BUSINESS VALUE OF SEMANTIC TECHNOLOGY

Preliminary Findings

Industry Advisory Council
Emerging Technology (ET) SIG
Information Sharing &
Collaboration Committee
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MILLS DAVIS

Mills Davis is TopQuadrant's managing director for industry research and strategic programs. He consults with technology manufacturers, global 2000 corporations, and government agencies on next-wave semantic technologies and solutions.

Mills serves as lead for the Federal CIO Council's Semantic Interoperability Community of Practice (SICoP) research into the business value of semantic technologies (Module-2).

A noted researcher and industry analyst, Mills has authored more than 100 reports, whitepapers, articles, and industry studies.

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TOPICS

- Semantic technologies
- Putting ontologies to work
- Early adoption
- Business value of semantic technologies

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SEMANTIC TECHNOLOGIES

- Semantics are shared meanings, associations, and know-how about the uses of things.
- Semantic technologies represent meanings digitally — separately from data, content, or program code.

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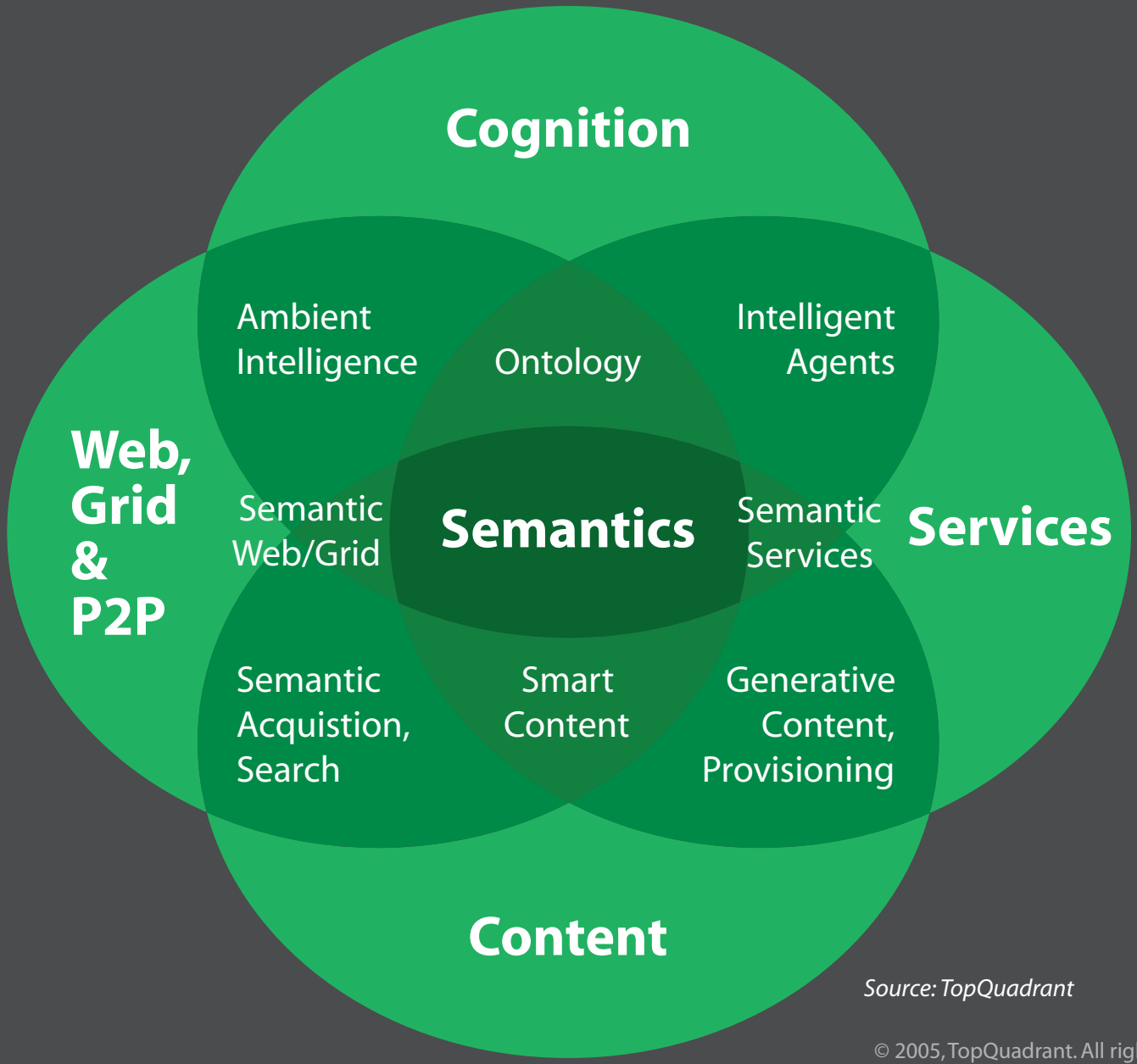
SEMANTIC TECHNOLOGY R&D THEMES



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SEMANTIC TECHNOLOGIES ARE ABOUT PUTTING ONTOLOGIES TO WORK...

- An **ontology** is a run-time model of information, defined using constructs for:
  - Concepts – classes
  - Relationships – properties (object and data)
  - Rules – axioms and constraints
  - Instances of concepts – individuals (data)
- Semantic web ontololgies are defined using W3C standards: RDF/S and OWL.

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ONTOLOGIES ARE LIKE AND UNLIKE OTHER IT MODELS

- Like **databases** ontologies are used by applications at run time (queried and reasoned over). Unlike databases, relationships are first-class constructs.
- Like **object models** ontologies describe classes and attributes (properties). Unlike object models, ontologies are set-based.
- Like **business rules** they encode rules. Unlike business rules, ontologies organize rules using axioms.
- Like **XML schemas** they are native to the web (and are in fact serialized in XML). Unlike XML schemas, ontologies are graphs not trees, and used for reasoning.

