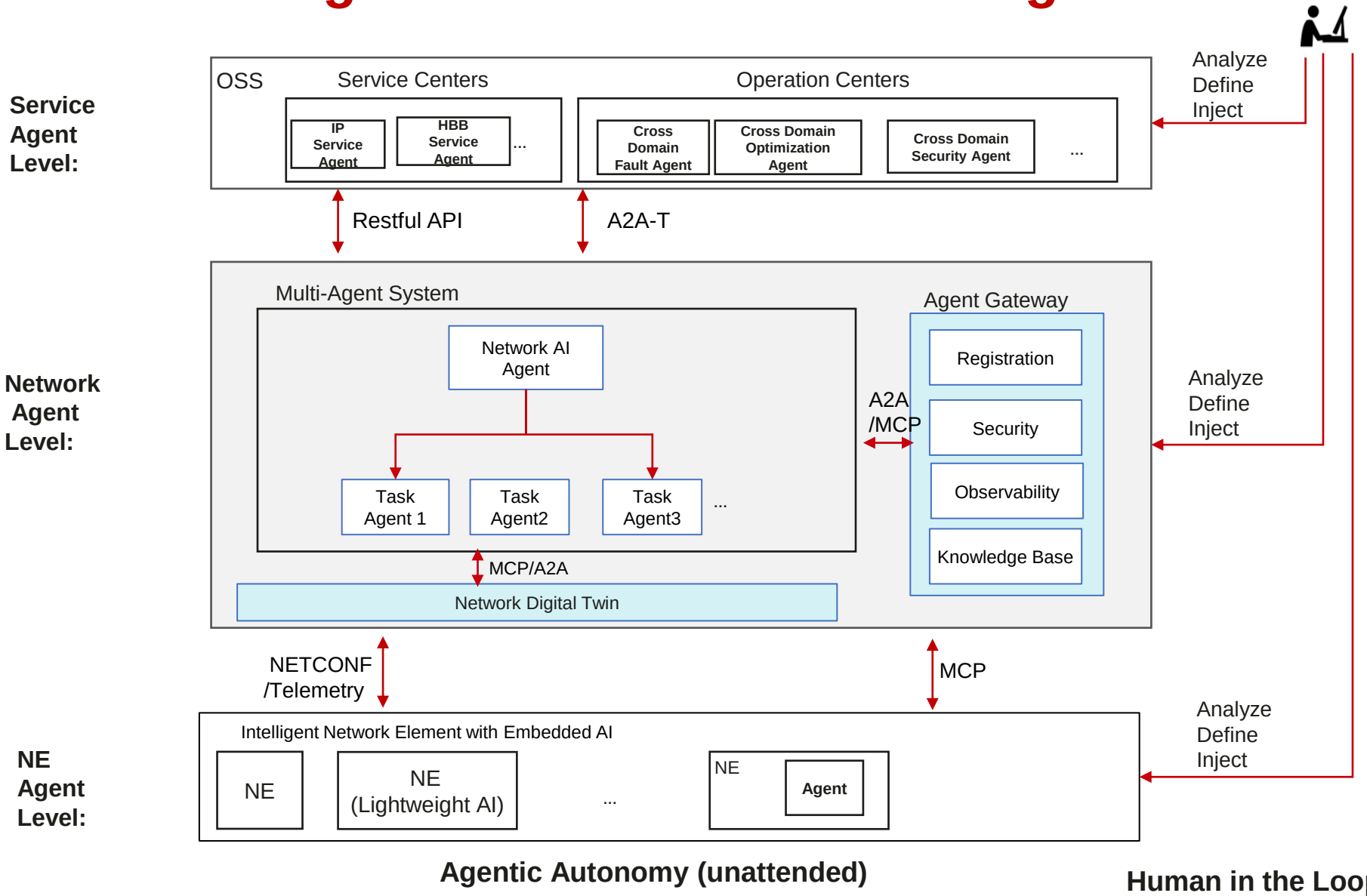
- OBO Human
  - Human Manipulation,Agent Delegation or authorization
- OBO Tools/APIs/LLMs
  - Misuse of Tools, Memory Poison,Resource overloading
- OBO other AI Agents
  - Repudiation & Untraceability,Agent Communication Poisoning,Insecure Inter-Agent Protocol Abuse

