Application of Message Fabrics to SRCE Systems

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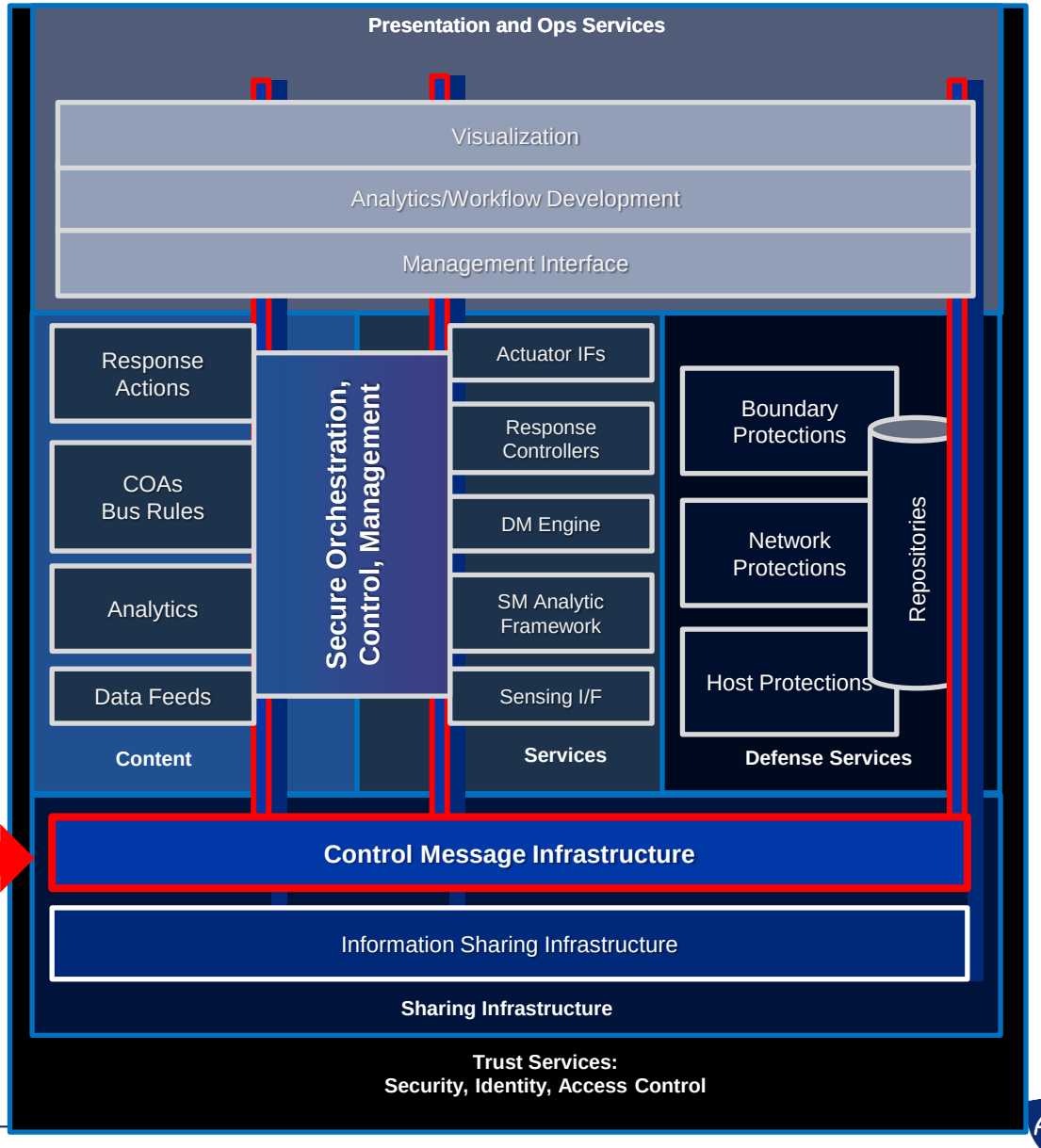
Message Fabrics in SRCE Context

- **Focus on the messaging within an enterprise in support of security operations automation and interoperability**
- **Enables secure, timely, and loosely coupled communication**

