INCOSE MBSE Patterns Working Group

Some Additional Model-Based Interface Patterns of Interest

Interface Patterns Project Meeting

May 24, 2018

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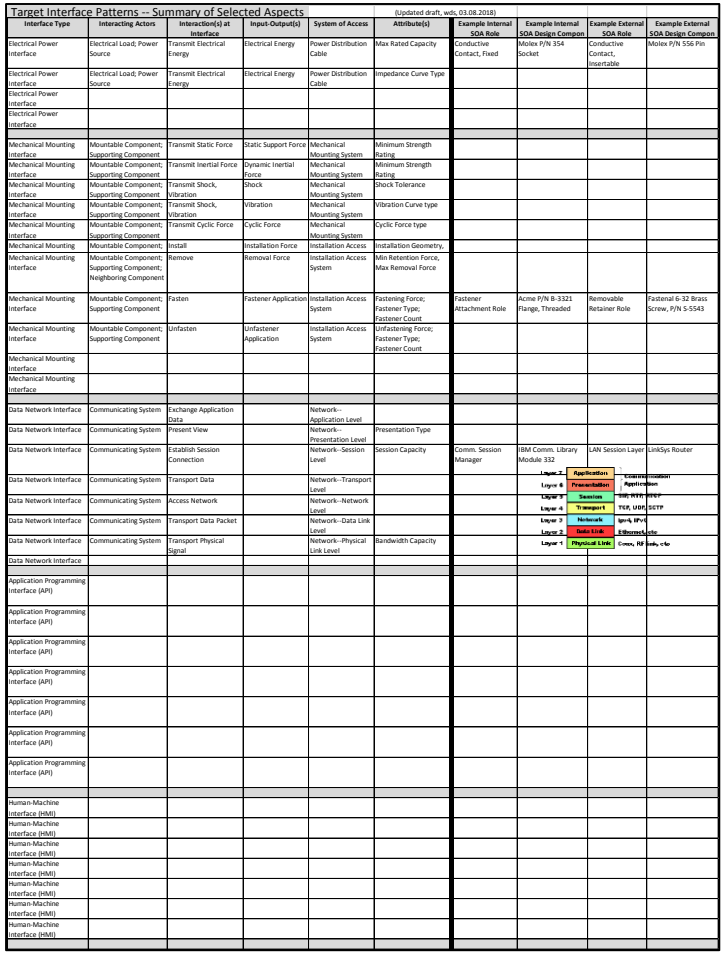
Interface Pattern Types of Interest—to date

- Several have already been identified and pursued in part in this project:
  - Electrical Power Interface
  - Mechanical Mounting Interface
  - Data Network Interface
  - Application Programming Interface (API)
  - Human-Machine Interface (HMI)



Target Interface Patterns -- Summary of Selected Aspects (Updated draft, wds, 03.08.2018)

