THE BUSINESS VALUE OF SEMANTIC TECHNOLOGY

From Vision to Mainstream Markets

2000 — 2010

Semantic Web Applications for National Security (SWANS)
April 7–8, 2005
Hyatt Regency
Crystal City, VA

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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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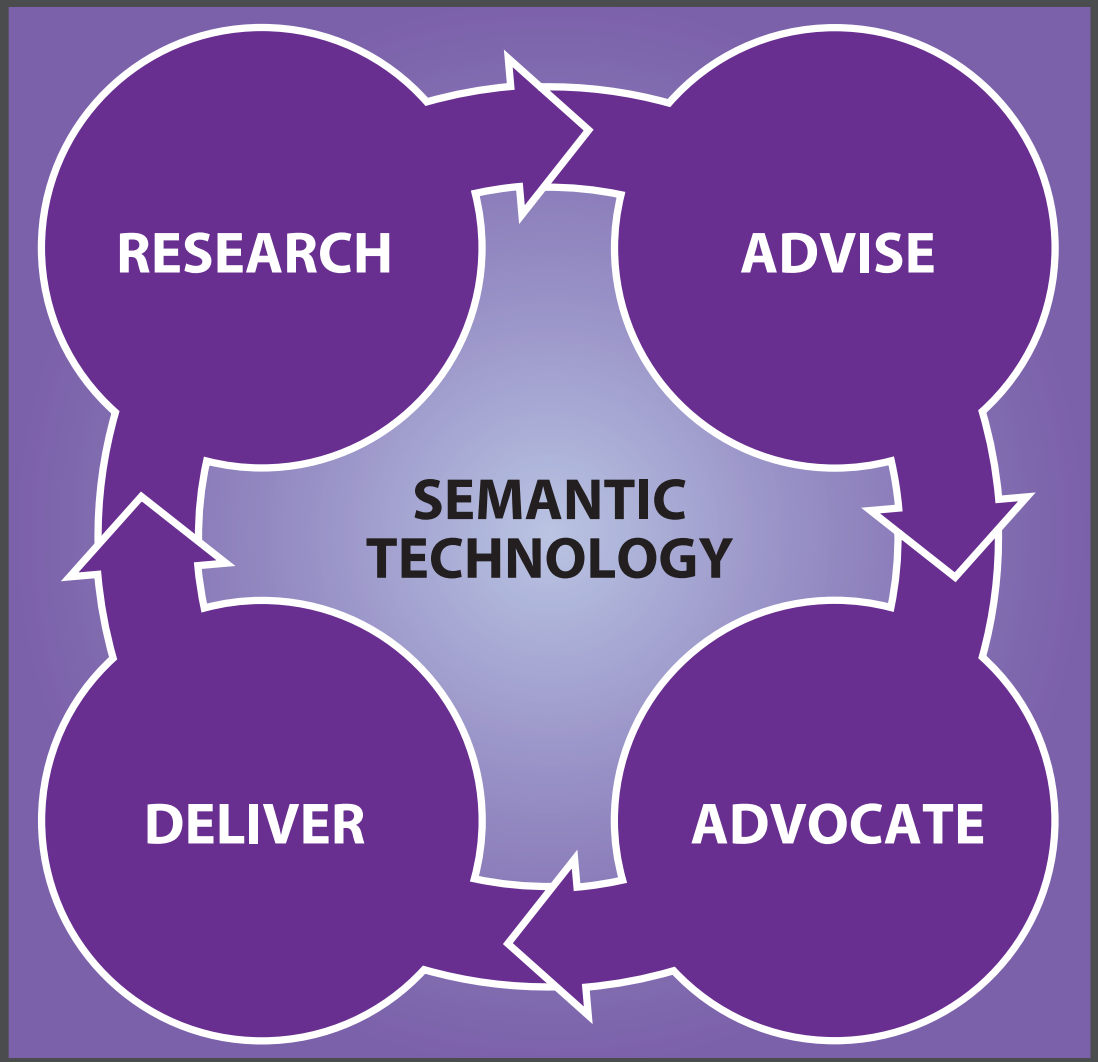

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TOPICS

- SICoP Module-2
- Evolution of the semantic wave
- Early adopter experiences
- Conclusions

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BUSINESS VALUE OF SEMANTIC TECHNOLOGIES

SICoP Module-2:

- WIKI:
  http://colab.cim3.net/cgi-bin/wiki.pl?SICoP
- Preliminary research:
  http://www.project10x.com/downloads/topconnexion/BusinessValue_v2.pdf
- Current focus: agency research
- Final report: September 2005

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KEY QUESTIONS

- How *"ready for adoption"* are semantic technologies?
- What *business problems* have *solution characteristics* that demand *capabilities* and *levels of performance* that can be met best with *semantic solutions* rather than another approach?