Context



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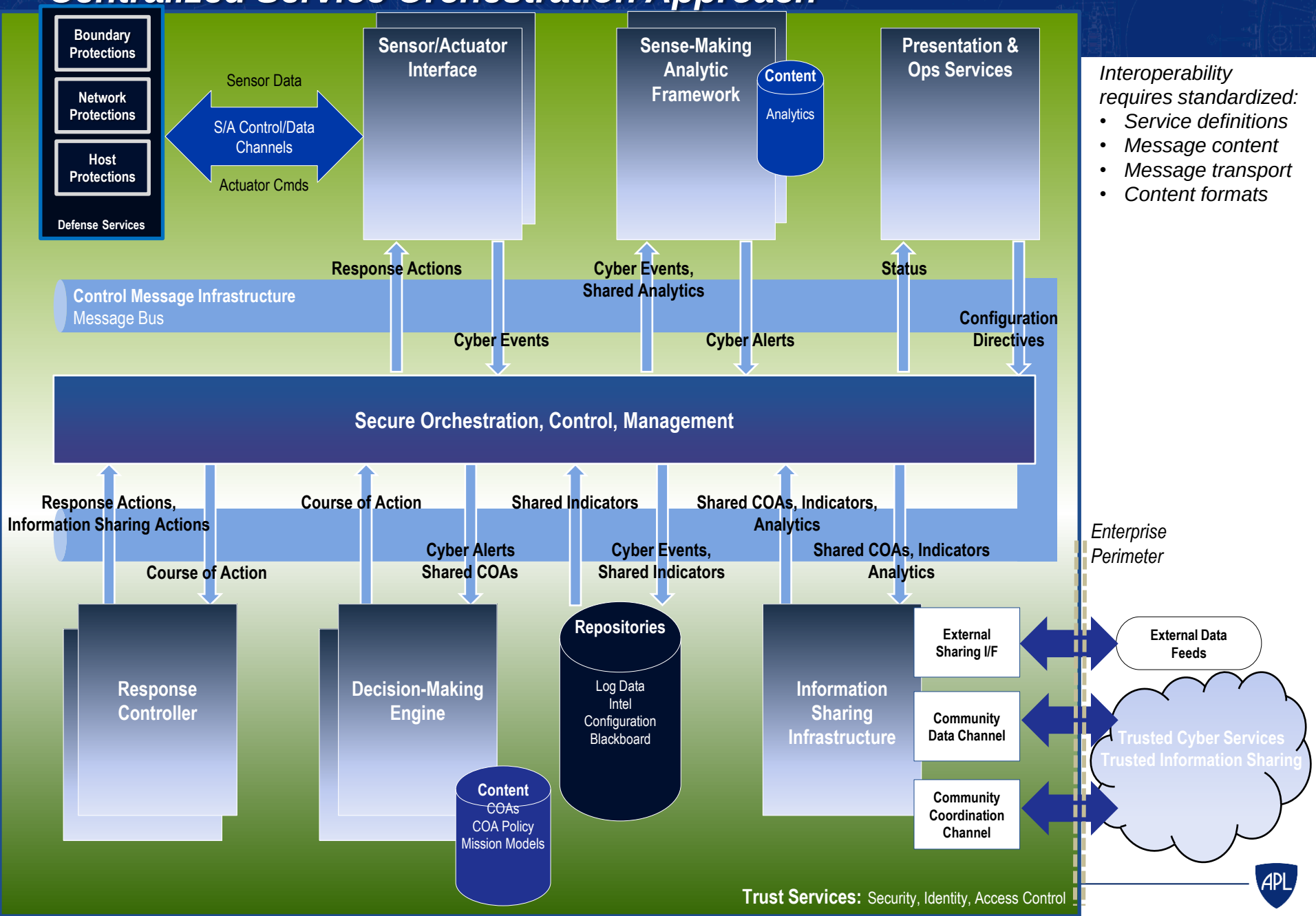
Challenges that Benefit from Message Fabric

- Enterprises will deploy components developed by vendors that may not have performed pairwise integration
- Vendor component capabilities will evolve independently over time
- Enterprises have diverse deployment topology and distribution requirements
- Sensor activity will occur at variable rates, with peaks, lulls