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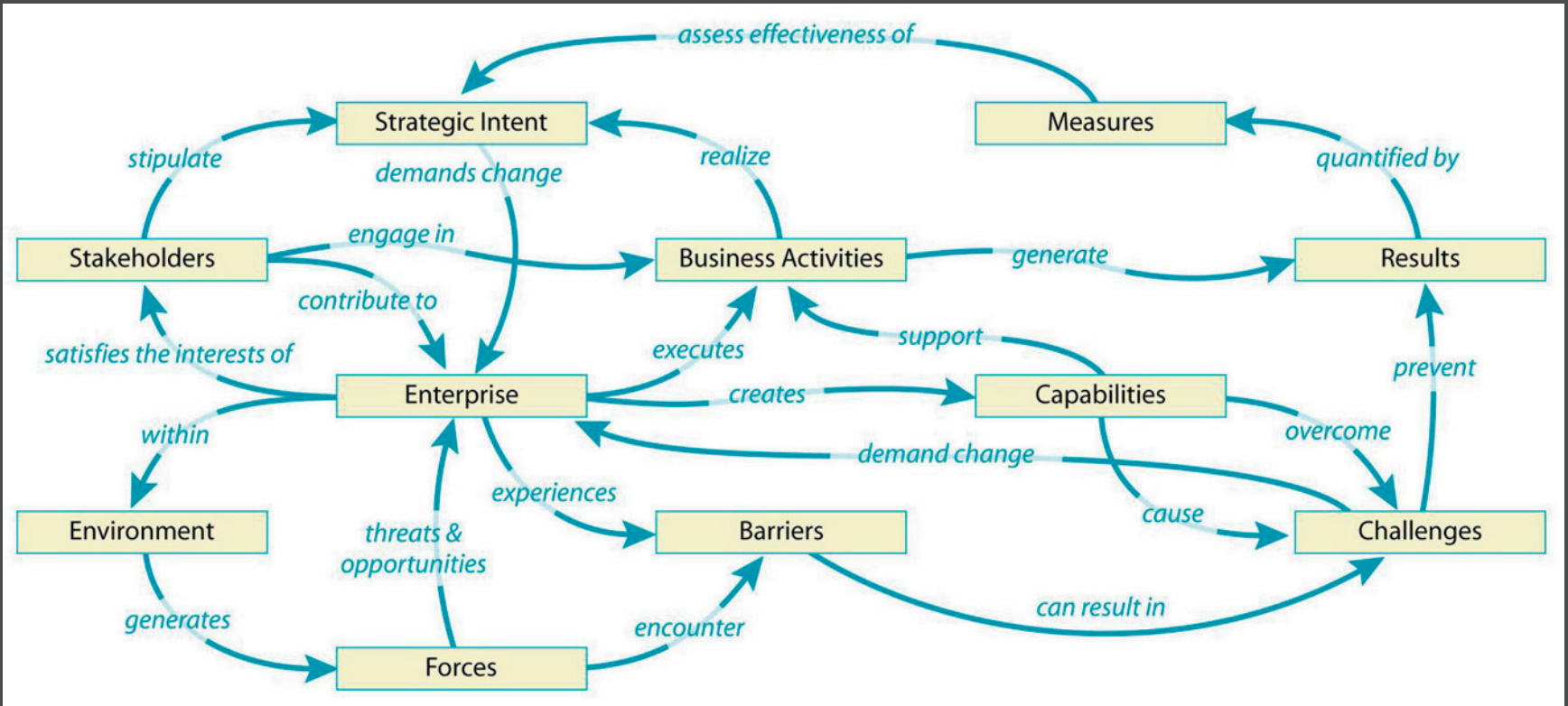
THIS IS A BUSINESS ONTOLOGY...