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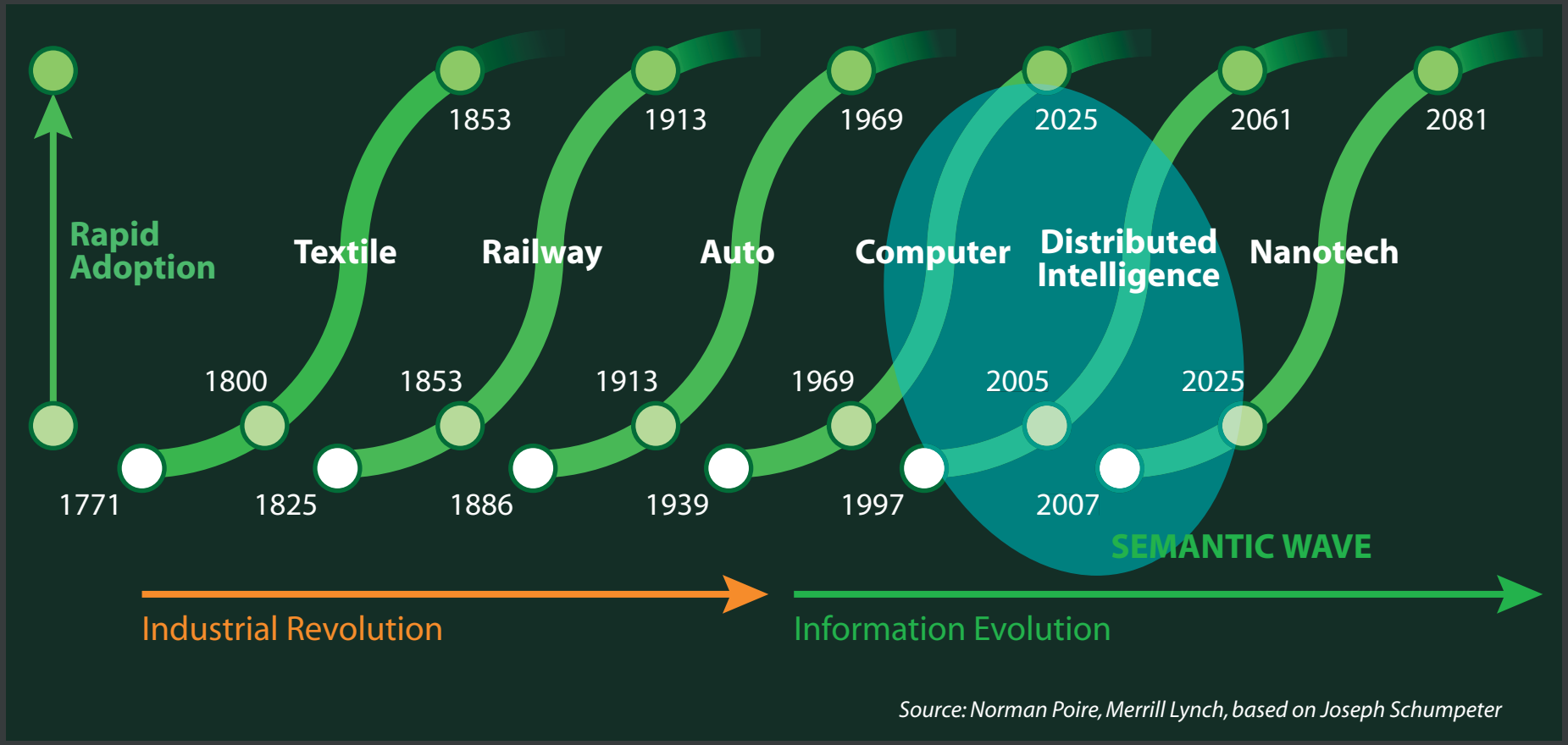
LONG WAVES OF INNOVATION...

What forces are driving the semantic wave?



Source: http://www.project10x.com/downloads/pubs/MDSeyboldPart1.pdf
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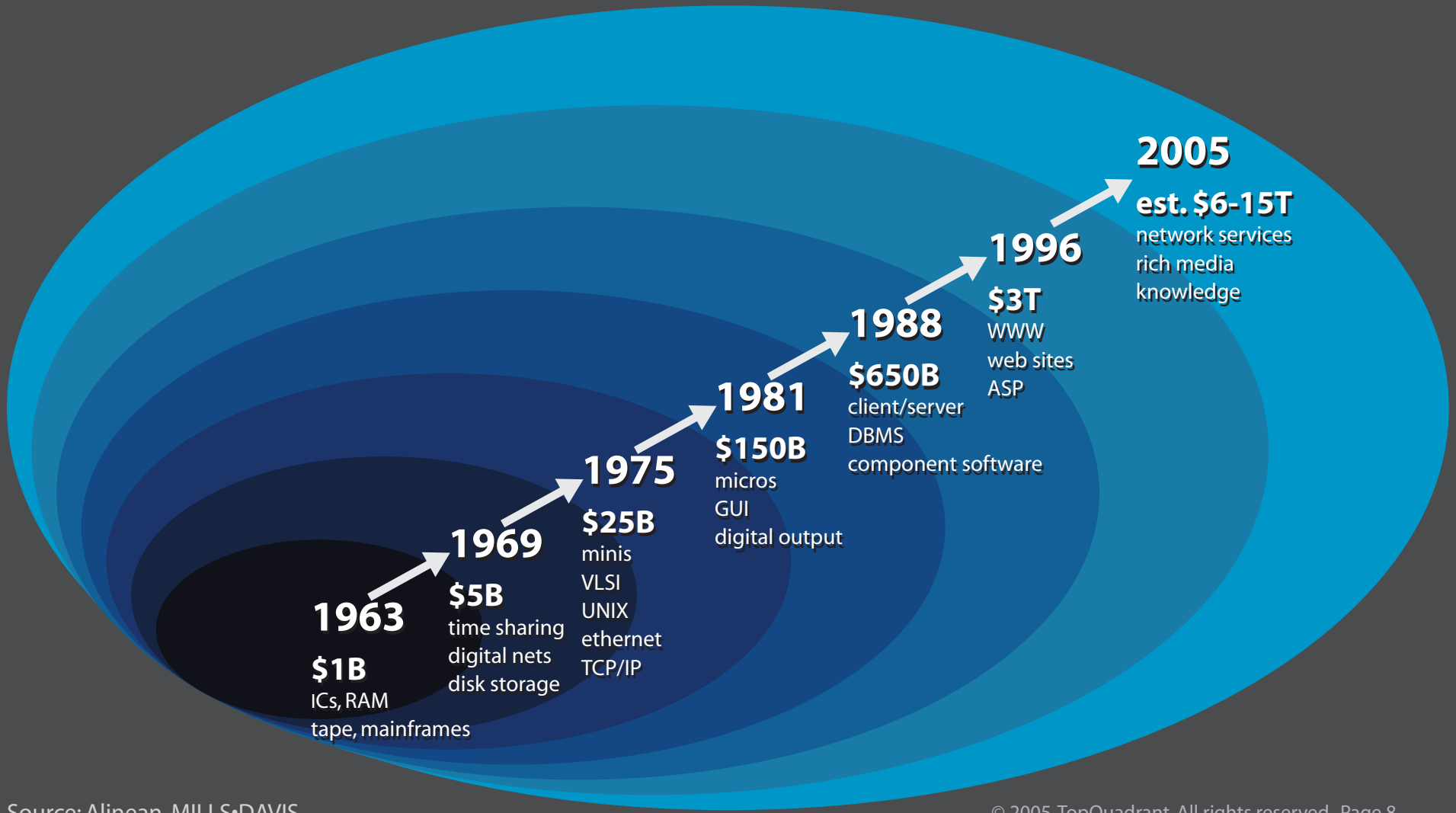
FUELED BY INVESTMENT CYCLES...