Implied SRCE Design Requirements

- **Distributed, asynchronous message processing**
  - **Permits faster message producers to proceed without waiting for slower consumers**
  - **Allows message consumers to catch-up during the lulls**
- **Minimal coupling between message producers and consumers**
  - **Rely only on common data representations and message bus interface**
  - **Facilitate integration of components from independent vendors**
- **Backward compatibility of message formats**
  - **Eliminate need for coordinated upgrades across components**

Message Fabric
Centralized Service Orchestration Approach



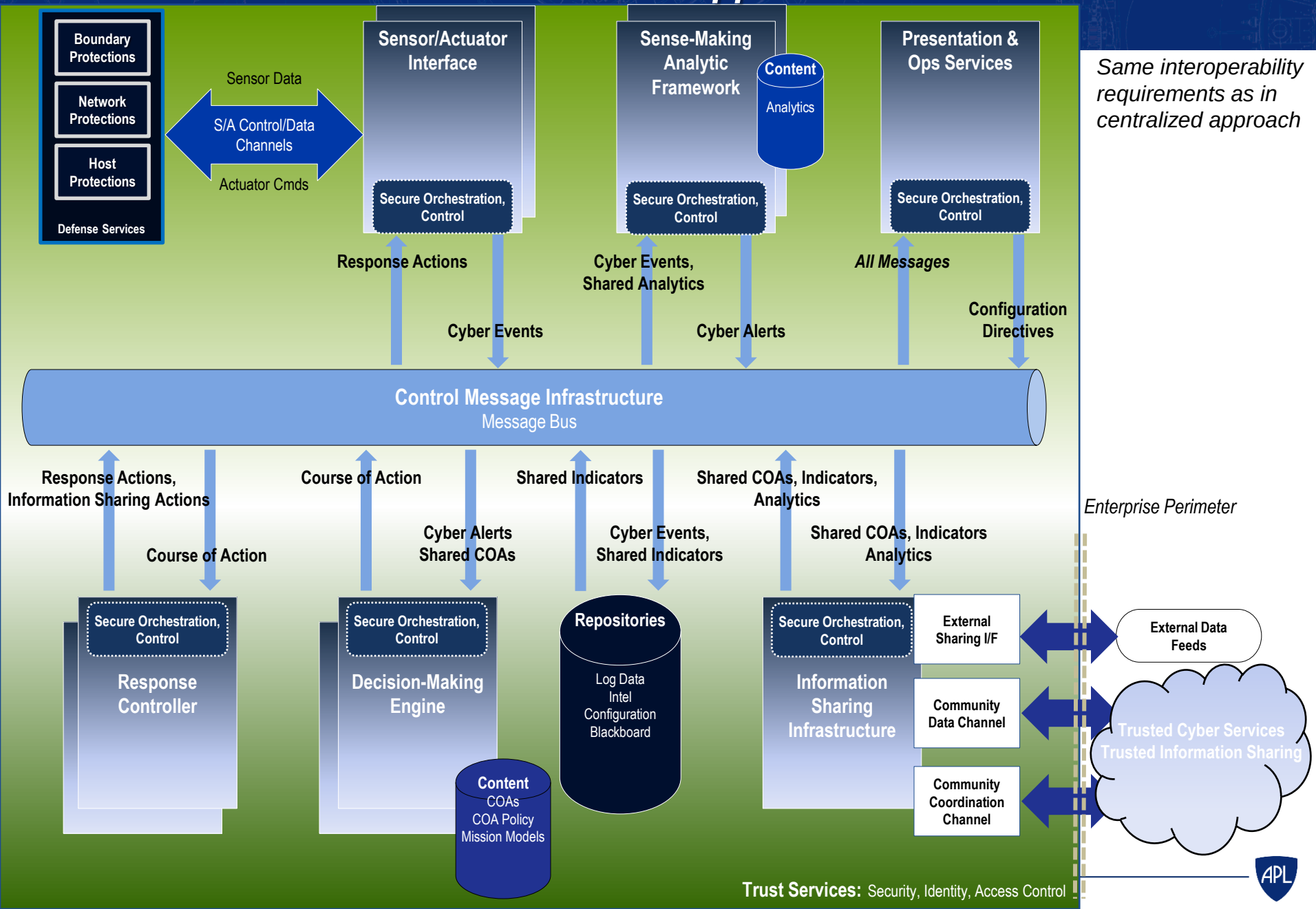
Interoperability requires standardized:

- *Service definitions*
- *Message content*
- *Message transport*
- *Content formats*

Enterprise Perimeter

APL

Message Fabric
Decentralized Service Orchestration Approach



Same interoperability requirements as in centralized approach

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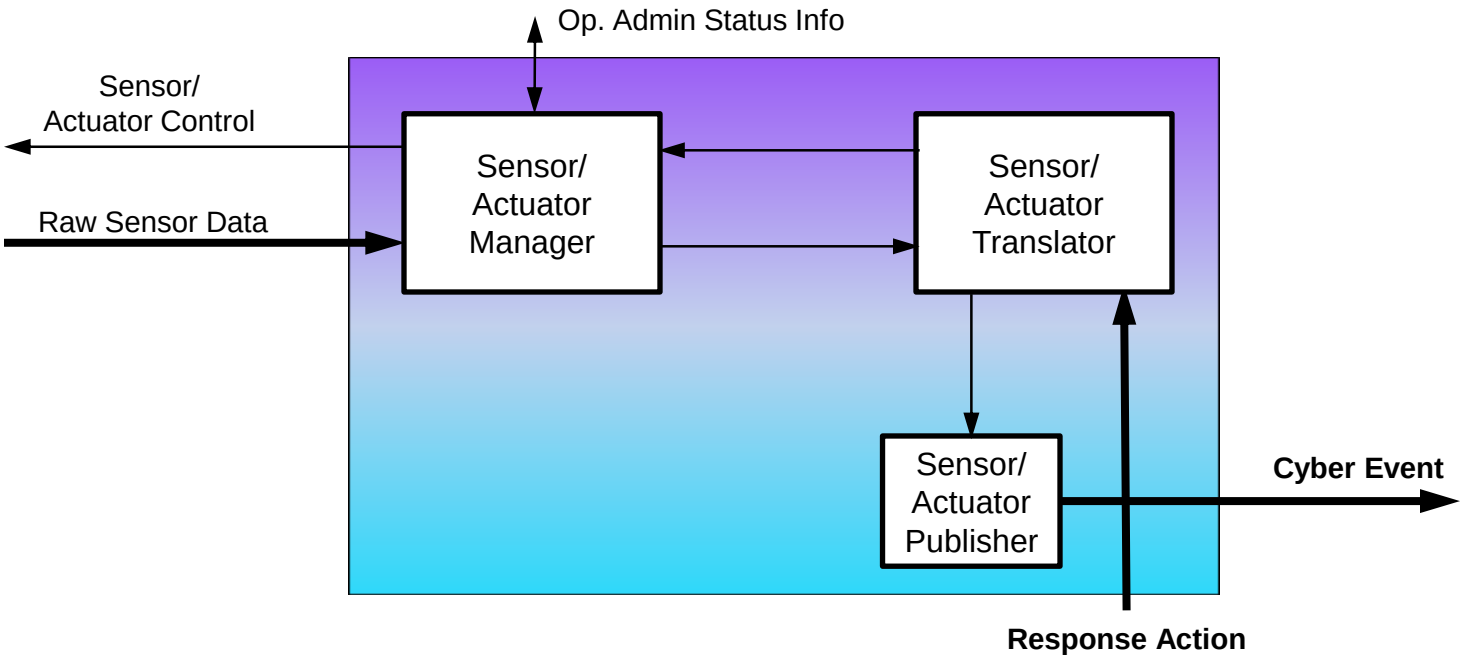
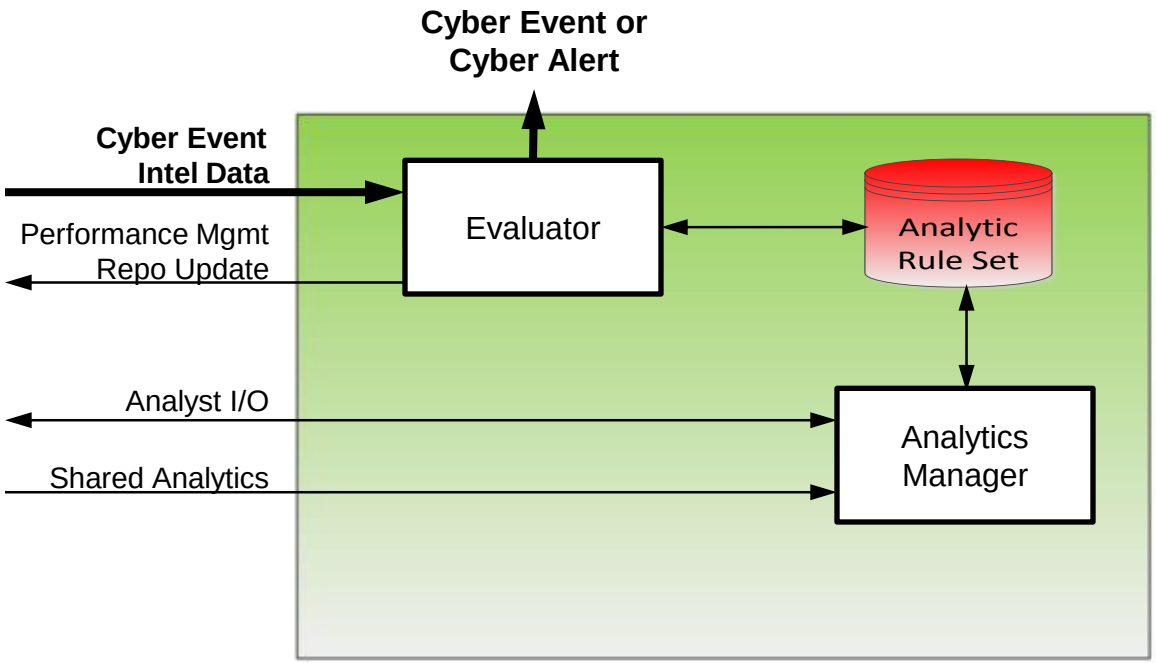
Message Content
Sensor Actuator Interface