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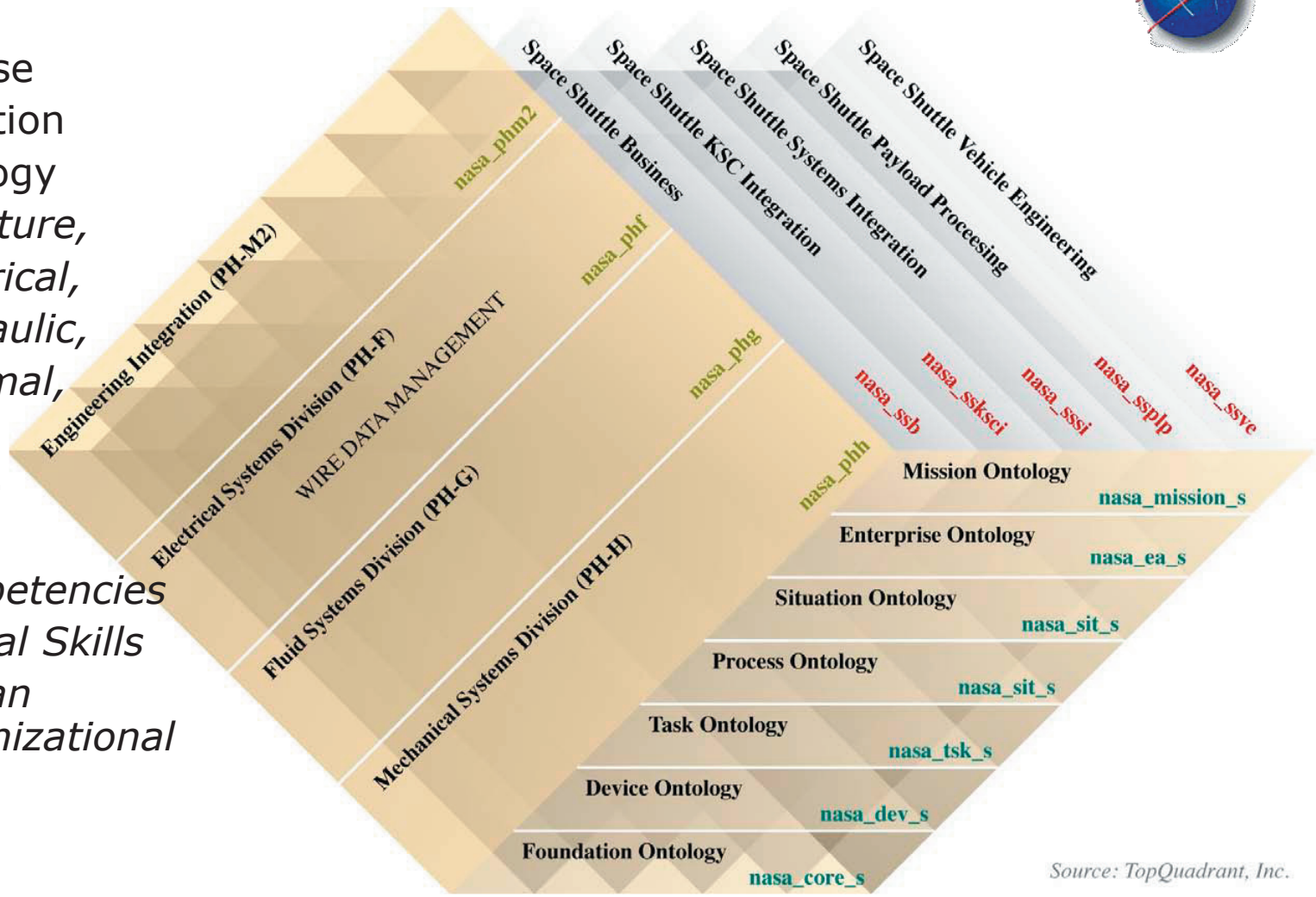
THIS IS AN ENTERPRISE ONTOLOGY…

Ontologies: Backplane of semantic enterprise

- Enterprise
- Information
- Technology
  - *Structure,*
  - *Electrical,*
  - *Hydraulic,*
  - *Thermal,*
  - *…*
- Lifecycle
- Social
  - *Competencies*
  - *Critical Skills*
  - *Human Organizational Risks*



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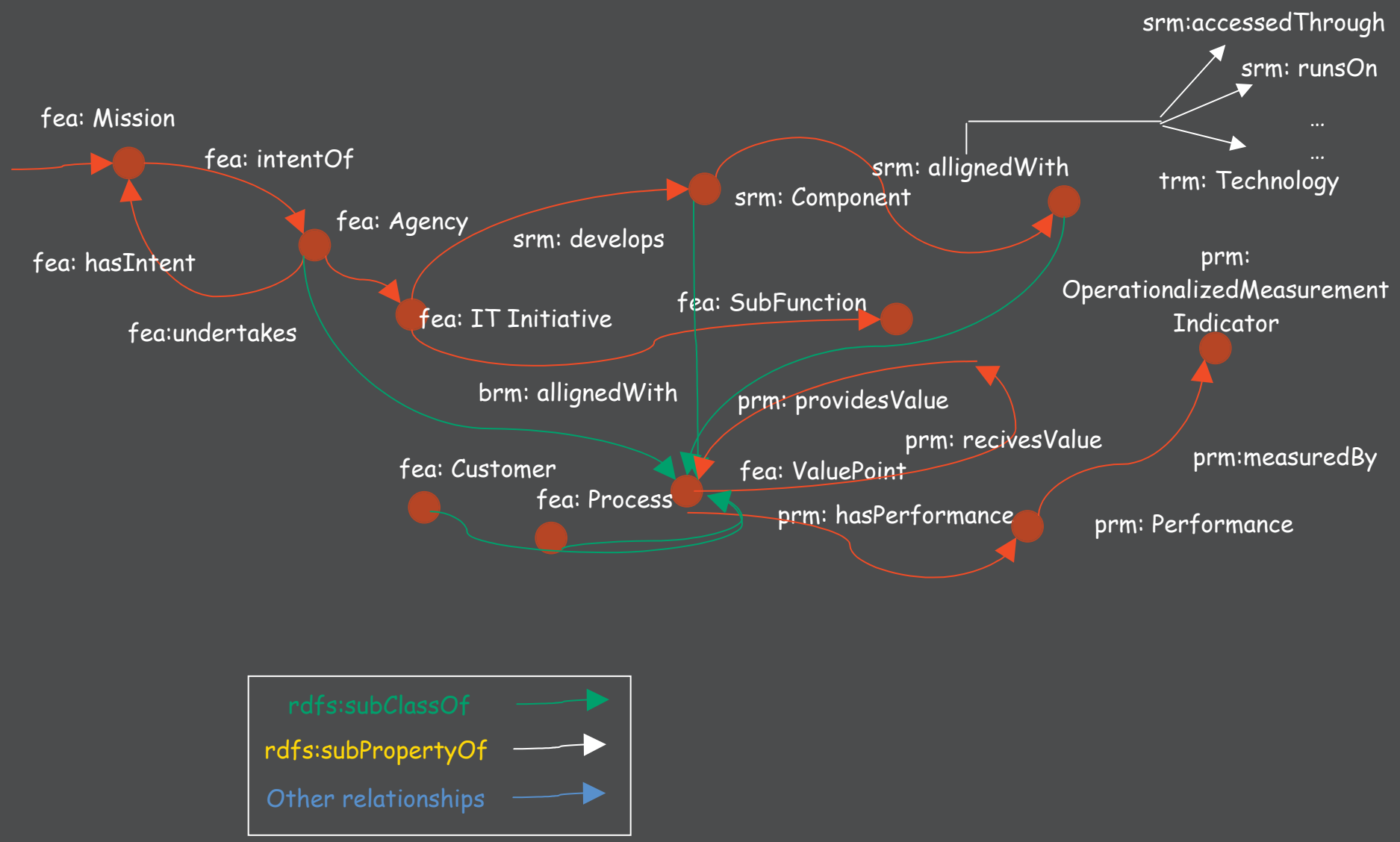
FEA REFERENCE MODEL ONTOLOGIES DELIVER "LINE OF SIGHT"!