Next wave investment will dwarf previous cycles!



Source: Alinean, MILLS•DAVIS

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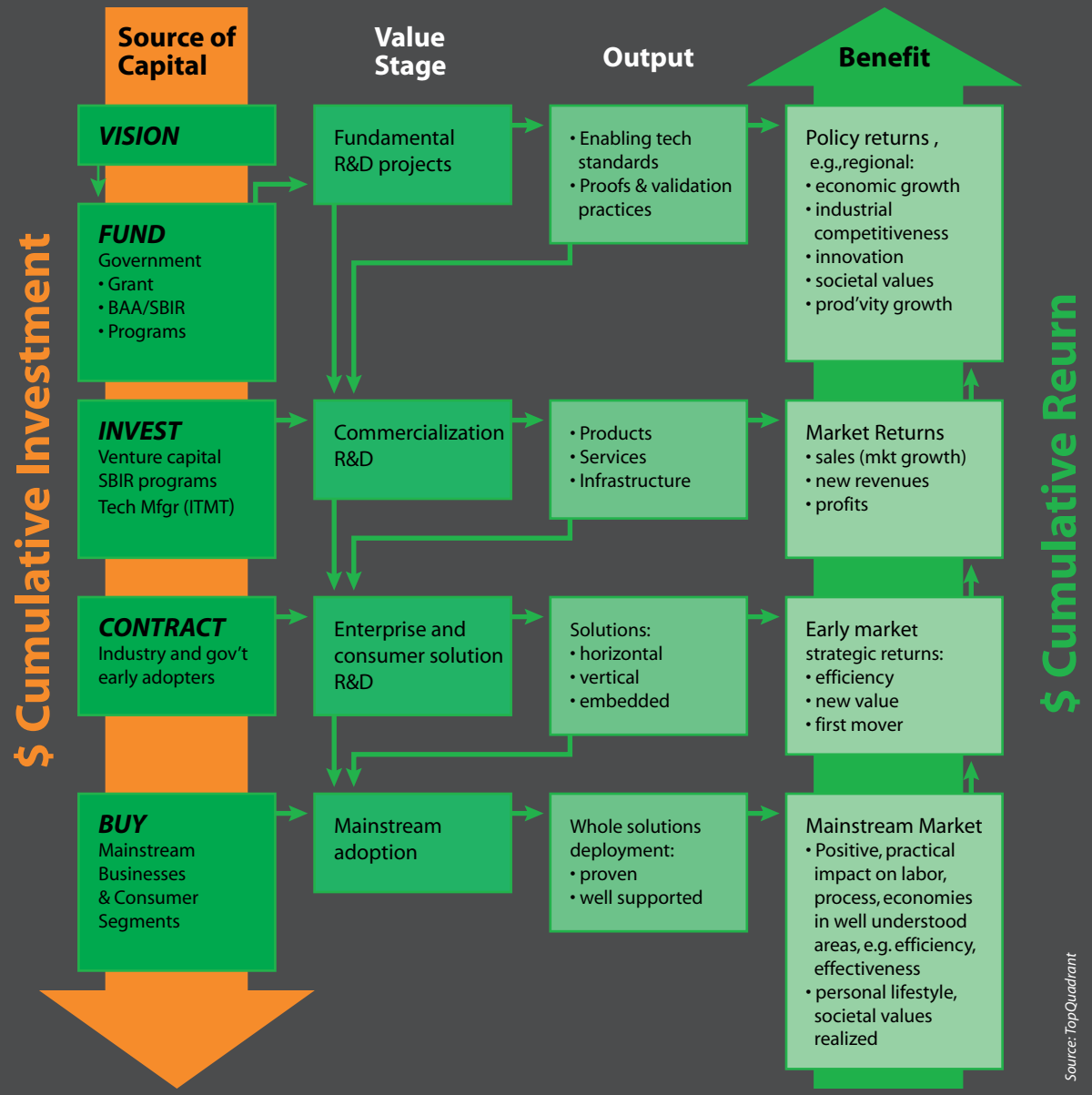
ANATOMY OF THE SEMANTIC WAVE



