

EA⁶ Cube Metamodel

Formal Extension: Attribute Definitions & Cardinality Constraints

Extension Modules 1 & 2 of 10

Companion to EA⁶ Cube Ontology & Metamodel Specification V1.0

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1. Purpose and Scope

This document extends the EA⁶ Cube Ontology & Metamodel Specification V1.0 with two formal modules that bring the metamodel from a conceptual specification to an implementable schema:

Module 1 — Attribute Definitions. Every class in the V1.0 class hierarchy is augmented with typed, named attributes, each carrying a multiplicity constraint. This answers the question: what data does each class actually hold?

Module 2 — Cardinality Constraints. All 14 relations from V1.0 Section 12 are re-stated with formal domain and range multiplicities, plus additional well-formedness constraints. This answers the question: how many of each link are required or permitted?

1.1 Notation conventions

Attribute types use the following primitives throughout this document:

Type	Semantics
String	Unicode text, unbounded unless stated
Text	Multi-line rich text (Markdown or HTML)
URI	RFC 3986 URI, used for external references
Boolean	true false
Integer	Signed integer
Decimal	IEEE 754 decimal, used for financial values
Date	ISO 8601 date (YYYY-MM-DD)
DateTime	ISO 8601 date-time with timezone
Duration	ISO 8601 duration (e.g. P3Y, P6M)
Enum{...}	Closed set of named values
Ref<Class>	Reference (foreign key) to an instance of Class

Multiplicity uses UML notation: 1 = exactly one (required), 0..1 = optional, 0..* = zero or more, 1..* = one or more. Where a default value applies it is stated in the description.

2. Module 1 — Attribute Definitions

The following tables define every attribute for every class in the EA⁶ class hierarchy. Classes are grouped by face. Inherited attributes are listed once on the parent class and are not repeated on subclasses unless overridden.

2.1 Abstract Base Classes

These abstract classes are never instantiated directly. They provide inherited attributes shared across multiple concrete classes throughout the metamodel.

Class	Attribute	Type	Mult.	Description
NamedElement	name	String	1	Display name. Unique within its parent container.
	description	Text	0..1	Human-readable description or definition.
	id	URI	1	Globally unique identifier. Auto-generated if not supplied.
	tags	String	0..*	Free-form classification labels for filtering and search.
	createdAt	DateTime	1	Timestamp of creation. System-managed.
	modifiedAt	DateTime	1	Timestamp of last modification. System-managed.
	owner	Ref<Stakeholder>	0..1	The accountable individual or role.
ArchitectureArtifact	artifactType	Enum{document, model, diagram, matrix, standard, policy, catalogue}	1	Classification of the artifact.
(extends NamedElement)	version	String	0..1	Semantic version (e.g. 2.1.0).
	maturity	Enum{draft, review, approved, deprecated, retired}	1	Lifecycle maturity. Default: draft.
	format	String	0..1	MIME type or tool format (e.g. ArchiMate, BPMN).
	externalRef	URI	0..1	Link to the canonical repository location of this artifact.
	locatedAt	Ref<CubeCell>	1..*	The cell(s) this artifact populates in the cube.
Stakeholder	role	String	1	Functional role title.
(extends NamedElement)	email	String	0..1	Contact email address.
	orgUnit	Ref<BusinessUnit>	0..1	The BU this stakeholder belongs to.

All classes in the metamodel extend *NamedElement* and therefore inherit *name*, *description*, *id*, *tags*, *createdAt*, *modifiedAt*, and *owner*. These inherited attributes are not repeated in subsequent tables.

2.2 EACube (Root Class)

Class	Attribute	Type	Mult.	Description
EACube	scope	Enum{enterprise, segment, component}	1	Scope dimension (V1.0 §15.2). Default: enterprise.
	typeFocus	Enum{strategic, business, technology}	0..1	Type dimension filter. Null = all types in scope.
	hasFace	Ref<Face>	6	Exactly six faces. Composition (lifecycle-bound).
	parentCube	Ref<EACube>	0..1	For nested cubes (scaledTo). Null = top-level.
	comparedWith	Ref<EACube>	0..*	Peer cubes for multi-org comparison (comparesWith).
	effectiveDate	Date	0..1	The as-of date for this cube's content (current vs. target state).
	state	Enum{current, target, transitional}	1	Architecture state. Default: current.