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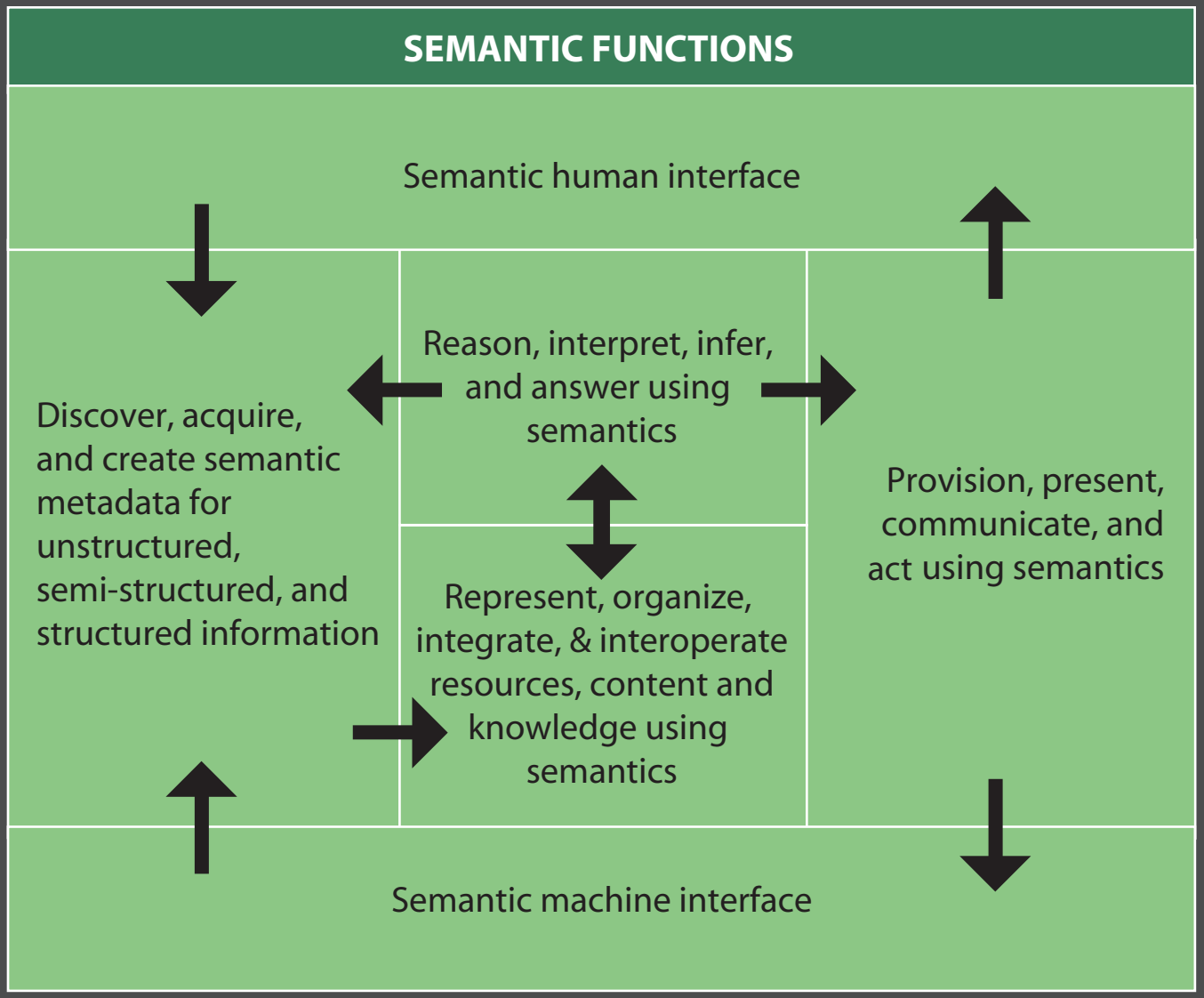
FUNCTIONS OF SEMANTIC TECHNOLOGIES