Interface Type	Interacting Actors	Interaction(s) at Interface	Input-Output(s)	System of Access	Attribute(s)	Example Internal SOA Role	Example Internal SOA Design Compon	Example External SOA Role	Example External SOA Design Compon
Electrical Power Interface	Electrical Load; Power Source	Transmit Electrical Energy	Electrical Energy	Power Distribution Cable	Max Rated Capacity	Conductive Contact, Fixed	Molex P/N 354 Socket	Conductive Contact, Insertable	Molex P/N 556 Pin
Electrical Power Interface	Electrical Load; Power Source	Transmit Electrical Energy	Electrical Energy	Power Distribution Cable	Impedance Curve Type				
Electrical Power Interface									
Electrical Power Interface									
Mechanical Mounting Interface	Mountable Component; Supporting Component	Transmit Static Force	Static Support Force	Mechanical Mounting System	Minimum Strength Rating				
Mechanical Mounting Interface	Mountable Component; Supporting Component	Transmit Inertial Force	Dynamic Inertial Force	Mechanical Mounting System	Minimum Strength Rating				
Mechanical Mounting Interface	Mountable Component; Supporting Component	Transmit Shock, Vibration	Shock	Mechanical Mounting System	Shock Tolerance				
Mechanical Mounting Interface	Mountable Component; Supporting Component	Transmit Shock, Vibration	Vibration	Mechanical Mounting System	Vibration Curve type				
Mechanical Mounting Interface	Mountable Component; Supporting Component	Transmit Cyclic Force	Cyclic Force	Mechanical Mounting System	Cyclic Force type				
Mechanical Mounting	Mountable Component;	Install	Installation Force	Installation Access	Installation Geometry,				
Mechanical Mounting Interface	Mountable Component; Supporting Component; Neighboring Component	Remove	Removal Force	Installation Access System	Min Retention Force, Max Removal Force				
Mechanical Mounting Interface	Mountable Component; Supporting Component	Fasten	Fastener Application	Installation Access System	Fastening Force; Fastener Type; Fastener Count	Fastener Attachment Role	Acme P/N B-3321 Flange, Threaded	Removable Retainer Role	Fastenal 6-32 Brass Screw, P/N S-5543
Mechanical Mounting Interface	Mountable Component; Supporting Component	Unfasten	Unfastener Application	Installation Access System	Unfastening Force; Fastener Type; Fastener Count				
Mechanical Mounting Interface									
Mechanical Mounting Interface									
Data Network Interface	Communicating System	Exchange Application Data		Network--Application Level					
Data Network Interface	Communicating System	Present View		Network--Presentation Level	Presentation Type				
Data Network Interface	Communicating System	Establish Session Connection		Network--Session Level	Session Capacity	Comm. Session Manager	IBM Comm. Library Module 332	LAN Session Layer	LinkSys Router
Data Network Interface	Communicating System	Transport Data		Network--Transport Level			Layer 7 Application; Layer 6 Presentation; Layer 5 Session		Layer 7 Application; Layer 6 Presentation
Data Network Interface	Communicating System	Access Network		Network--Network Level			Layer 4 Transport		TCP, UDP, SCTP
Data Network Interface	Communicating System	Transport Data Packet		Network--Data Link Level			Layer 3 Network		Ipv4, IPv6
Data Network Interface	Communicating System	Transport Physical Signal		Network--Physical Link Level	Bandwidth Capacity		Layer 2 Data Link; Layer 1 Physical Link		Ethernet, etc.
Data Network Interface									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Human-Machine Interface (HMI)									
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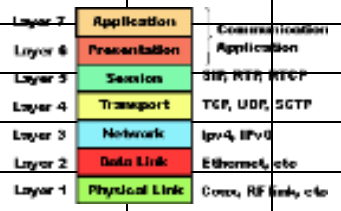
Data Network Interface	Communicating System	Transport Data		Network--Transport Level					
Data Network Interface	Communicating System	Access Network		Network--Network Level					
Data Network Interface	Communicating System	Transport Data Packet		Network--Data Link Level					
Data Network Interface	Communicating System	Transport Physical Signal		Network--Physical Link Level	Bandwidth Capacity				
Data Network Interface									
Application Programming									



Target Interface Patterns -- Summary of Selected Aspects

(Updated draft, wds, 03.08.2018)