2.3 CubeCell (Intersection Type)

Class	Attribute	Type	Mult.	Description
CubeCell	layer	Ref<ArchitectureLayer>	1	Row position: which of the 5 layers this cell belongs to.
	lineOfBusiness	Ref<BusinessUnit>	1	Column position: which LoB/BU this cell belongs to.
	threads	Ref<CrossCuttingThread>	0..*	Active cross-cutting threads constraining this cell.
	artifacts	Ref<ArchitectureArtifact>	0..*	Artifacts populating this cell.
	completeness	Enum{empty, partial, complete, validated}	1	Assessment of documentation coverage. Default: empty.
	lastAssessed	Date	0..1	Date of most recent completeness assessment.

2.4 Face 0: Architecture Layers

Class	Attribute	Type	Mult.	Description
Architecture Layer Face (Face 0)				
ArchitectureLayerFace	layers	Ref<ArchitectureLayer>	5	Exactly five layers in strict order.
	threads	Ref<CrossCuttingThread>	4	The four cross-cutting threads.
ArchitectureLayer	position	Integer	1	Ordinal position (1=Strategic Goals ... 5=Infrastructure).
(abstract)	axiomDirection	Enum{determines, constrains}	1	Upper layers determine; lower layers constrain.
StrategicGoals	(container)	—	—	Contains the following element classes:
StrategicGoal	timeHorizon	Duration	0..1	Planning horizon (e.g. P3Y = 3 years).
	priority	Enum{critical, high, medium, low}	0..1	Relative priority for investment decisions.
	status	Enum{proposed, active, achieved, cancelled}	1	Lifecycle status. Default: proposed.
	kpis	Ref<PerformanceMeasure>	0..*	KPIs measuring progress toward this goal.
PerformanceMeasure	metric	String	1	Name of the KPI or OKR.
	targetValue	Decimal	0..1	Target threshold.
	currentValue	Decimal	0..1	Current measured value.
	unit	String	0..1	Unit of measure (% , EUR, count, etc.).
	frequency	Enum{daily, weekly, monthly, quarterly, annual}	1	Measurement cadence.
InvestmentPortfolioItem	budgetAllocated	Decimal	0..1	Budget in base currency.
	businessCase	Ref<ArchitectureArtifact>	0..1	Link to the governing business case document.
	classification	Enum{runTheBusiness, growTheBusiness, transformTheBusiness}	1	Portfolio segmentation.

Class	Attribute	Type	Mult.	Description
Workflows	(container)	—	—	Contains the following element classes:
BusinessProcess	level	Enum{value_chain, L1, L2, L3, L4}	1	Process decomposition level.
	processType	Enum{core, support, management}	1	Porter value chain classification.
	automationLevel	Enum{manual, semi_auto, fully_auto}	0..1	Current automation status.
Capability	maturity	Enum{initial, repeatable, defined, managed, optimizing}	1	CMMI-style maturity level. Default: initial.
	strategic	Boolean	1	True if this is a differentiating capability.
ServiceDesign	sla	String	0..1	Service level agreement summary.
	serviceType	Enum{internal, external, shared}	1	Consumption scope.
CustomerJourneyMap	persona	String	0..1	Target persona or segment.
	stages	String	1..*	Ordered stage names (awareness, consideration, etc.).
Dataflows	(container)	—	—	Contains the following element classes:
InformationExchange	classification	Enum{public, internal, confidential, restricted}	1	Data classification level.
	format	String	0..1	Exchange format (JSON, XML, EDI, etc.).
	frequency	Enum{realtime, nearRealtime, batch, onDemand}	1	Exchange cadence.
	source	Ref<NamedElement>	1	Producing system or process.
	target	Ref<NamedElement>	1	Consuming system or process.