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

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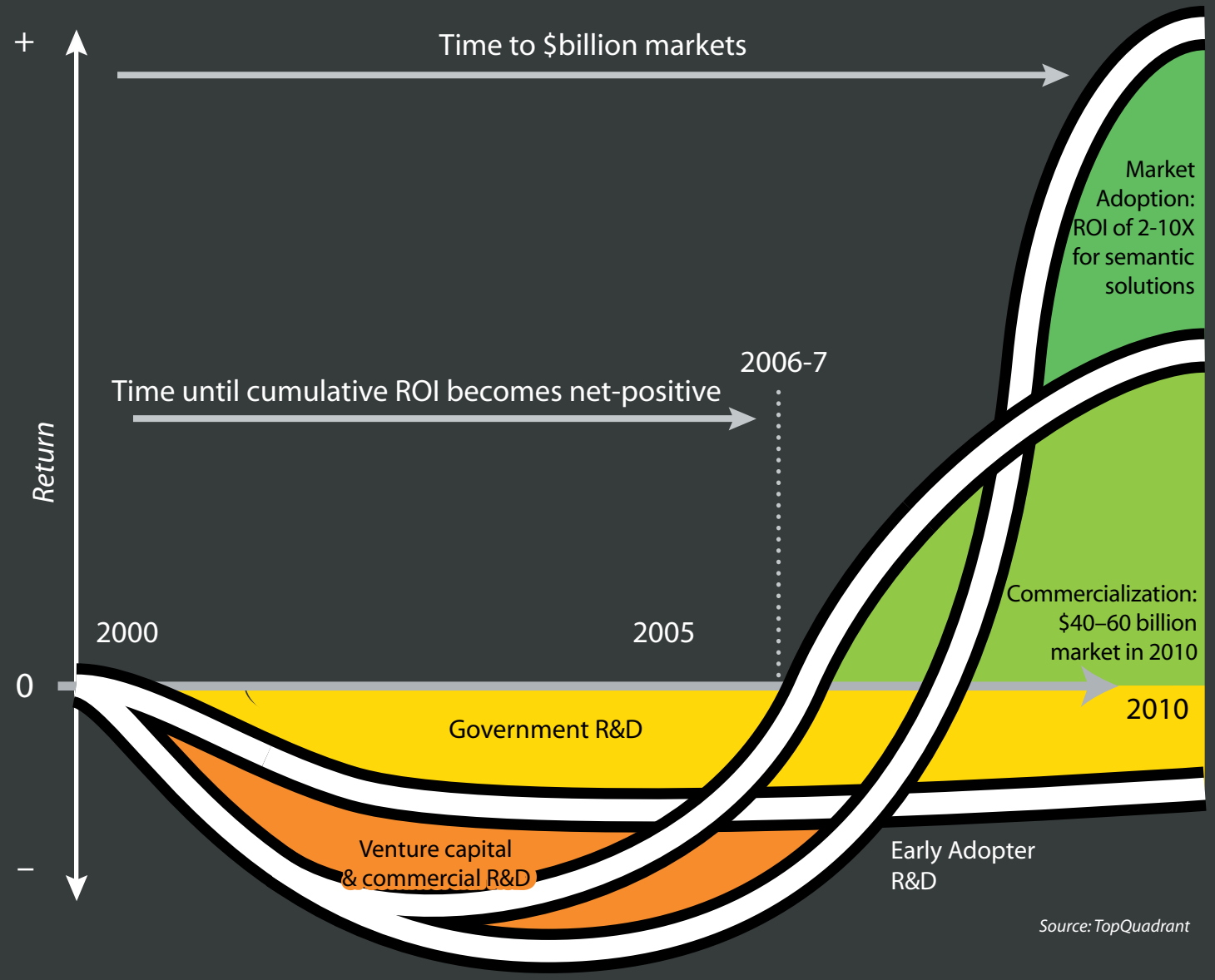
ECONOMICS OF THE SEMANTIC WAVE