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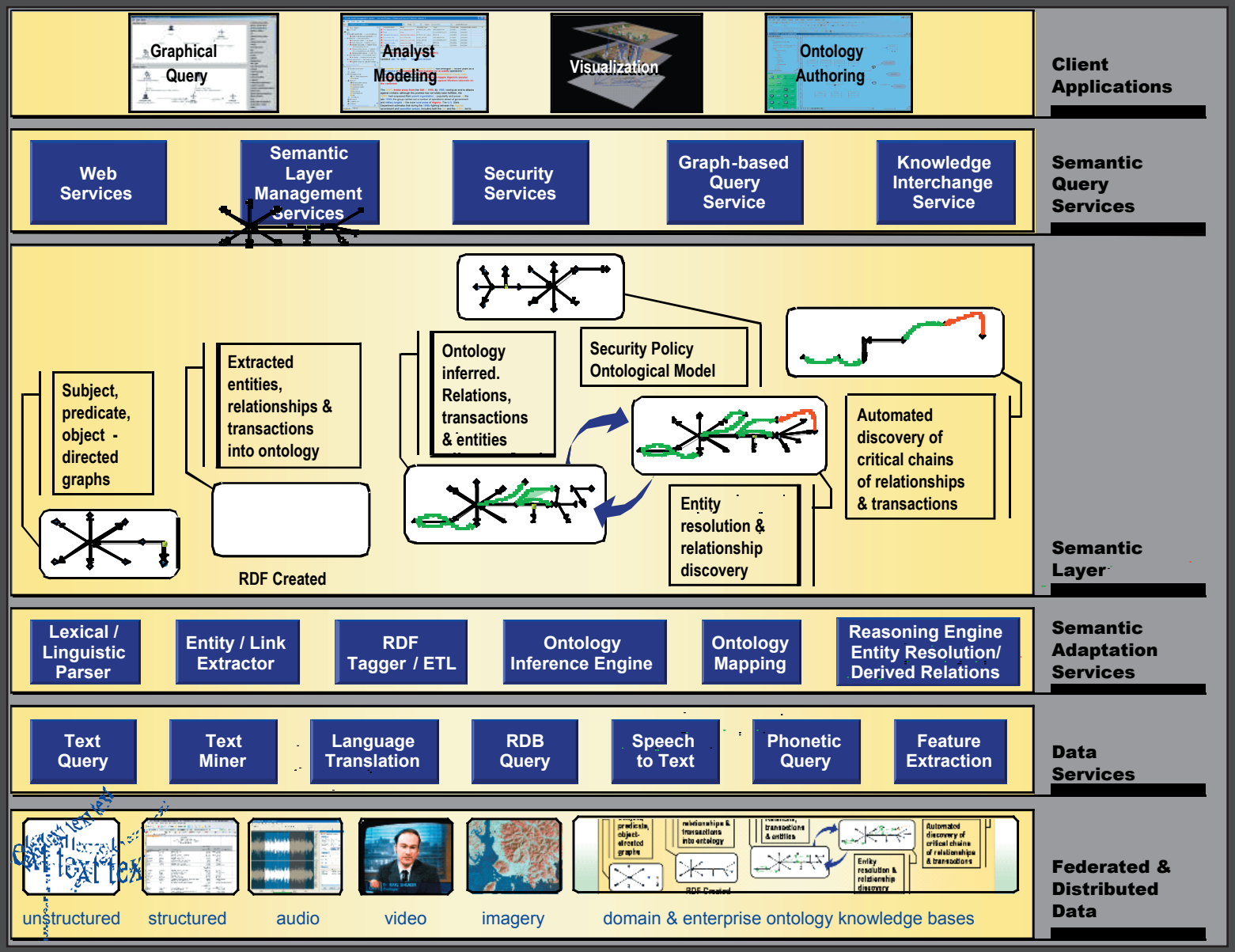
INTELLIGENCE COMMUNITY SEMANTIC ARCHITECTURE



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INTELLIGENCE COMMUNITY DATA MATURITY MODEL

Data Maturity	Data Fidelity	Metadata Type	Data Instance	Data Organization	Metadata Content	Tools	Data Autonomy
4 Optimized Semantics	High Fidelity	Multi-layer Markup	Ontology and automated reasoning	Ontology	Inferred Relationships	Semantic Web Agent Technology	Smart Data
3 Managed Relationships		Entity & Relationship Markup	Taxonomies and Documents with horizontal integration of domain vocabularies	Ontology Taxonomy	Named Relationships	Data Independent	
2 Defined Content		Entity Markup	XML Documents using vertical domain vocabularies	Taxonomy	Content Mission	Filtering, Clustering. Categorization	
1 Repeatable Structure		Structure Markup	Schemas & DTDs	Document Models	Security Resource Format	Database Tools	
0 Chaotic	Low Fidelity	Unstructured	Text Documents & Database Records	Proprietary Application	Proprietary Properties	Search Tools	Dependent Data