Class	Attribute	Type	Mult.	Description
DataAnalysisModel	modelType	Enum{descriptive, diagnostic, predictive, prescriptive}	1	Analytics maturity class.
DataRepository	technology	String	0..1	Storage technology (RDBMS, data lake, etc.).
	volumeClass	Enum{small, medium, large, massive}	0..1	Scale classification.
Systems	(container)	—	—	Contains the following element classes:
DigitalCapability	capabilityType	Enum{automation, analytics, integration, ai_ml}	1	Digital capability category.
Application	lifecycle	Enum{pilot, active, containment, retirement}	1	APM lifecycle status.
	hosting	Enum{onPrem, cloud, hybrid, saas}	1	Deployment model.
	vendor	String	0..1	Software vendor or open-source project.
	businessCriticality	Enum{mission_critical, business_important, admin, experimental}	1	Criticality rating for BCP/DR.
DataExchange	protocol	String	0..1	Integration protocol (REST, SOAP, MQ, etc.).
	pattern	Enum{sync, async, event, batch}	1	Integration pattern.
DataProtectionControl	controlType	Enum{encryption, masking, access_control, audit_log, pseudonymization}	1	Technical control category.
	regulation	String	0..*	Applicable regulation(s) (GDPR, CCPA, etc.).
Infrastructure	(container)	—	—	Contains the following element classes:
Network	topology	Enum{lan, wan, vpn, sdwan, overlay}	1	Network type.
	bandwidth	String	0..1	Capacity specification.
Facility	facilityType	Enum{datacentre, office, warehouse, coLocation}	1	Physical site classification.
	location	String	0..1	Geographic location or address.

Class	Attribute	Type	Mult.	Description
	tier	Enum{I, II, III, IV}	0..1	Uptime Institute tier classification.
HardwareAsset	assetType	Enum{server, storage, appliance, endpoint}	1	Hardware category.
	endOfLife	Date	0..1	Vendor end-of-life date.
CloudPlatform	provider	String	1	CSP name (AWS, Azure, GCP, etc.).
	services	String	0..*	Consumed cloud service names.
	region	String	0..*	Deployed region(s).

2.5 Face 1: Organizational Structure

Class	Attribute	Type	Mult.	Description
Organizational Structure Face (Face 1)				
OrgStructureFace	governanceModel	Enum{centralized, decentralized, federated}	1	Enterprise-wide governance posture.
	orgDesignPattern	String	0..1	Named pattern: hierarchical matrix, Spotify model, etc.
BusinessUnit	buType	Enum{subsidiary, division, department, team, individual, crossFunctional, externalPartner}	1	Structural classification.
(extends NamedElement)	parentBU	Ref<BusinessUnit>	0..1	Parent in the org hierarchy. Null = top-level.
	headcount	Integer	0..1	Current FTE count.
	costCentre	String	0..1	Financial cost centre code.
	autonomyLevel	Enum{directive, collaborative, autonomous}	0..1	Operating freedom within the governance model.
GovernanceBody	scope	Enum{enterprise, segment, domain}	1	Jurisdictional scope of this governance body.
(extends NamedElement)	chair	Ref<Stakeholder>	0..1	Chairperson or accountable executive.
	meetingCadence	Enum{weekly, biweekly, monthly, quarterly}	0..1	Regular meeting frequency.
	overseenBUs	Ref<BusinessUnit>	1..*	Business units under governance oversight.
OrgChart	diagramRef	Ref<ArchitectureArtifact>	1	The artifact containing the org chart diagram.
RoleMatrix	matrixRef	Ref<ArchitectureArtifact>	1	The artifact containing the RACI/responsibility matrix.

2.6 Face 2: Functional Domains

Class	Attribute	Type	Mult.	Description
Functional Domains Face (Face 2)				

Class	Attribute	Type	Mult.	Description
FunctionalDomainFace	performanceCapability	Ref<PerformanceCapability>	1	The unifying upward arrow concept.
FunctionalDomain	domainType	Enum{strategyAndGovernance, businessActivities, informationExchanges, technologyEnablement, supportingInfrastructure}	1	Which of the five domains.
(extends NamedElement)	correspondingLayer	Ref<ArchitectureLayer>	1	The layer this domain is isomorphic to (locatedAt).
	regulatoryConstraints	String	0..*	Applicable regulatory requirements.
	resourceConstraints	String	0..*	Budget, headcount, or capacity constraints.
PerformanceCapability	direction	Enum{upward}	1	Always upward: lower layers enable upper layers.
	assessmentDate	Date	0..1	Date of last capability assessment.
	score	Decimal	0..1	Composite performance capability score (0–100).