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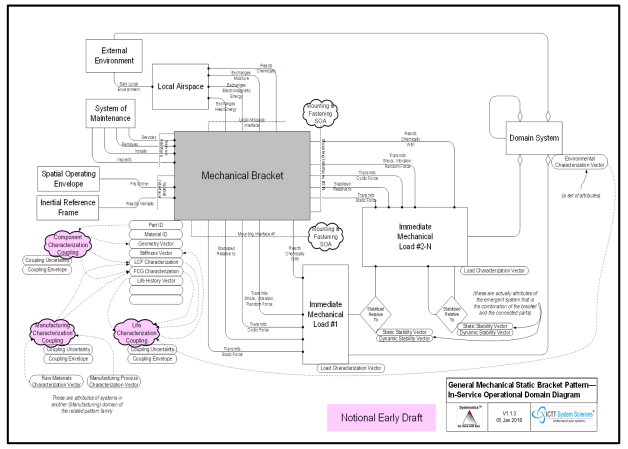
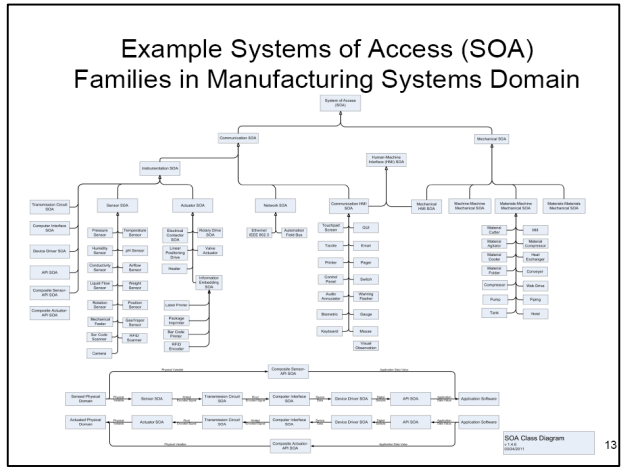
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Application Programming Interface (API)									
Human-Machine Interface (HMI)									
Human-Machine Interface (HMI)									
Human-Machine Interface (HMI)									
Human-Machine Interface (HMI)									
Human-Machine Interface (HMI)									
Human-Machine Interface (HMI)									
Human-Machine Interface (HMI)									

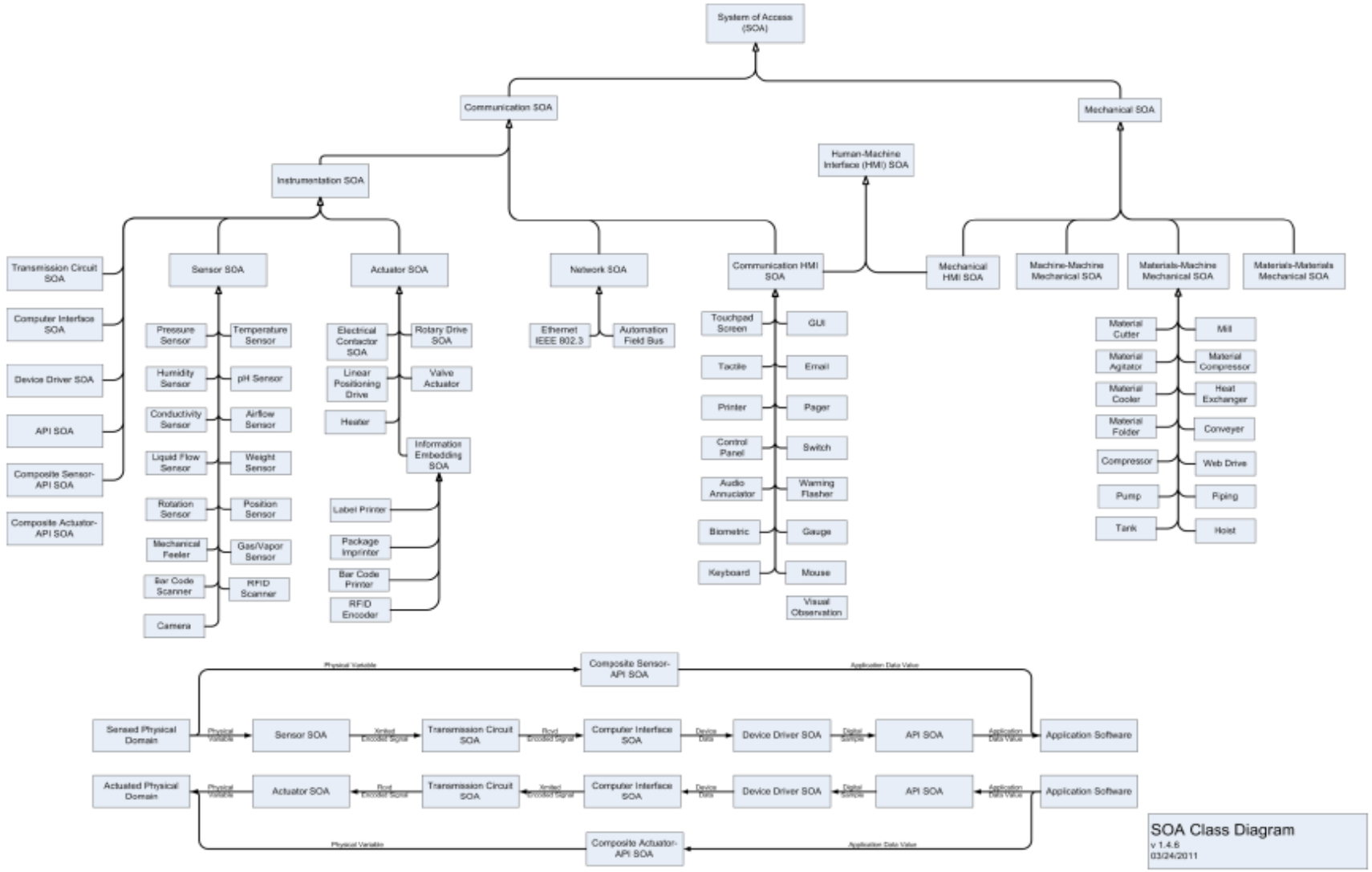
Interface Pattern Types of Interest--additional