Challenge3 : Protocol among Agents/Tools/Models

- High Risk Operations
- The Collaboration Timeliness Requirements
- The Collaboration Reliability

Legend:
OBO: On behalf Of
DSL: Domain Specific Language

Agentic AI IP Network Management Architecture



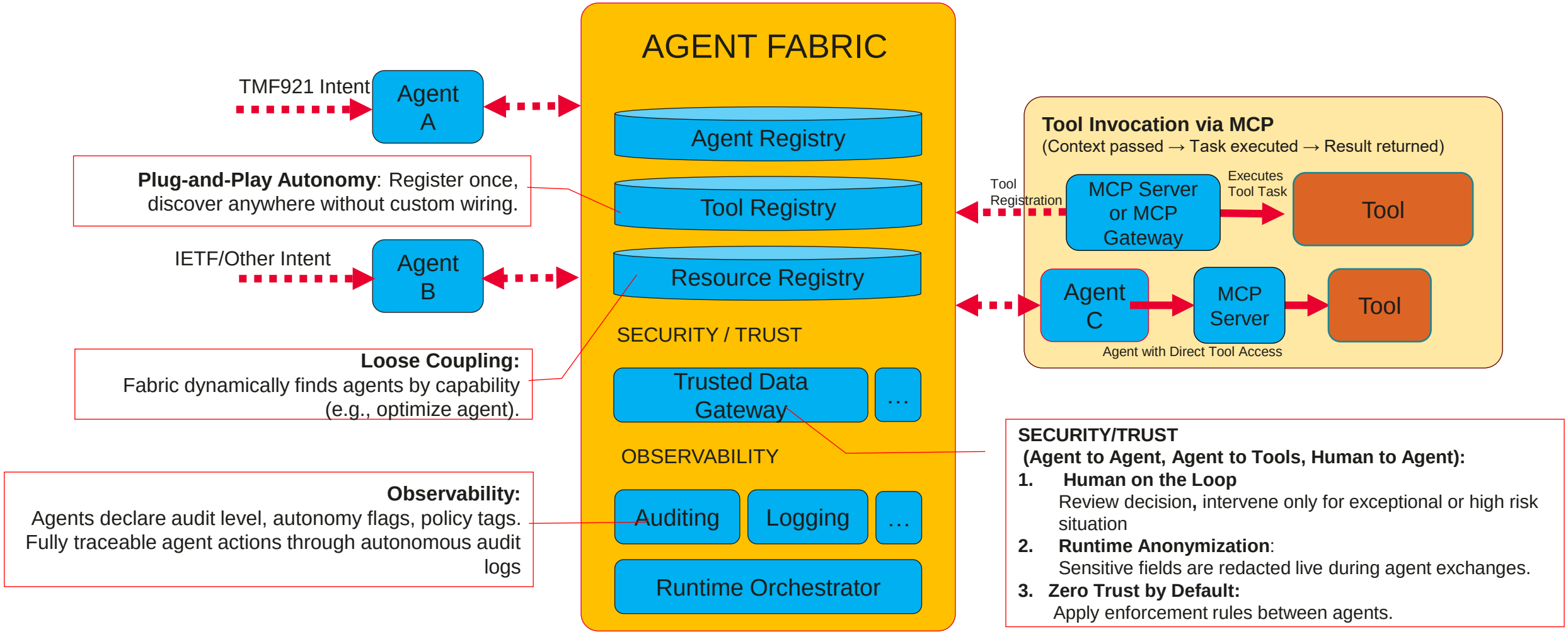
Architecture Evolution

- 3 Level Agentic Architecture
- Single Agent, Single Scenario=> Multi-Agent, Multi-Scenario Collaboration In the Autonomous Domain