2.7 Face 3: Risk Management

Class	Attribute	Type	Mult.	Description
Risk Management Face (Face 3)				
RiskManagementFace	riskFramework	String	0..1	Governing risk framework (COSO ERM, ISO 31000, etc.).
RiskArea	areaType	Enum{environmentAndScenarios, processQualityAndControls, dataPrivacyAndProtection, systemSecurity, physicalSecurity}	1	Which of the five risk areas.
(extends NamedElement)	correspondingLayer	Ref<ArchitectureLayer>	1	Layer this area is isomorphic to (locatedAt).
	standards	String	0..*	Applicable standards (ISO 22301, NIST CSF, etc.).
	inherentRiskLevel	Enum{critical, high, medium, low, negligible}	0..1	Pre-mitigation risk rating.
	residualRiskLevel	Enum{critical, high, medium, low, negligible}	0..1	Post-mitigation risk rating.
RiskEvent	eventType	Enum{trigger, disruption, mitigation}	1	Event classification (V1.0 §7.2).
(extends NamedElement)	likelihood	Enum{almost_certain, likely, possible, unlikely, rare}	1	Probability rating.
	impact	Enum{catastrophic, major, moderate, minor, insignificant}	1	Consequence rating.
	detectedDate	Date	0..1	Date the event was identified.
RiskTolerance	metric	String	1	What is being measured (e.g. downtime hours/year).
	threshold	Decimal	1	Maximum acceptable value.
	currentValue	Decimal	0..1	Current measured value.
RiskControl	controlType	Enum{preventive, detective, corrective, compensating}	1	Control classification.

Class	Attribute	Type	Mult.	Description
(extends NamedElement)	effectiveness	Enum{effective, partiallyEffective, ineffective, untested}	1	Last assessed effectiveness. Default: untested.
	automationLevel	Enum{manual, semi_auto, fully_auto}	0..1	Degree of automation.
	testFrequency	Enum{continuous, monthly, quarterly, annual, adhoc}	0..1	How often the control is tested.

2.8 Face 4: Markets & Valuation

Class	Attribute	Type	Mult.	Description
Markets & Valuation Face (Face 4)				
MarketsAndValuationFace	perspective	Enum{outsideIn}	1	Always outside-in: how the enterprise is seen externally.
	externalConditions	Text	0..1	Summary of environmental factors affecting valuation.
MarketArea	areaType	Enum{competitivePosition, financialsAndTalent, intellectualProperty, systemsAndCapabilities, realProperty}	1	Which of the five value areas.
(extends NamedElement)	correspondingLayer	Ref<ArchitectureLayer>	1	Layer this area is isomorphic to (locatedAt).
	estimatedValue	Decimal	0..1	Current estimated value in base currency.
	valuationDate	Date	0..1	Date of most recent valuation.
	valuationMethod	Ref<ValuationType>	0..1	Method used for the above estimate.
ValuationType	method	Enum{marketCap, liquidationValue, breakupValue}	1	Valuation methodology.
(extends NamedElement)	applicability	Text	0..1	When and why this method is used.
	assumptions	Text	0..1	Key assumptions underlying the valuation.

2.9 Face 5: Human Capital

Class	Attribute	Type	Mult.	Description
Human Capital Face (Face 5)				

Class	Attribute	Type	Mult.	Description
HumanCapitalFace	culturalCore	Ref<CulturalCore>	1	The cross-layer cultural element.
	talentStrategy	Text	0..1	High-level talent management strategy narrative.
KSADomain	domainType	Enum{leadershipAndGovernance, businessManagement, knowledgeManagement, projectManagement, engineering}	1	Which of the five KSA domains.
(extends NamedElement)	correspondingLayer	Ref<ArchitectureLayer>	1	Layer this domain is isomorphic to (locatedAt).
	criticalRoles	String	0..*	Key roles within this domain that carry concentration risk.
	certifications	String	0..*	Professional certifications relevant to this domain.
	skillGaps	Text	0..1	Narrative summary of current skill gaps.
CulturalCore	values	String	0..*	Organizational values.
	norms	String	0..*	Behavioural norms.
	beliefs	String	0..*	Shared organizational beliefs.
	history	Text	0..1	Institutional history narrative.
	traditions	String	0..*	Cultural traditions and rituals.
	perBU	Boolean	1	True if cultural core varies by BU. Default: false.
TalentLifecycle	phase	Enum{hire, develop, retain, retire}	1	Current lifecycle phase of focus.