- Additional types or cases of interest:
  - Especially for Model Uncertainty Quantification (VVUQ) use, including multiple SOA attributes and couplings:
    - Sensor (including multiple interfaces, device(s), transmission media)
    - Actuator (including multiple interfaces, device(s), transmission media)
    - Milling Interface
    - Additive Fusion Interface
    - Pharmaceutical Injection Interface
    - Blood Collection Interface
    - Implanted Medical Device Interface(s)
  - Especially for certification use:
    - Mechanical Bracket (extension of Mech Mtg Intfc, multi-level SOAs)
  - Especially for General Manufacturing System Pattern use:
    - Materials-Machine Interface family
    - Instrumentation Interface family





Example Systems of Access (SOA) Families in Manufacturing Systems Domain



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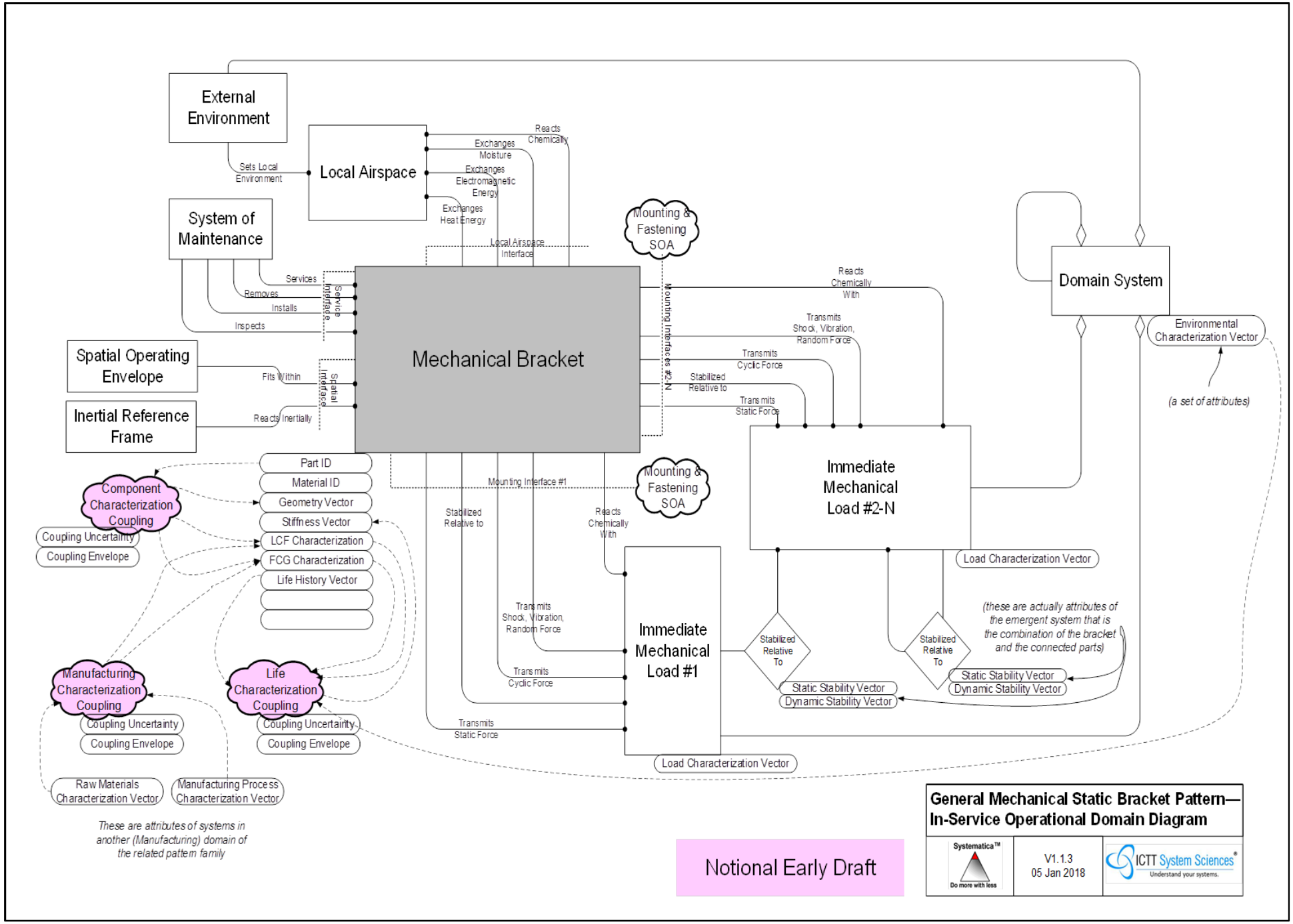
External Environment
Sets Local Environment
Local Airspace
Reacts Chemically
Exchanges Moisture
Exchanges Electromagnetic Energy
Exchanges Heat Energy
Local Airspace Interface
System of Maintenance
Services
Removes
Installs
Inspects
Service Interface
Spatial Operating Envelope
Fits Within
Spatial Interface
Inertial Reference Frame
Reacts Inertially
Mechanical Bracket
Mounting & Fastening SOA
Mounting Interfaces #2-N
Reacts Chemically With
Transmits Shock, Vibration, Random Force