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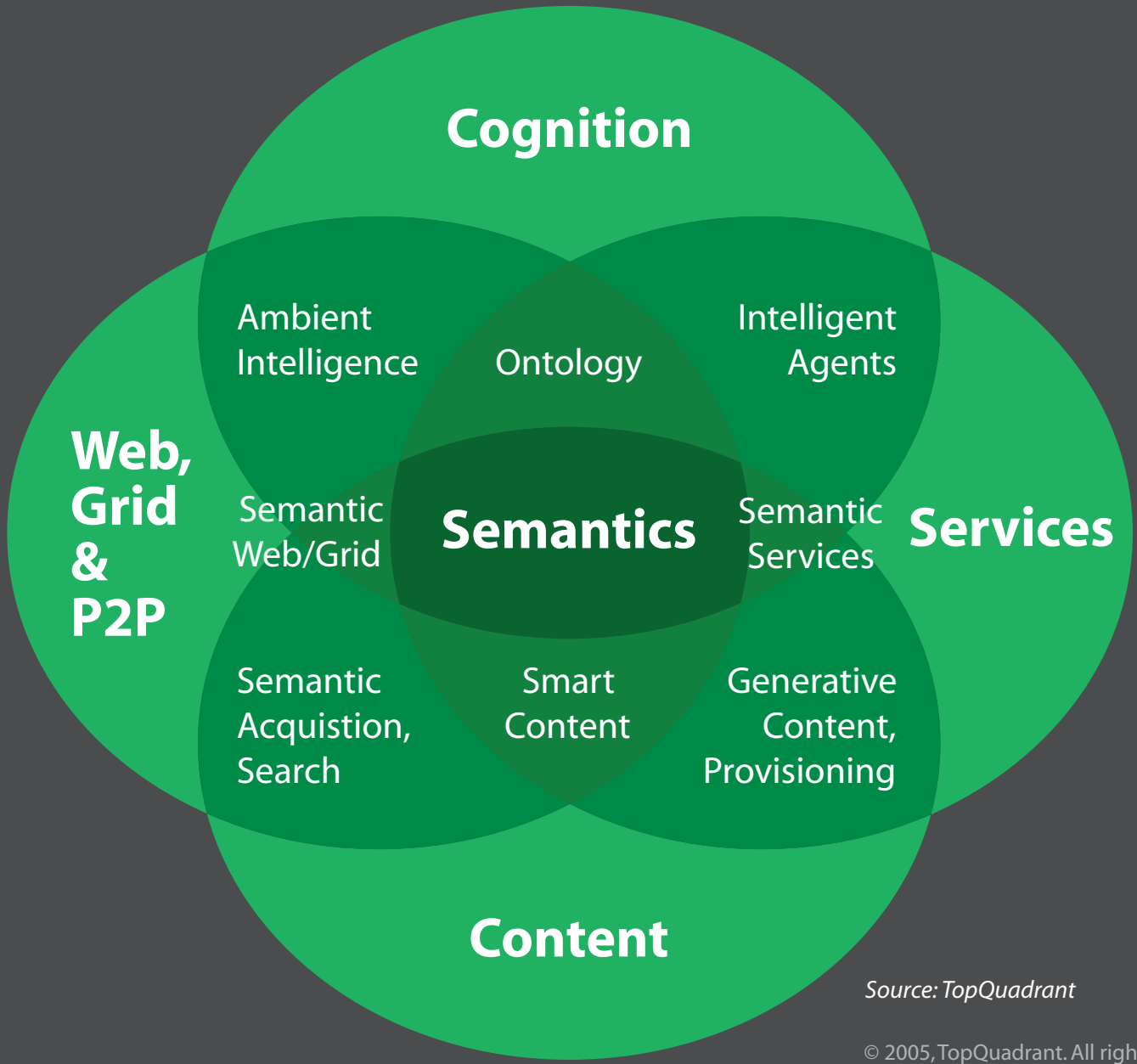
R&D THEMES IN THE SEMANTIC WAVE



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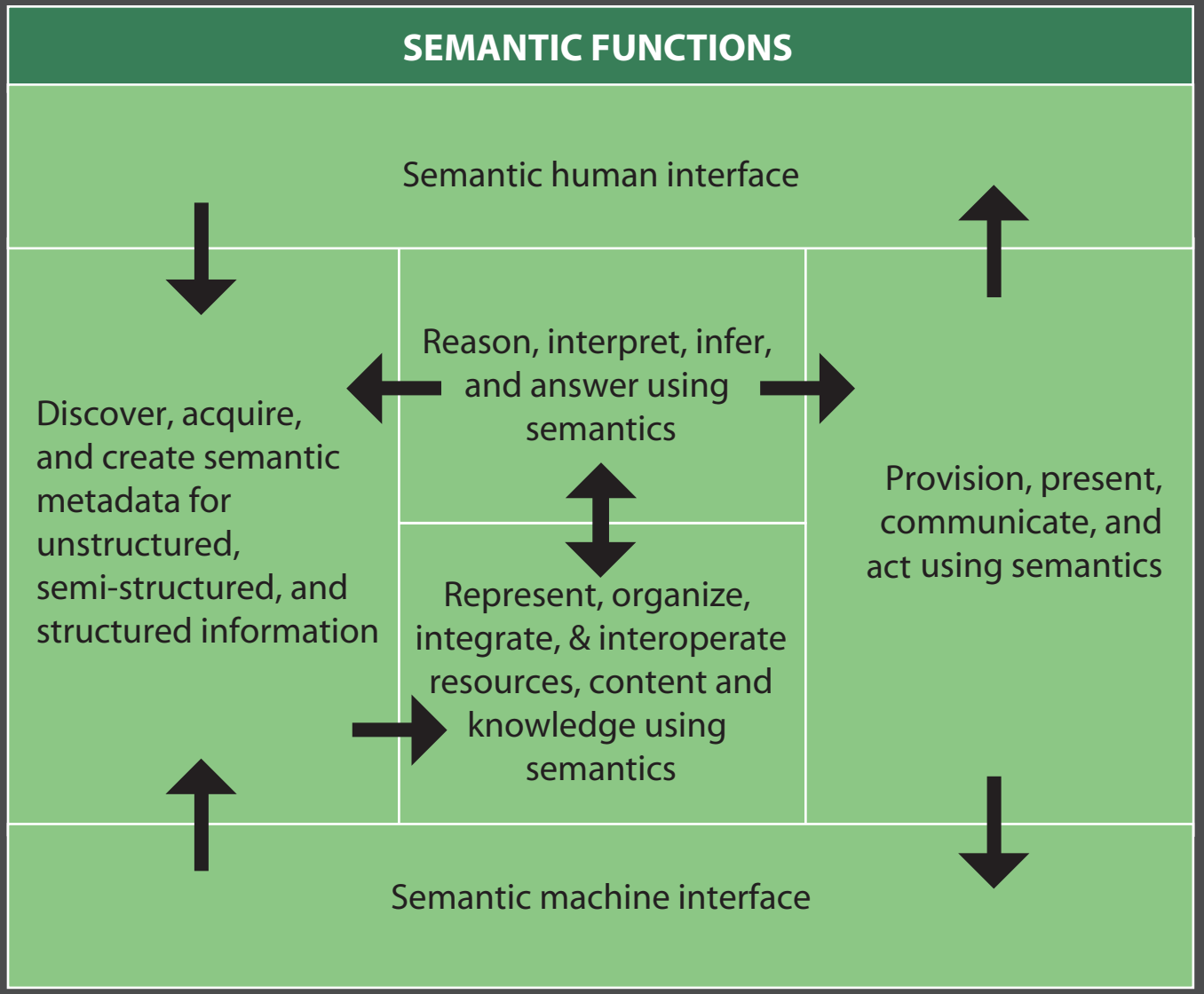
SEMANTIC FUNCTIONS