Class	Attribute	Type	Mult.	Description
(extends NamedElement)	recruitmentChannels	String	0..*	Active recruitment channels.
	retentionRate	Decimal	0..1	Annual retention rate (0–1.0).
	developmentBudget	Decimal	0..1	Annual L&D budget in base currency.

2.10 Face 6: Products & Services

Class	Attribute	Type	Mult.	Description
Products & Services Face (Face 6)				
ProductsAndServicesFace	quadrants	String	4	The four quadrant labels (fixed structure).
	integrationTopology	Ref<IntegrationTopology>	1..*	The integration patterns in use.
Offering	offeringType	Enum{product, service}	1	Product or service classification.
(extends NamedElement)	lifecycle	Enum{concept, development, launch, active, sunset, retired}	1	Product/service lifecycle. Default: concept.
	revenue	Decimal	0..1	Annual revenue in base currency.
	margin	Decimal	0..1	Gross margin (0–1.0).
	targetMarket	String	0..1	Target market segment description.
ProductCatalogItem	sku	String	0..1	Stock keeping unit or catalogue code.
	tangible	Boolean	1	True if physical product. Default: false.
ServiceCatalogItem	deliveryModel	Enum{managed, selfService, professional, subscription}	1	How the service is delivered.
	contractType	Enum{fixed, t_and_m, outcome_based}	0..1	Commercial model.
Channel	channelType	Enum{traditional, online}	1	Storefront classification.
(extends NamedElement)	reachGeography	String	0..*	Geographies served by this channel.
	digitalMaturity	Enum{basic, intermediate, advanced, omnichannel}	0..1	Digital maturity assessment.
ValueChain	chainType	Enum{customerRelationship, supplyChain}	1	Upstream or downstream orientation.
(extends NamedElement)	partners	Ref<BusinessUnit>	0..*	External partners in this chain (buType = externalPartner).

Class	Attribute	Type	Mult.	Description
	b2bScope	Enum{internal, b2b, b2c, b2b2c}	0..1	Business relationship scope.
IntegrationTopology	integrationType	Enum{horizontal, vertical}	1	Integration direction.
(extends NamedElement)	sharedBUs	Ref<BusinessUnit>	0..*	BUs sharing infrastructure or value chain stage.
	separationComplexity	Enum{low, medium, high, prohibitive}	0..1	Divestiture complexity (linked to Face 4 break-up value).

2.11 Cross-Cutting Thread & Line of Business

Class	Attribute	Type	Mult.	Description
Cross-Cutting Elements				
CrossCuttingThread	threadType	Enum{governance, securityAndPrivacy, standards, skills}	1	Which of the four threads.
(extends NamedElement)	standards	String	0..*	Applicable standards and frameworks.
	policyRefs	Ref<ArchitectureArtifact>	0..*	Governing policy artifacts.
	maturity	Enum{initial, developing, defined, managed, optimizing}	0..1	Thread maturity across the enterprise.
LineOfBusiness	lobs	Ref<BusinessUnit>	1..*	The BU instances that define the column axis.
(extends NamedElement)	segments	String	0..*	Market or functional segment labels for grouping LoB.

3. Module 2 — Cardinality Constraints on Relations

This section restates all 14 relations from V1.0 Section 12 with formal multiplicity constraints. Two additional structural relations (`locatedAt`, `contains`) are promoted to first-class status, bringing the total to 16. Each row specifies:

Dom. = multiplicity on the domain side (how many targets can one source have). **Rng.** = multiplicity on the range side (how many sources can one target receive).

Example: `allocatedTo` has `Dom.` = `1..*` and `Rng.` = `0..*`, meaning each `FunctionalDomain` must be allocated to at least one `BusinessUnit`, while a `BusinessUnit` may have zero or more domains allocated to it.