Sensors and actuators have translators and managers that bridge the proprietary interfaces (*Raw Sensor Data*) to the standard Control Message Infrastructure format (***Cyber Events***)



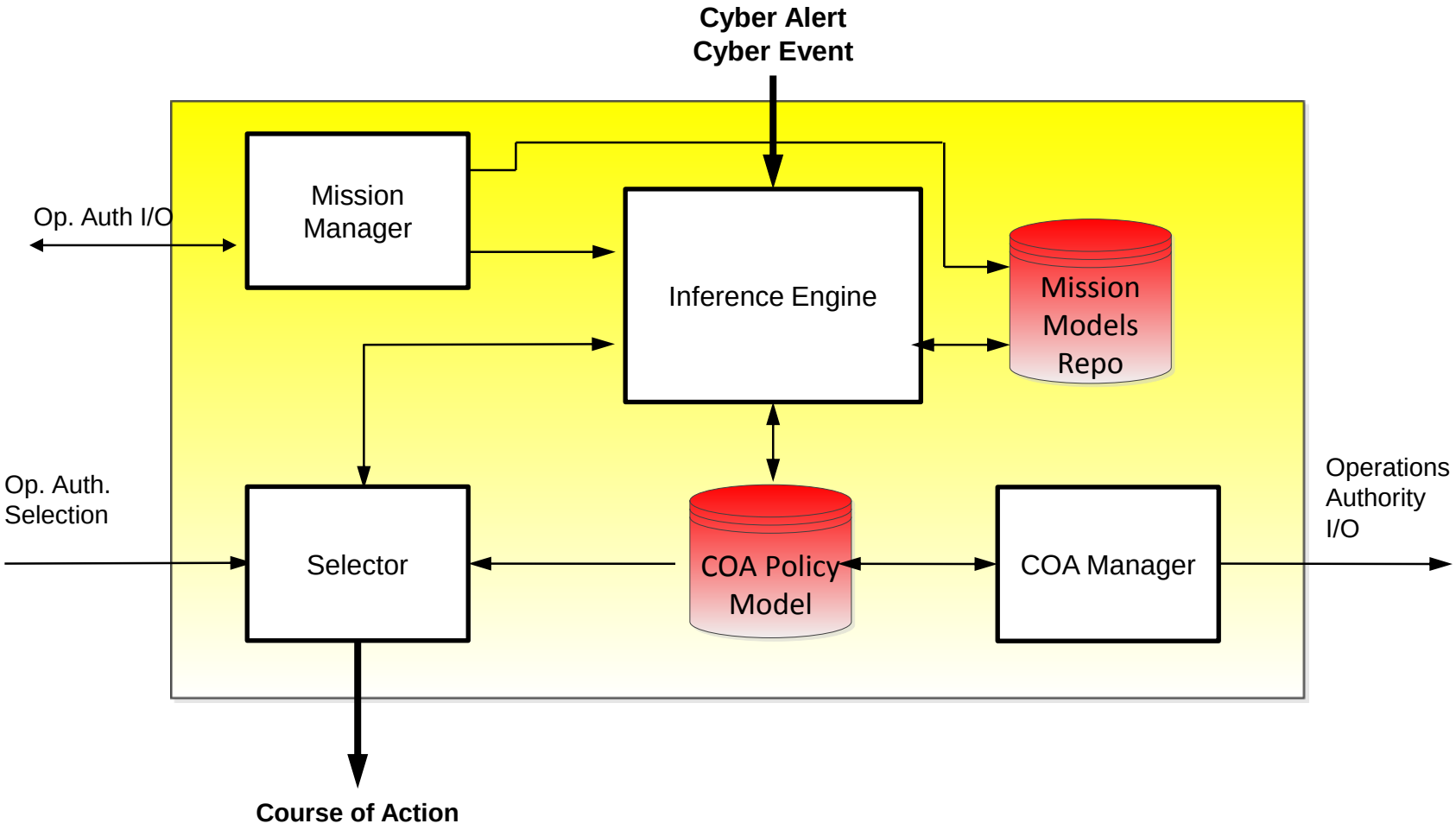
Message Content
Sense Making Analytic Framework