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COMMERCIALIZATION IN THE SEMANTIC WAVE

Technology Providers Developing Semantic Solutions

Active Navigation
Adobe
Aduna
AKT Triple Store
Amblit Technologies
Anacubis
Apelon
APR Smartlogik
Arbortext
Ask Jeeves
AskMe
Aspasia
Astoria Software
AT&T
Attensity
Autonomy
Avaki
BEA
Black Pearl
Blue Oxide
BrandSoft
Broadvision
Btexact
Business Objects
C24 Solutions
Captiva
Celcorp
Cisco
ClearForest
Clear Methods
CoeTruman Technologies
Cogito
CognIT
Cognos
Compositee
Compoze Software
Computas
Computer Associates
Conformative Systems
Connecterra
Connotate
Context Media
Contivo
Convera
Copernic
Correlate
Coveo Solutions
Crystal Semantics
Cycorp
Dassault Systems
DAY
Digital Harbor
Discovery Machine
EasyAsk
Ektron
EMC/Documentum
Empolis
Endeca
Engenium
Enigmatec
EnLeague Systems
Entopia
Entrieva
Epistemics Ltd.
Factiva
FAST
FileNet
GeoReference Online
Global360
Google
Grand Central
Groxis
H5 Technology
Hewlett Packard
Hummingbird
Hyperion
IBM
InfoData Systems
Informatics
Innodata (ISOGEN)
Intellidimension
Interwoven
Inxight
JARG
Kalido
Knowledge Foundations
Kofax
L&C
Merant
Metallect
Metamatrix
Metatomix
Miosoft
Modulant
Mondeca
Network Inference
Neurok
Noetix
nStein
NuTech
Ontologent
Ontology Works
Ontoprise
OpenText
Oracle
Pinnacor
Primus
Profium
Radar Networks
RedDot Solutions
Sandpiper Software
SAP
SAS
SchemaLogic
SeeBeyond
Semagix
Semanatic Sciences
Semansys Technologies
Semaview
Semio
Semtation GmbH
ServiceWare
Siderean
SilkRoad
Software AG
Sony
Stellent
Stratify
Sun Microsystems
Sybase
TEMISThe Brain
Thoughtshare
Triple Hop
Troux
Unicorn
Verity
VerticalNet
Vignette
Visual Knowledge
Vitria
XSB
ZeroG

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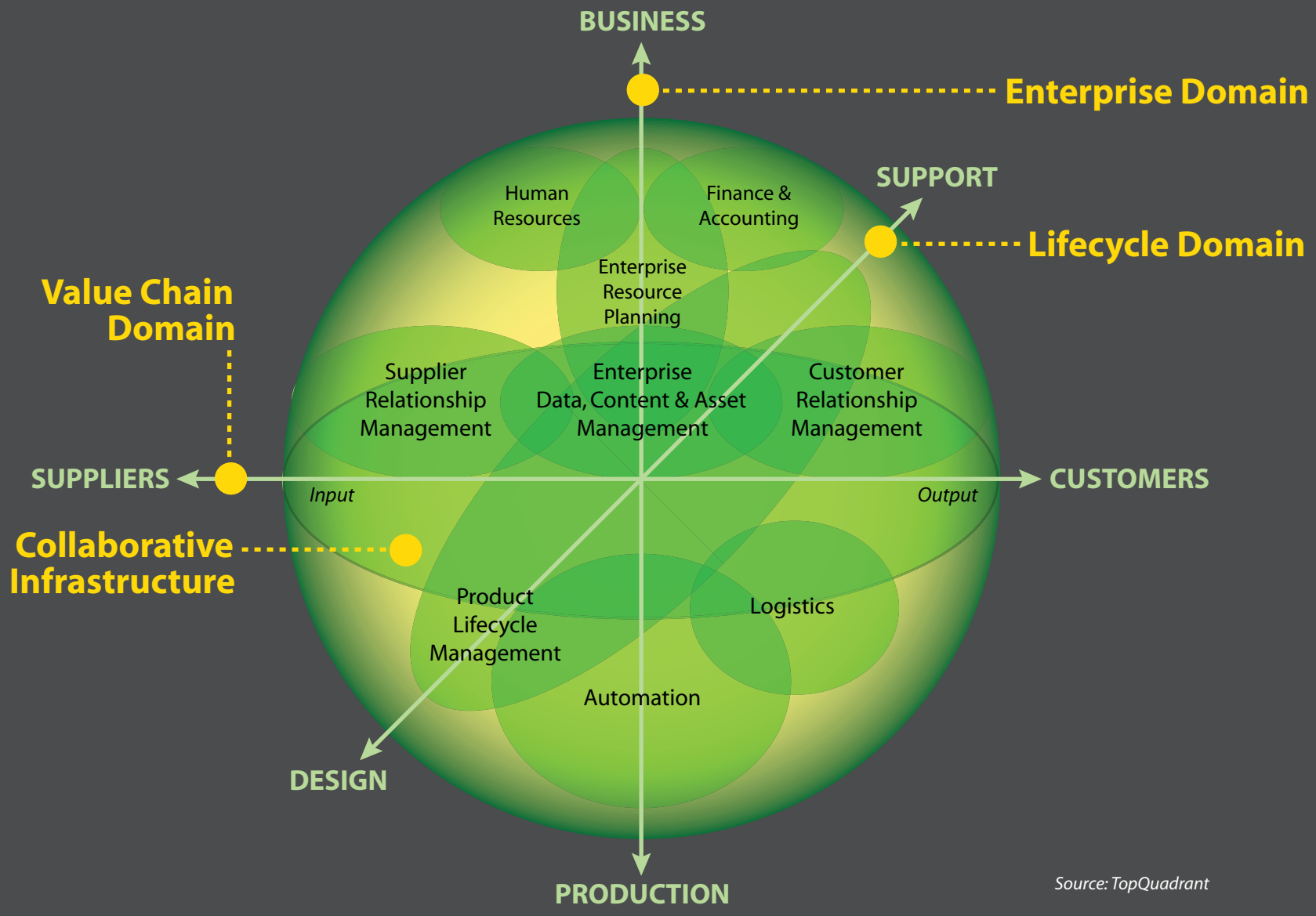
EARLY ADOPTION OF SEMANTIC TECHNOLOGY