Protocol Evolution

- Service AI Agent and Network AI Agent Interaction
  - Restulf API=>A2A-T
- Network AI Agent and NE AI Agent Interaction
  - NETCONF/Telemetry Coexist with MCP
- Human and Agent interaction through Agent Gateway
  - Human in the loop interface

Solution Overview



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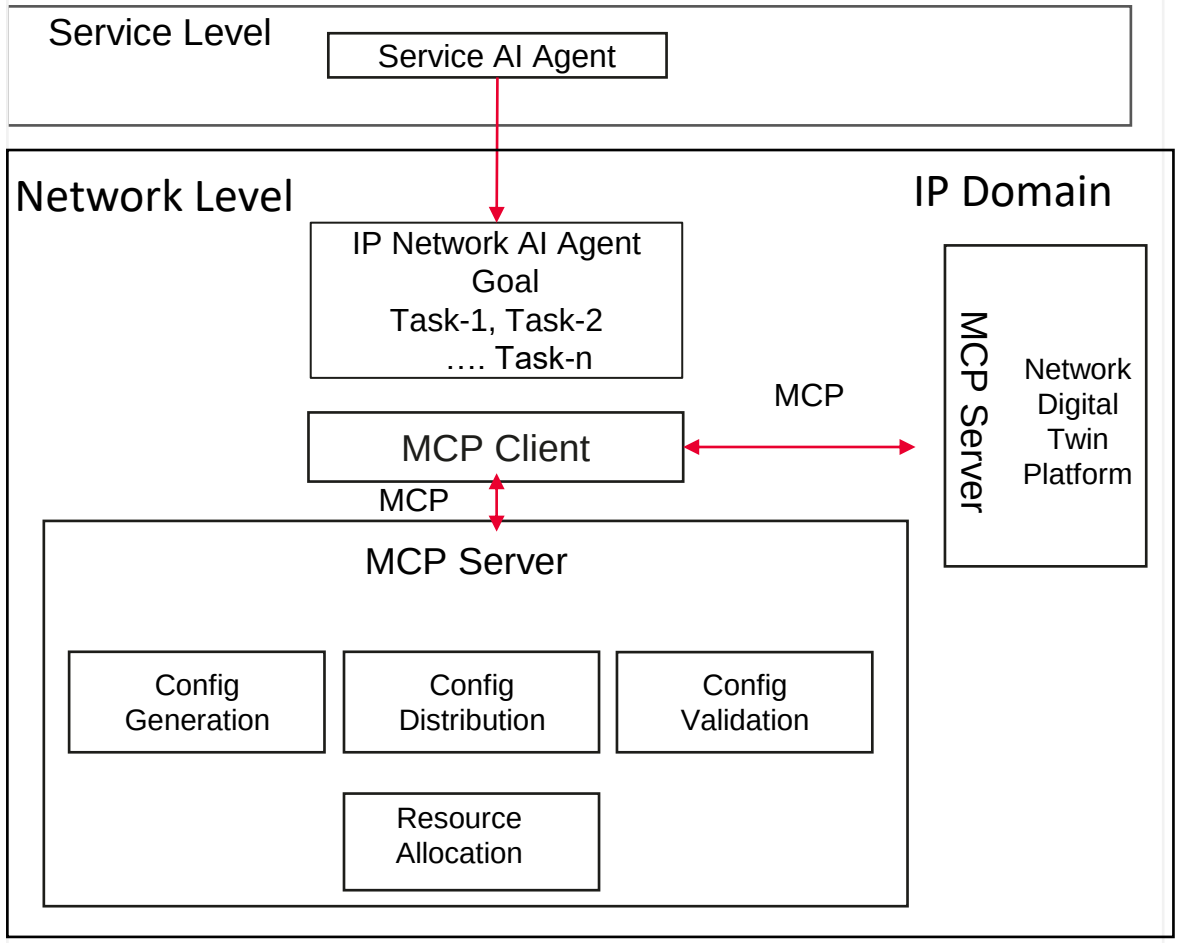
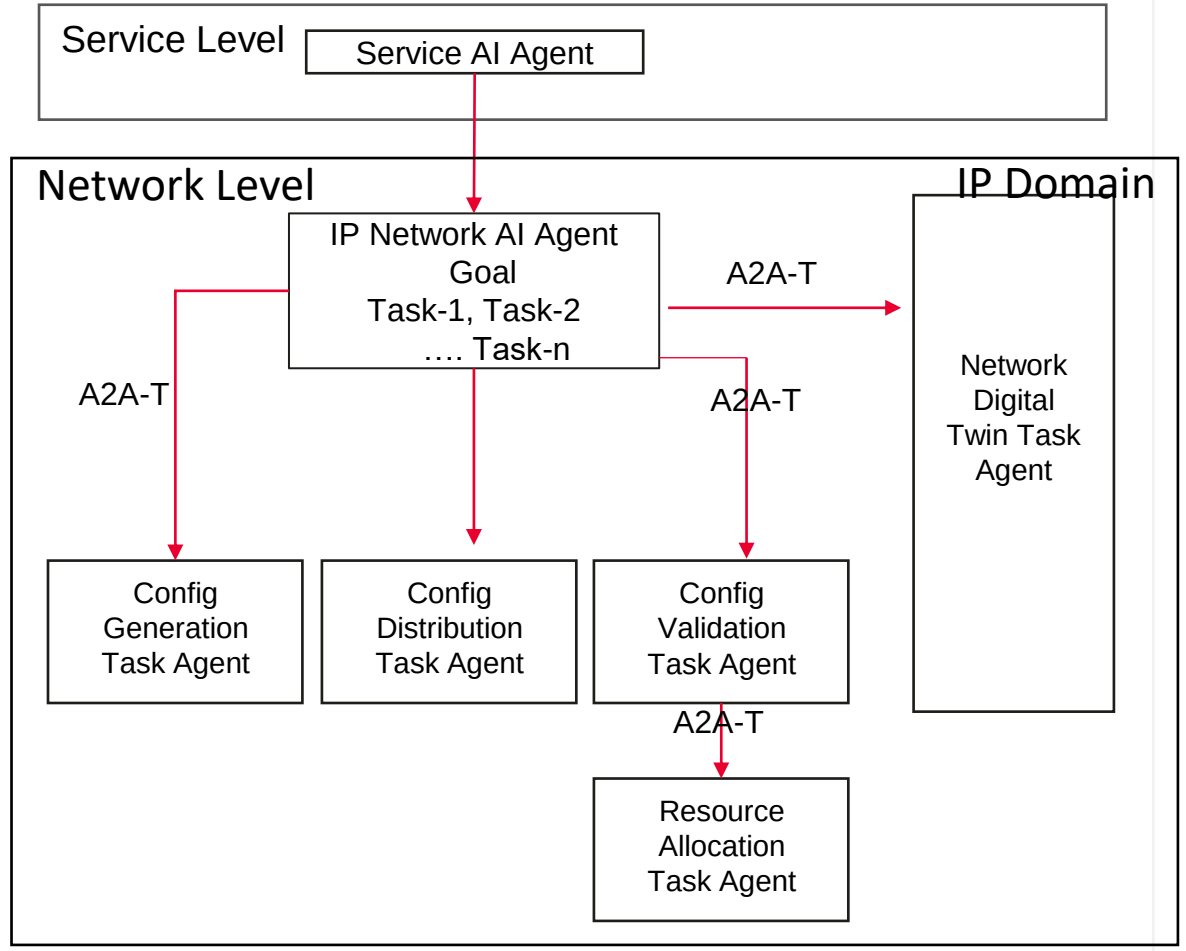
Domain Specific Autonomous with Network Management Agents