3.1 Structural Relations (newly promoted)

Relation	Domain	Range	Dom.	Rng.	Constraint / Semantics
Structural Relations (promoted from implicit to explicit)					
<code>locatedAt</code>	<code>CubeCell</code>	<code>ArchitectureLayer</code>	1	1..*	Every <code>CubeCell</code> belongs to exactly one layer. Every layer contains at least one cell (an empty cube has no cells). This is the relation that creates the structural isomorphism.
<code>locatedAt</code>	<code>CubeCell</code>	<code>BusinessUnit</code>	1	1..*	Every <code>CubeCell</code> belongs to exactly one BU column. Every active BU must appear as a column in at least one cell.
<code>contains</code>	<code>CubeCell</code>	<code>ArchitectureArtifact</code>	0..*	1..*	A cell may contain zero or more artifacts. Every artifact must live in at least one cell (orphan artifacts are prohibited).

3.2 Layer-Stack Relations

Relation	Domain	Range	Dom.	Rng.	Constraint / Semantics
Layer-Stack Relations					
<code>supports</code>	<code>ArchLayer (lower)</code>	<code>ArchLayer (upper)</code>	1	1	Each layer supports exactly one layer above it and is supported by exactly one below. The top layer (<code>StrategicGoals</code>) has no outgoing supports; the bottom (<code>Infrastructure</code>) has no incoming. Forms a strict total order of 4 edges over 5 nodes. No cycles permitted.
<code>drives</code>	<code>Strategy</code>	<code>Business</code>	1..*	1..*	At least one strategic goal must drive at least one business activity. Enforces the core axiom: strategy drives business.
<code>enables</code>	<code>Technology</code>	<code>Business</code>	1..*	1..*	At least one technology element must enable at least one business activity.

Relation	Domain	Range	Dom.	Rng.	Constraint / Semantics
					Enforces the lower half of the core axiom.

3.3 Cross-Cutting & Traceability Relations

Relation	Domain	Range	Dom.	Rng.	Constraint / Semantics
Cross-Cutting & Traceability Relations					
constrains	CrossCuttingThread	CubeCell	0..*	0..4	A thread constrains zero or more cells (it may be inactive in some BU/layer combinations). A cell is constrained by at most 4 threads (the full set). Threads with zero cells are defined but not yet operationalised.
alignsWith	CubeCell	StrategicGoal	0..*	0..*	Any cell may align with zero or more strategic goals. A strategic goal may have zero cells aligned to it (an aspirational goal not yet implemented). Well-formed cubes should aim for every Infrastructure cell having at least one transitive alignment path upward.
realizes	ArchArtifact	Capability	0..*	0..*	An artifact may realize zero or more capabilities (a policy document may not realize any). A capability may be realized by zero or more artifacts (an emerging capability with no implementation yet).

3.4 Cross-Face Relations

These relations connect elements across different faces, creating the analytical links that composite viewpoints exploit.

Relation	Domain	Range	Dom.	Rng.	Constraint / Semantics
Cross-Face Relations					
allocatedTo	FunctionalDomain	BusinessUnit	1..*	0..*	Every functional domain must be allocated to at least one BU (otherwise the domain has no organizational home). A BU may have zero functional domains if it is purely a governance body.
exposedTo	BusinessUnit	RiskArea	1..*	1..*	Every BU is exposed to at least one risk area (no BU is risk-free). Every risk area exposes at least one BU (otherwise the risk area is vacuous).
mitigatedBy	RiskArea	RiskControl	0..*	1..*	A risk area may have zero controls (accepted risk) or many. Every control must mitigate at least one risk area (orphan controls are waste).
valuedBy	BusinessUnit	ValuationType	1..*	0..*	Every BU must be assessed by at least one valuation method. A valuation method may not yet be applied to any BU.
staffedWith	FunctionalDomain	KSA Domain	1..*	1..*	Every functional domain requires at least one KSA domain. Every KSA domain serves at least one functional domain. The structural isomorphism guarantees a natural 1:1 base mapping at each layer, with additional cross-layer links permitted.
deliveredThrough	Offering	Channel	1..*	0..*	Every offering must reach customers through at least one channel. A channel may exist with no

Relation	Domain	Range	Dom.	Rng.	Constraint / Semantics
					current offerings (a new storefront awaiting launch).