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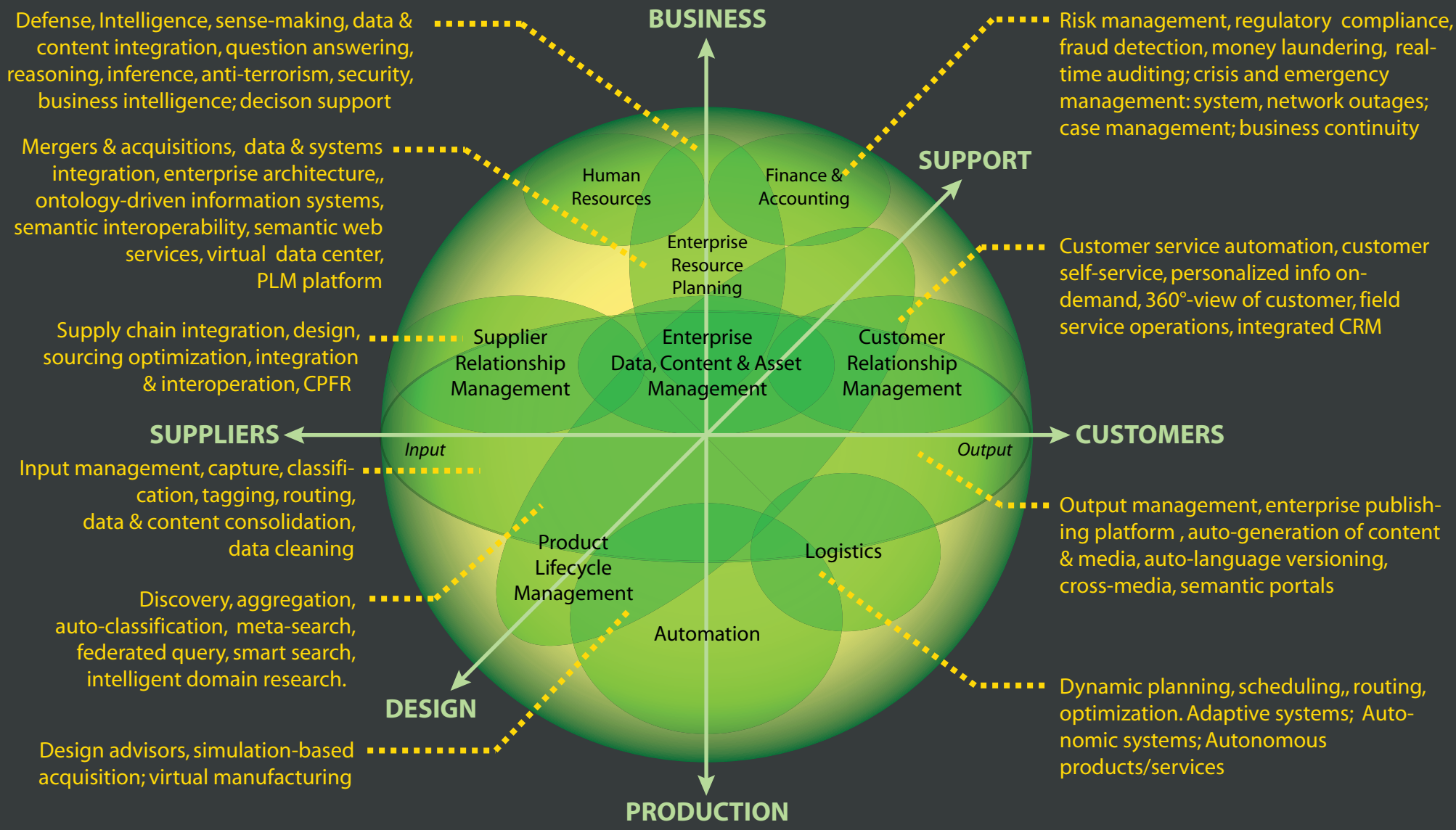
EARLY ADOPTION OF SEMANTIC TECHNOLOGY



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BUSINESS VALUE OF SEMANTIC TECHNOLOGIES

The acid test for any new technology or solution investment:

- Does it deliver the capability and performance that is needed?
- Do its benefits outweigh the costs and risks associated with making the change?
- Is its life cycle value superior to alternatives?