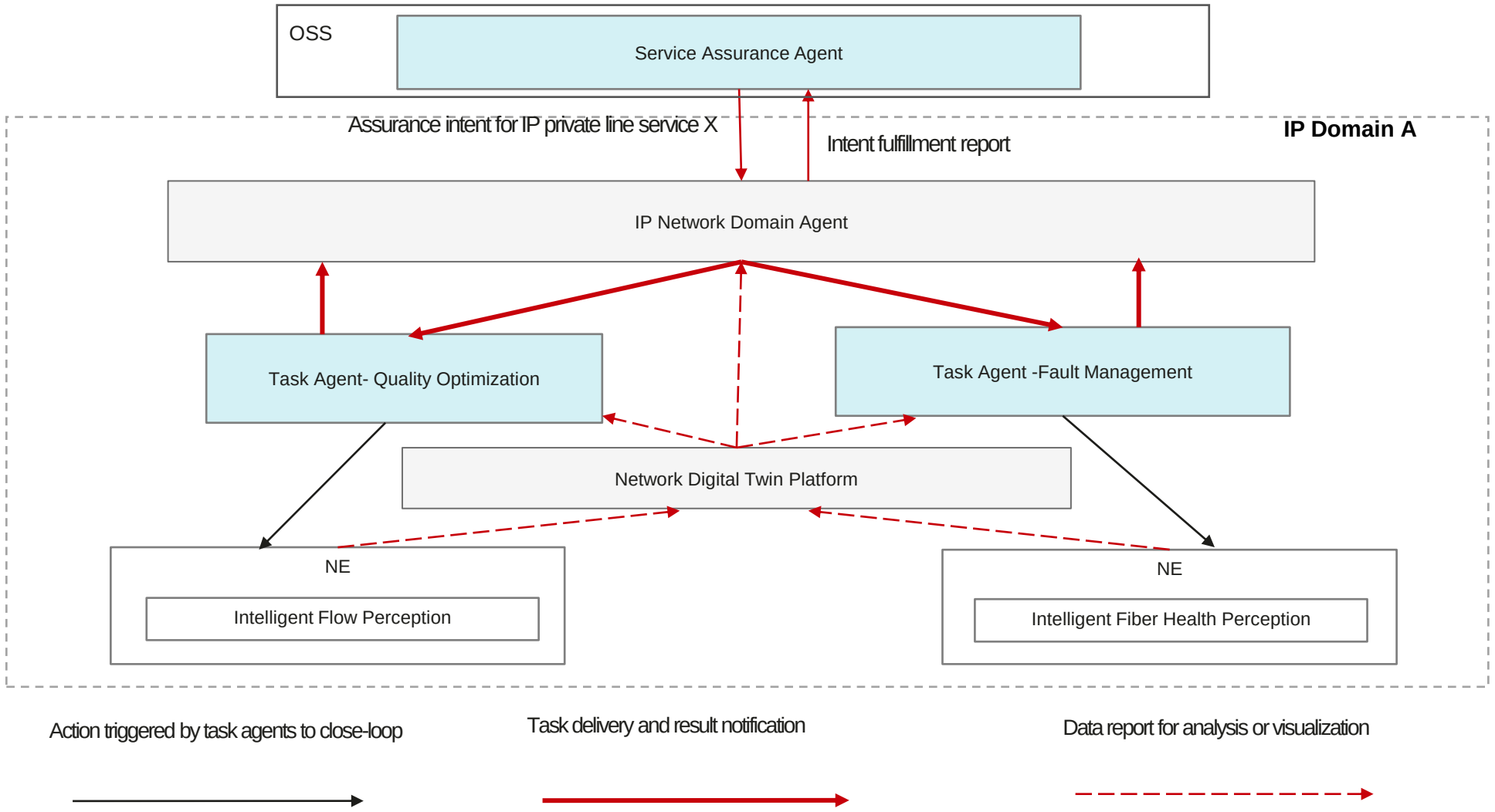
UC1:Single Agent integrated with multiple MCP Servers