Source: http://wonderweb.semanticweb.org/deliverables/documents/D25.pdf

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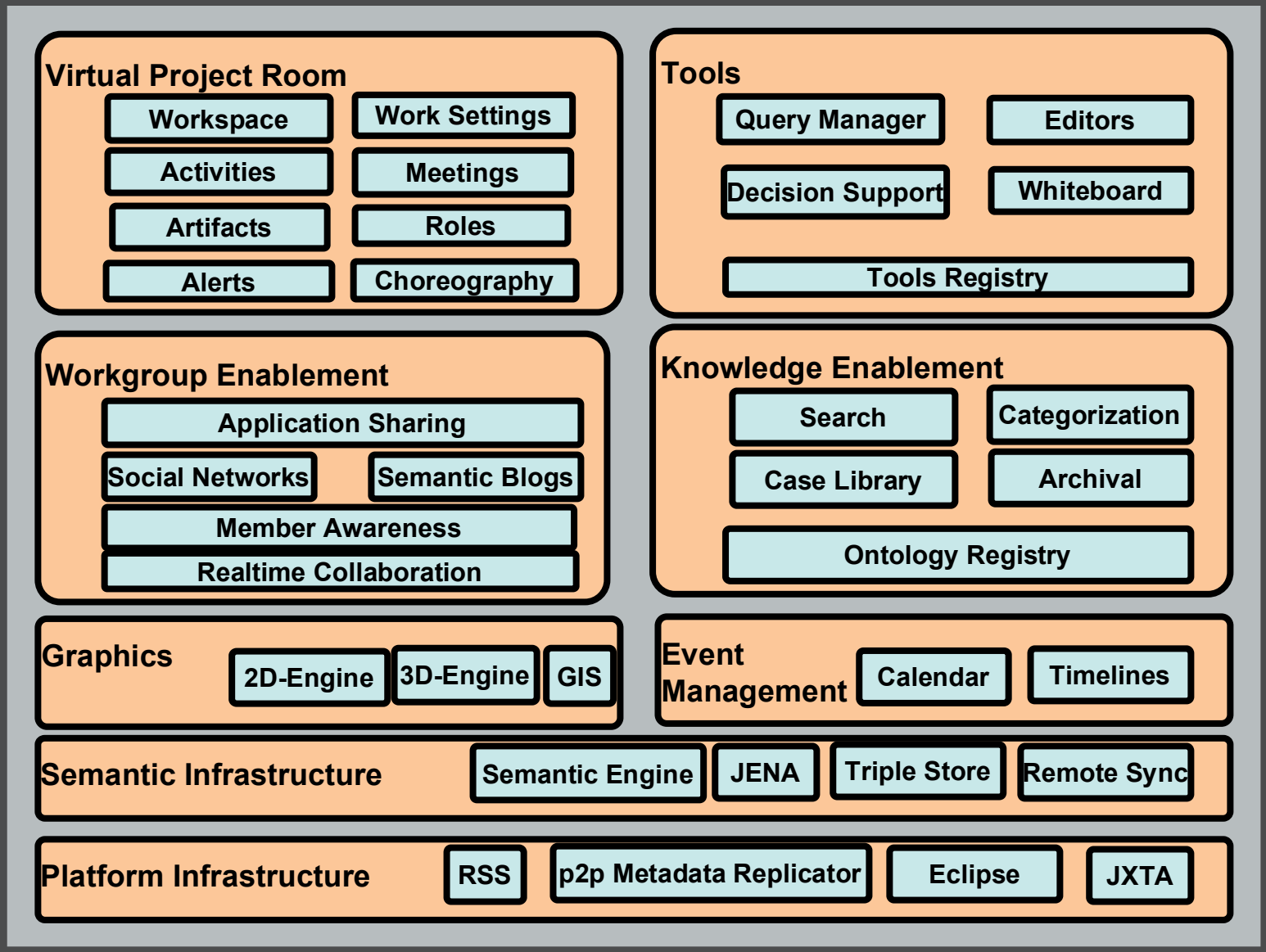
SEMANTIC COLLABORATIVE ENVIRONMENT



Source: Alinean, MILLS•DAVIS

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SEMANTIC COMMAND AND CONTROL

Knowledge Base

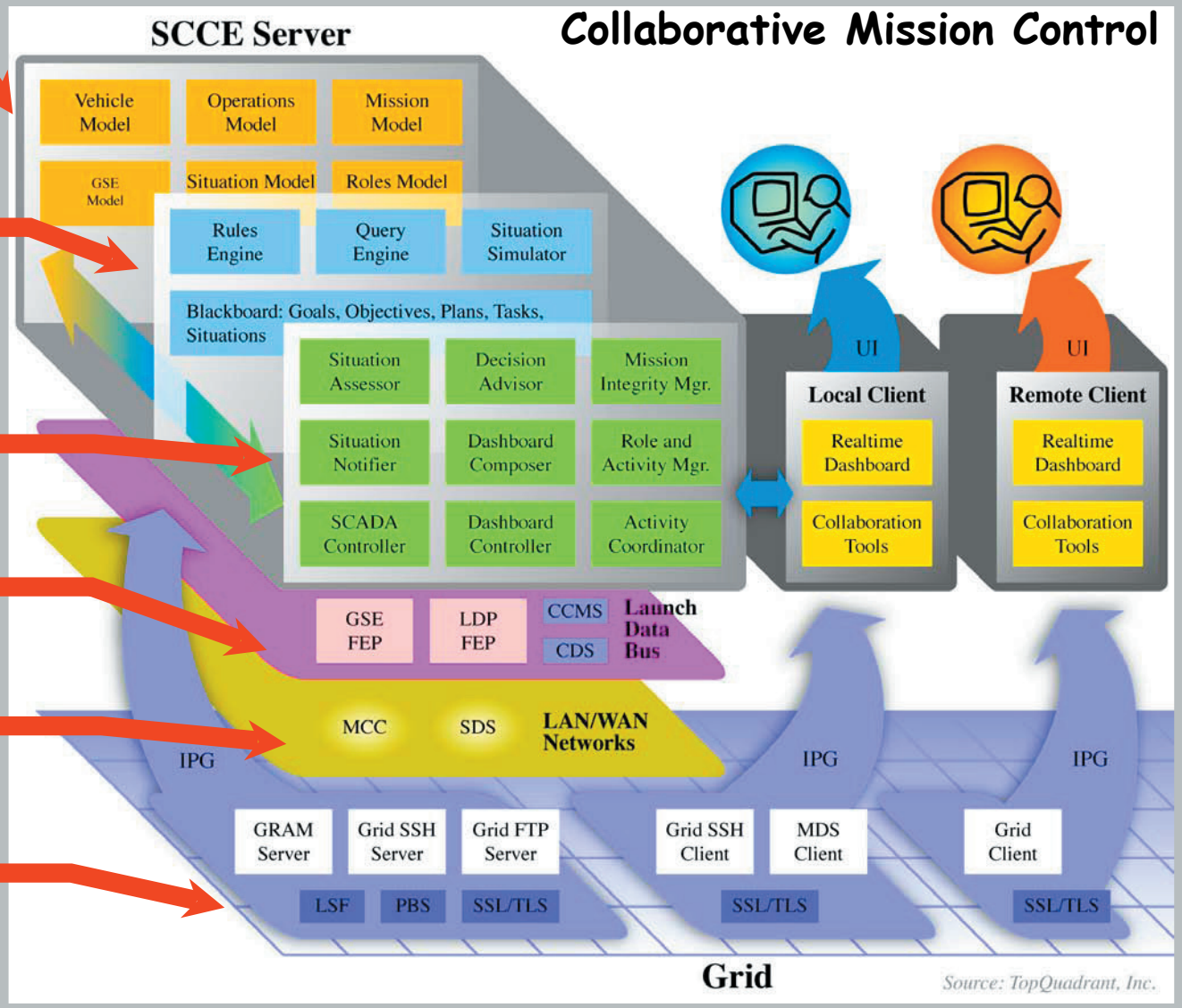
Semantic Engine

SCCE Capabilities

Launch Data Bus

NASA Networks

NASA Grid



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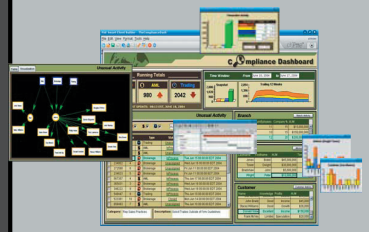
SEMANTIC COMPOSITE APPLICATIONS