Evaluators use analytics to assess ***Cyber Events*** against ***Intel Data***, determine if a ***Cyber Alert*** should be generated or if the ***Cyber Event*** requires further analysis



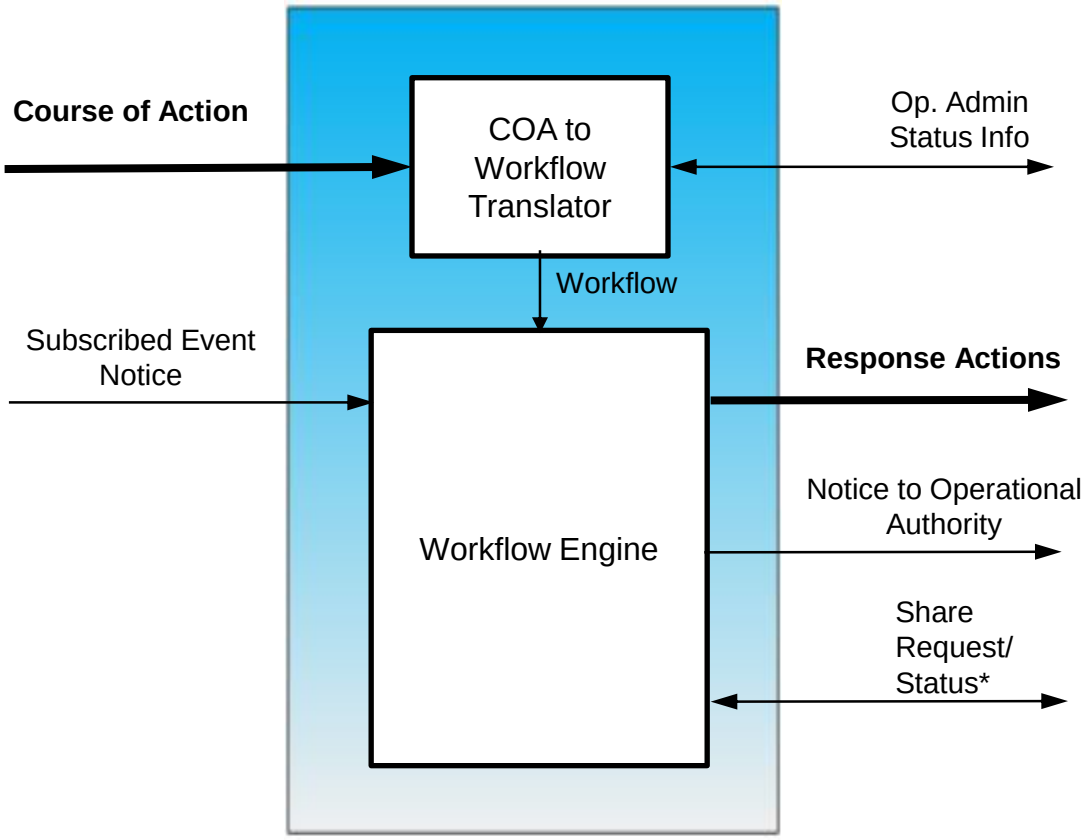
Message Content
Decision-Making Engine

Given a ***Cyber Alert*** or ***Cyber Event***, DM-Engine determines a course of action (***COA***) to minimize risk while considering mission impact of the alternative COAs



Message Content
Response Action Controller

Selected COAs ***(Couse of Action*)**, with parameters for targets and other options, converted to specific ***Workflow***s containing ***Sensor/Actuator Control Info*** for execution



* Incoming status includes Tip/Event/COA sharing notice

Messaging Attacks and SRCE

Attack Vectors	Example SRCE Outcome	Mitigation May Include
Message Replay	CoA enabled when not authorized, potentially causing network disruption	Signed messages with timestamp
Malformed Data (e.g. buffer overflow)	Response Controller could be affected by malformed data, allowing attacker undetected high privilege access	Whitelisting signed recipients, strong type/field checks
Man-in-the-Middle	A malicious party may intercept sensor data and replace it with recorded sensor output that appears normal, while actual abnormal sensor data is inaccessible to SRCE	Mutual authentication
Message flooding	Critical third party services may be rendered inaccessible if malicious party directs high bandwidth resources appropriately	Upstream high-speed dynamic filtering, use of efficient signing mechanisms (e.g., HMAC)