Transmits Cyclic Force
Stabilized Relative to
Transmits Static Force
Domain System
Environmental Characterization Vector
(a set of attributes)
Immediate Mechanical Load #2-N
Load Characterization Vector
Part ID
Material ID
Geometry Vector
Stiffness Vector
LCF Characterization
FCG Characterization
Life History Vector
Component Characterization Coupling
Coupling Uncertainty
Coupling Envelope
Mounting Interface #1
Mounting & Fastening SOA
Stabilized Relative to
Reacts Chemically With
Transmits Shock, Vibration, Random Force
Transmits Cyclic Force
Transmits Static Force
Immediate Mechanical Load #1
Load Characterization Vector
Stabilized Relative To
Static Stability Vector
Dynamic Stability Vector
Stabilized Relative To
Static Stability Vector
Dynamic Stability Vector
(these are actually attributes of the emergent system that is the combination of the bracket and the connected parts)
Manufacturing Characterization Coupling
Coupling Uncertainty
Coupling Envelope
Life Characterization Coupling
Coupling Uncertainty
Coupling Envelope
Raw Materials Characterization Vector
Manufacturing Process Characterization Vector
These are attributes of systems in another (Manufacturing) domain of the related pattern family
Notional Early Draft
General Mechanical Static Bracket Pattern—In-Service Operational Domain Diagram
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