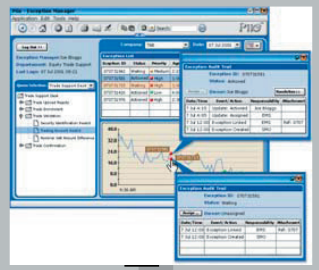
Many knowledge applications have a similar lifecycle…

Lifecycle often begins with automated capture of events, followed by human monitoring and analysis of situation based on information from different sources in different formats (structured & unstructured). People need to keep the context, share the picture of the situation, and resolve it.



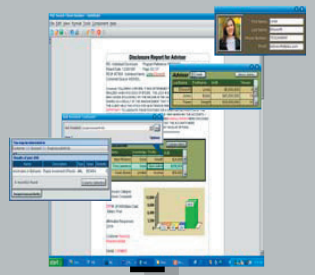
Event Capture

- –Dashboards
- –Rich Visualization
- –Thresholds & Highlights
- – In-context navigation
- -Live updates
- -Ad Hoc Discovery
- -Multiple Ops Systems



Monitoring & Analysis

- –Many types and sources of information
- –Save as 'smartlets'
- –Personalized view of common operating picture
- –Optimized Data Access

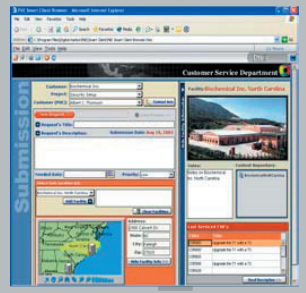


Case Management

- –Assemble the pieces
- –Show the relationships
- –Link different kinds of information (data with documents with internet with media)
- –Keep live data

Contextual Communication

- –Reports with Context
- –Live data in the report
- –Reusable Smartlets
- –Rapid Development
- –Easy Distribution
- –Common operating picture



Event Resolution

- –Action Oriented
- –Dynamic Workflows
- –Process UI for end users
- –Process Monitoring
- –Transactional

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SEMANTIC COMPOSITE APPLICATIONS

Anatomy of a solution: apply semantics at 3 levels…

(1) Composite UI

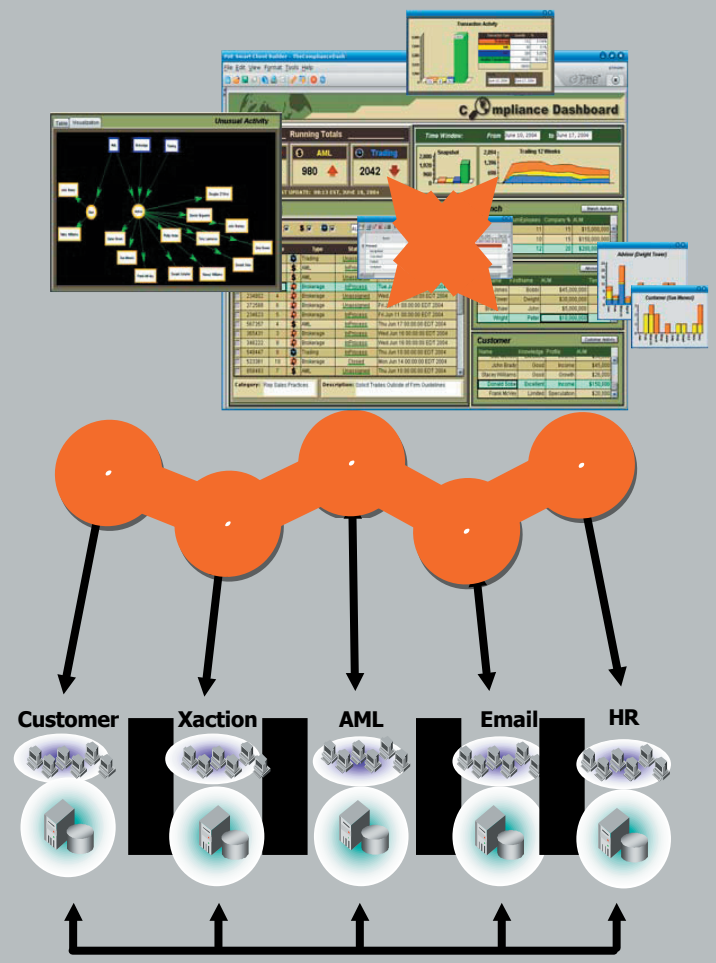
UI must persist and expose semantics such that users can interact with meaningful objects

(2) Composite schema (business ontology)

A business ontology describes the *semantics* of data relationships, workflow, and events

(3) Composite queries (EII)

Logically map multiple databases or web services as if they came from a single source