Spoofing	Malicious party receives sensitive analytics that can be used to develop stealth tactics	Use of strong key management or strong CA capabilities
Passive Eavesdropping	Indicators and COAs for a particular attack are learned by an adversary leading to changes in the attack vector to bypass the described mitigations	Use of strong confidentiality mechanisms

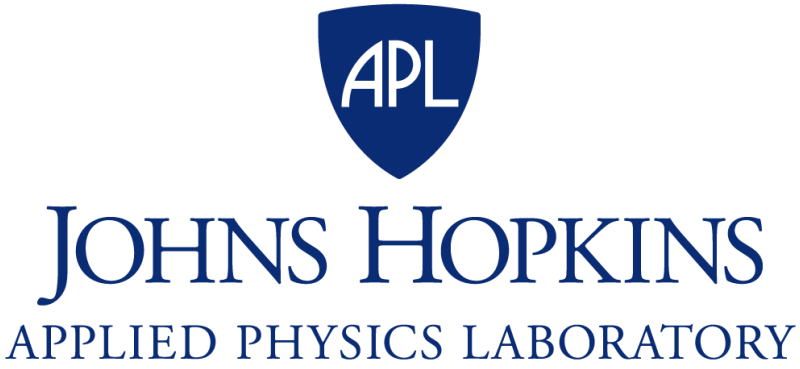
Potentially Relevant Standards Efforts

- **Message Transport**
  - Advanced Message Queueing Protocol (AMQP) from OASIS
  - Data Distribution Services (DDS) from Object Management Group
- **Message Content**
  - Common Event Format (CEF) from HP ArcSight
  - Incident Object Description Exchange Format (IODEF) from MILE
  - Reporting Formats in Security Content Automation Protocol (SCAP) from NIST
  - Open C2 from Open C2 Working Group
- **Security**
  - DDS Security v1.0 Beta 1
- **IETF Working Groups**
  - Security Automation and Continuous Monitoring (SACM)
  - Managed Incident Lightweight Exchange (MILE)
  - DDoS Open Threat Signaling (DOTS)

Summary

- **Interoperability requires standardized:**
  - **Service definitions**
  - **Message content**
  - **Message transport**
  - **Content formats**
- **Connects the core services supporting Sensing, Sense Making, Decision Making, and Acting**
- **Can support centralized, decentralized, or hybrid orchestration models**

Specifications are to be determined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