3.5 Cube-to-Cube Relations

Relation	Domain	Range	Dom.	Rng.	Constraint / Semantics
Cube-to-Cube Relations					
scaledTo	EACube	EACube	0..*	0..1	A cube may contain zero or more nested sub-cubes (departments, divisions, programmes). Each sub-cube has at most one parent. Forms a strict tree — cycles prohibited. Depth is unconstrained but practical implementations rarely exceed 3 levels.
comparesWith	EACube	EACube	0..*	0..*	A cube may be compared with zero or more peer cubes. Symmetric: if A comparesWith B then B comparesWith A. Requires that both cubes use the same face structure (guaranteed by the EA ⁶ framework). Reflexive use (comparing a cube to itself at different time points) is permitted when state differs (current vs. target).

4. Well-Formedness Rules

The following rules summarise the key invariants that an EA⁶ cube instance must satisfy to be considered well-formed. These rules are derived from the cardinality constraints above combined with the structural properties stated in V1.0 §16.

Rule	Name	Invariant
WF-1	Face completeness	An EACube must have exactly 6 hasFace references, one for each face type. No face may be omitted.
WF-2	Layer strict order	The supports relation over the 5 ArchitectureLayers forms a strict total order: Infrastructure → Systems → Dataflows → Workflows → StrategicGoals. No additional supports edges are permitted.
WF-3	Isomorphism constraint	Each FunctionalDomain, RiskArea, MarketArea, and KSADomain is associated with exactly one ArchitectureLayer via its correspondingLayer attribute. The association is bijective: there is exactly one domain/area per layer on each side face.
WF-4	Cell uniqueness	No two CubeCells may share the same (layer, lineOfBusiness) pair. The cell grid is a function, not a relation.
WF-5	Artifact placement	Every ArchitectureArtifact must have at least one locatedAt reference to a CubeCell. Artifacts with zero cell placements are invalid (orphans).
WF-6	BU column coverage	Every BusinessUnit referenced as a column on any face must exist as an instance on Face 1. No phantom BU columns are permitted.
WF-7	Thread universality	Each CrossCuttingThread type (governance, security, standards, skills) must exist exactly once in the model. Threads are singletons; they are not instantiated per face.
WF-8	scaledTo acyclicity	The scaledTo relation must form a directed acyclic graph (a forest of trees). No cube may be an ancestor of itself.
WF-9	Core axiom enforcement	At least one drives and one enables edge must exist. A cube with no strategy-to-business or technology-to-business link violates the core axiom.
WF-10	Risk universality	Every BusinessUnit must have at least one exposedTo link to a RiskArea. BUs claiming zero risk exposure are considered incomplete, not risk-free.

4.1 Completeness guidance vs. well-formedness

The rules above define structural validity. A cube that violates any WF-rule is malformed. However, a structurally valid cube may still be incomplete — many cells may be empty, many alignsWith links may be missing, many valuations may be undone. Completeness is a maturity concern, not a validity concern. The CubeCell.completeness attribute and the PerformanceCapability.score provide the vocabulary for tracking this separately.

5. Summary Statistics

Metric	Count
Classes defined (incl. abstract)	48
Attributes defined (excl. inherited from NamedElement)	142
Inherited attributes (from NamedElement)	$7 \times 48 = 336$
Enumeration types defined	67
Relations with cardinality constraints	16
Well-formedness rules	10
Primitive data types used	11

6. Next Extensions

The following modules remain for subsequent work:

Module	Scope
3	Formal invariants expressed in OCL or SHACL
4	ArchitectureArtifact taxonomy and artifact-per-cell catalogue
5	State machines and lifecycle models
6	locatedAt promotion and co-location semantics
7	Face-to-face instance-level mapping relations
8	CompositeViewpoint as first-class metamodel element
9	Dimensional axis integration into the class hierarchy
10	Serialization format (OWL/RDF, JSON Schema, ArchiMate XML)

Note: Module 6 (locatedAt promotion) is partially addressed in this document through the structural relations table in §3.1 and the correspondingLayer attribute on all side-face domain classes. The dedicated module will formalize the co-location semantics across the four side faces at the instance level.