UC2: Multi-Agent Collaboration



Multi- Scenario Autonomous with Multi-Agent Collaboration



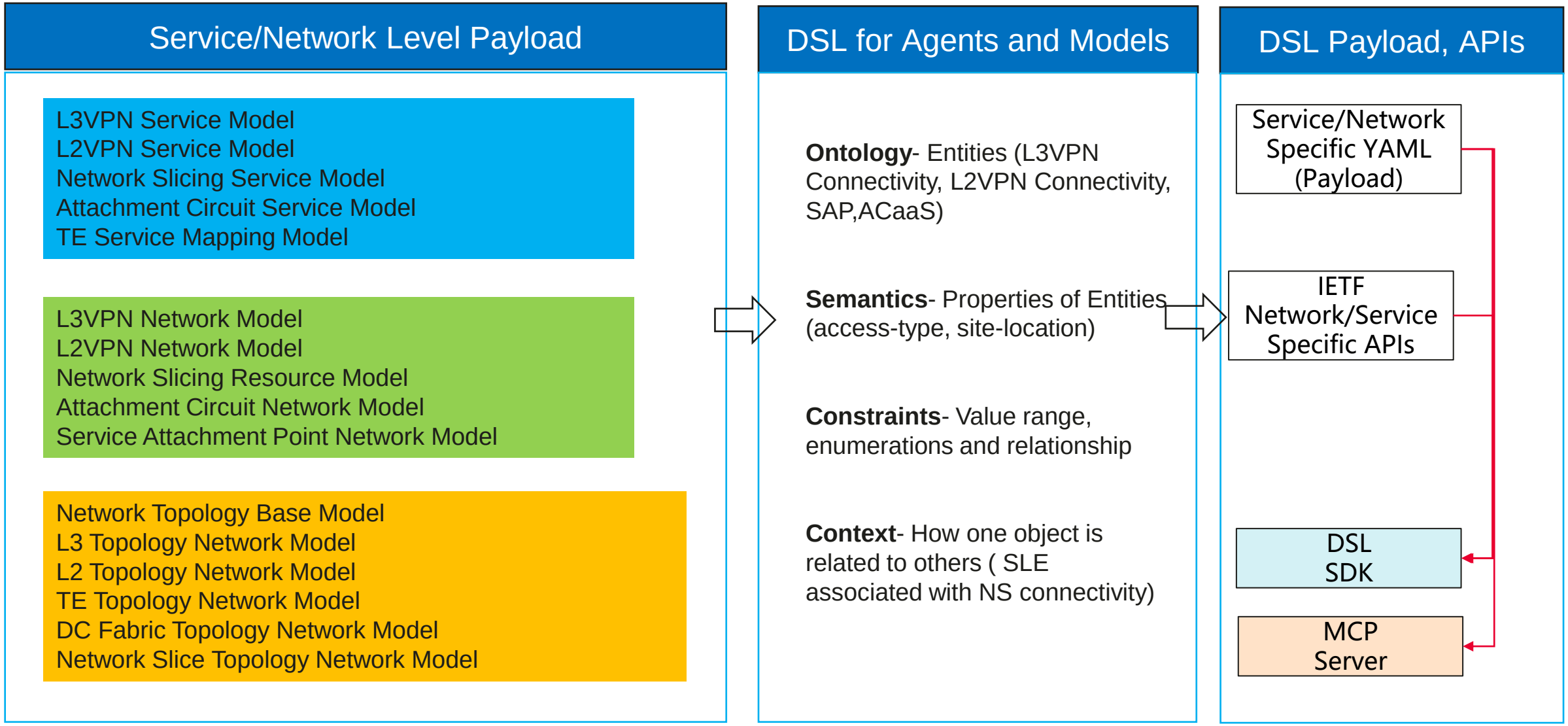
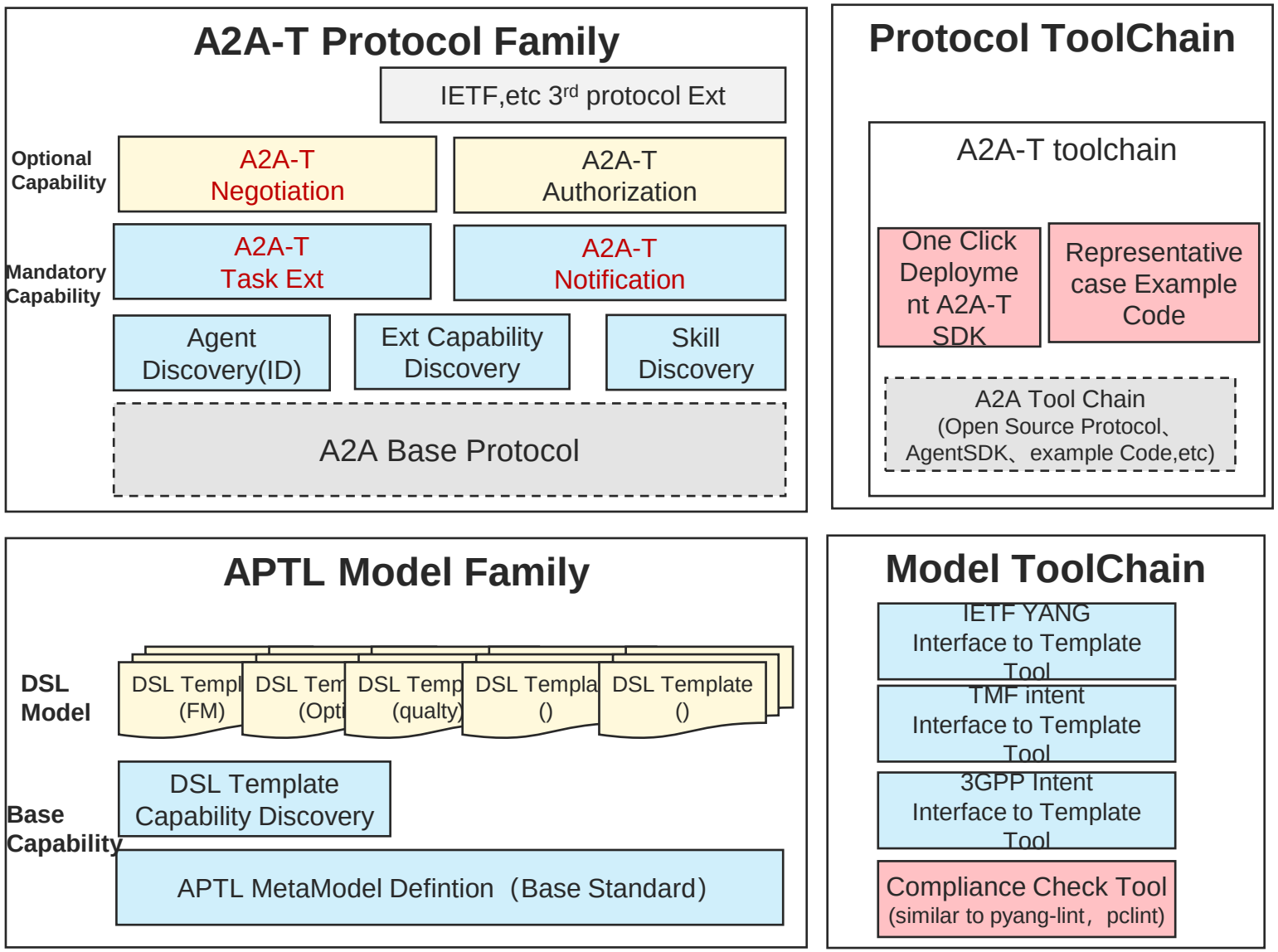
Next Steps

- Ask for RG adoption
  - Serve foundation for Agentic AI for Network Management Operation

- Agentic AI for IP network operation Side meeting Update
  - Meeting time: 16:30~18:00,Tuesday, March 17, 2026
  - Meeting Location: JiangSu

- Address issue tickets raised in the GitHub
  - https://github.com/QiufangMa/Agent-architecture/issues

Domain Specific Language for Agents and models



Domain Specific Language for Agents and models