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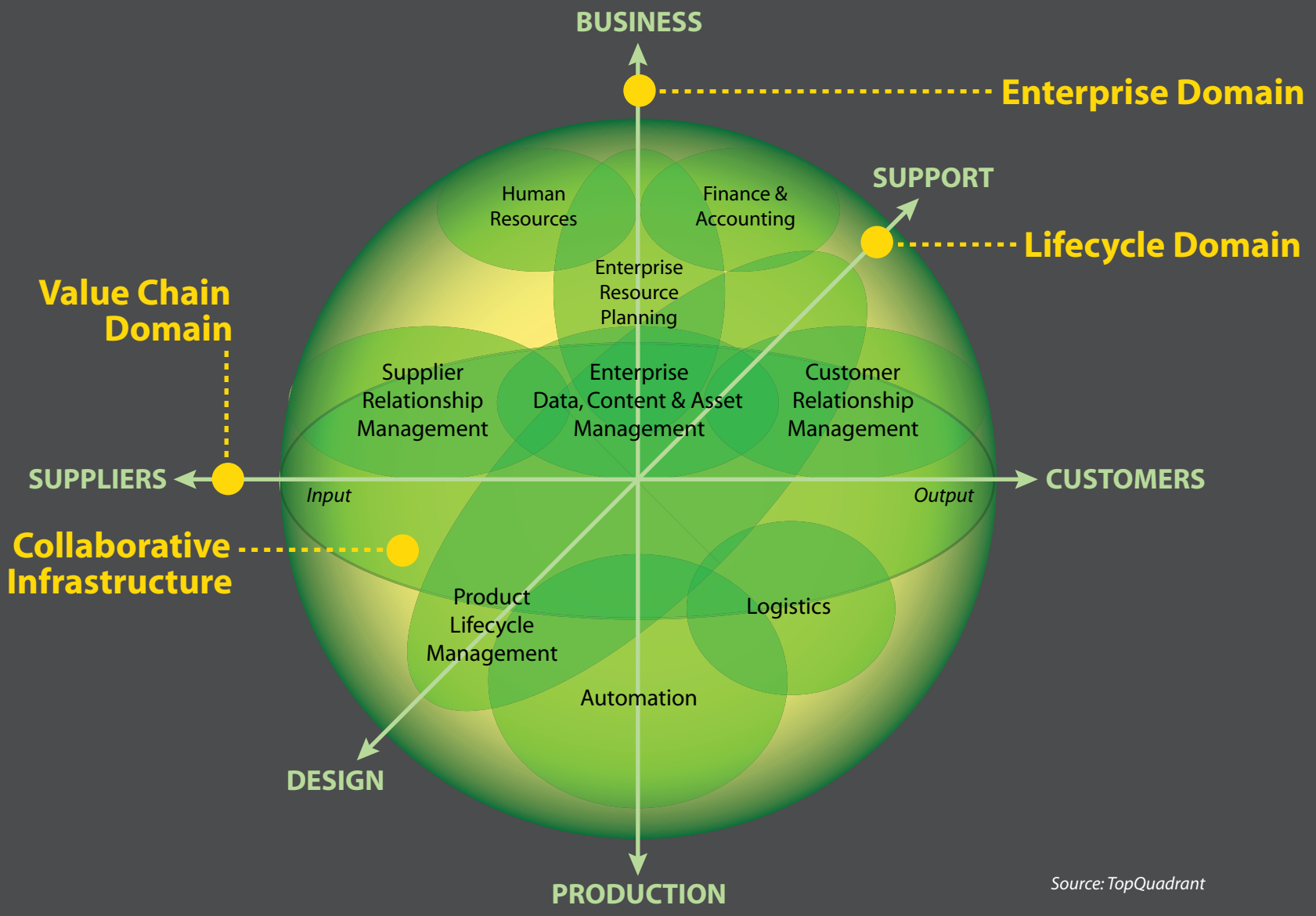
EARLY ADOPTION OF SEMANTIC TECHNOLOGY



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BUSINESS IMPACT

EFFICIENCY	EFFECTIVENESS	EDGE
Cost savings Doing the same job faster, cheaper, or with fewer resources than it was done before	*Return on assets* Doing a better job than the one you did before, making other resources more productive and increasing their return on assets and attain-ment of mission	*Return on investment* Changing some aspect of what the business does, resulting in growth, new value capture, mitigation of business risk, or other strategic advantage
IMPACT OF SEMANTIC TECHNOLOGIES		
20-80% less labor hours 20-90% less cycle time 30-60% less inventory levels 20-75% less operating cost 25-80% less set-up & development time 20-85% less development cost	50-500% quality gain 2-50X productivity gain 2-10X greater number or complexity of concurrent projects, product releases & units of work handled 2-25X increased return on assets.	2-30X revenue growth 20-80% reduction in total cost of ownership 3-12 month positive return on investment 2-300X positive ROI over 3-years

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LIFECYCLE VALUE AND ROI

Development Stage

Discovery → **Solution Delivery** → **Operation & Support** → **Growth**

Lifecycle Activities

Discovery	Solution Delivery	Operation & Support	Growth
Diagnose problem Envision solution Map ontology Make business case	Design semantic apps Build business ontology Connect resources Integrate & test Deploy	Use, operate solution Monitor, measure performance Maintain & support	Analyze new needs Add capabilities Upgrade solution Optimize performance

Semantic Technology Benefits

Discovery	Solution Delivery	Operation & Support	Growth
Explicit business case Knowedge needs modeled Interrelated data, system sources Value of legacy preserved Make, buy, rent, share options Flexible, federated architecture Less time/cost to prototype	Business ontology speeds data, process integration Composite applications give total picture, unified UI Capital outlay reduced Less time/cost to solution Faster time-to-market Faster return on investment Reduced development risk	Faster, better decision-making Cycle time, productivity improved Higher service levels Improved quality & reliability Less training and support Simplified maintenance Reduced operating cost Reduced total cost of ownership	Faster time to enhance Greater agility, flexibility Less capital re-investment Real-time optimization Faster time to deploy Reduced development risk Enhanced ROI

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