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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 attainment 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

Lifecycle Activities

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

Semantic Technology Benefits

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

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SUMMARY

- Global investment to develop semantic technologies by governments, venture capital, and industry will approach $15 billion this decade. Semantic solution, services and software markets will top $50B by 2010.
- More than 150 ITC companies have semantic technology R&D in progress, including most major players. 65 offfer products.
- Semantic technologies are "crossing the chasm" to mainstream use. Early adopter research documents 2 to 10 times improvements in key measures of performance across the solution lifecycle.

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REFERENCE

Presentation slides available at:

http://www.project10x.com/downloads/topconnexion/MD_BizValue2005_SWANS.pdf

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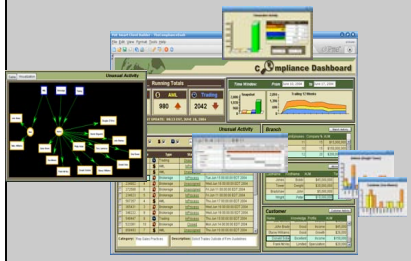
Example-1: Information in Context

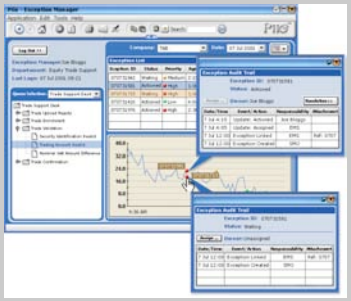
Many knowledge applications have a similar lifecycle…

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.



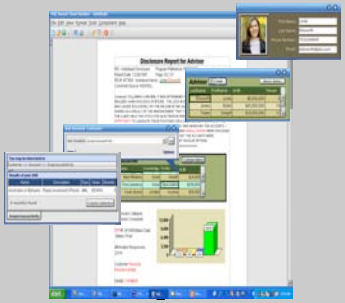
Event Capture

- –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

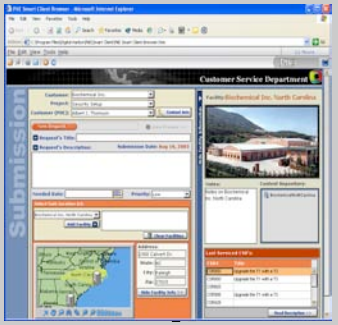


Case Management

- –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



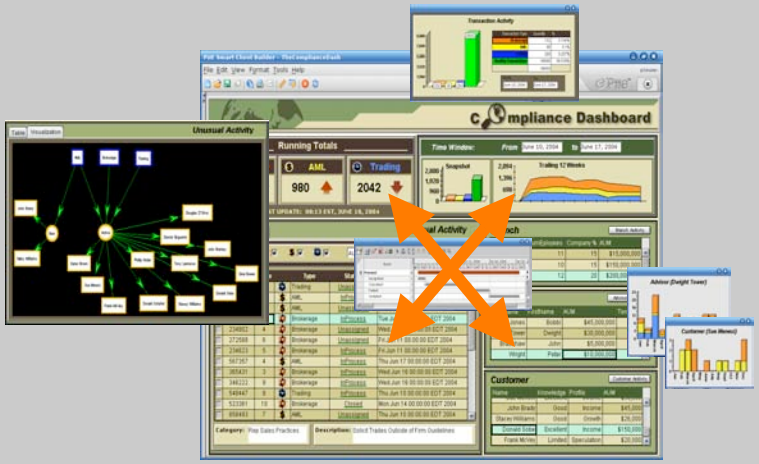
Event Resolution

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

Anatomy of a solution: apply semantics at 3 levels…

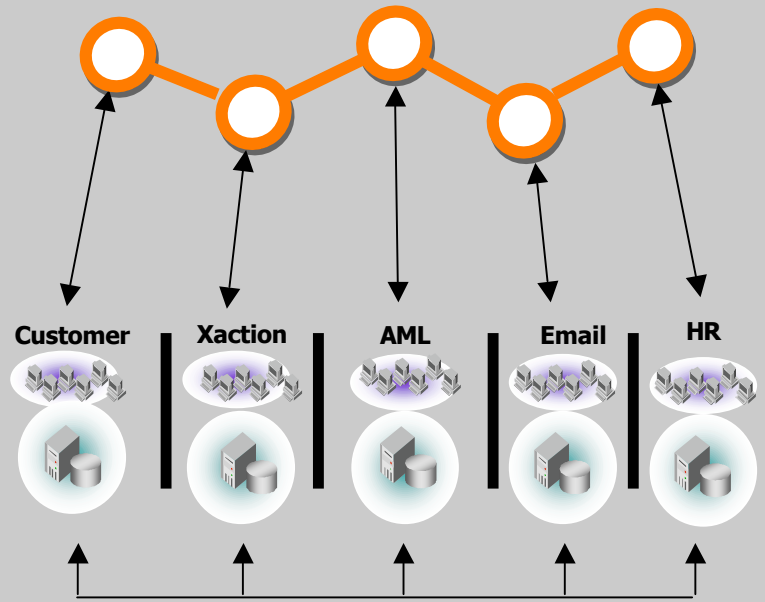
(1) Composite UI

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

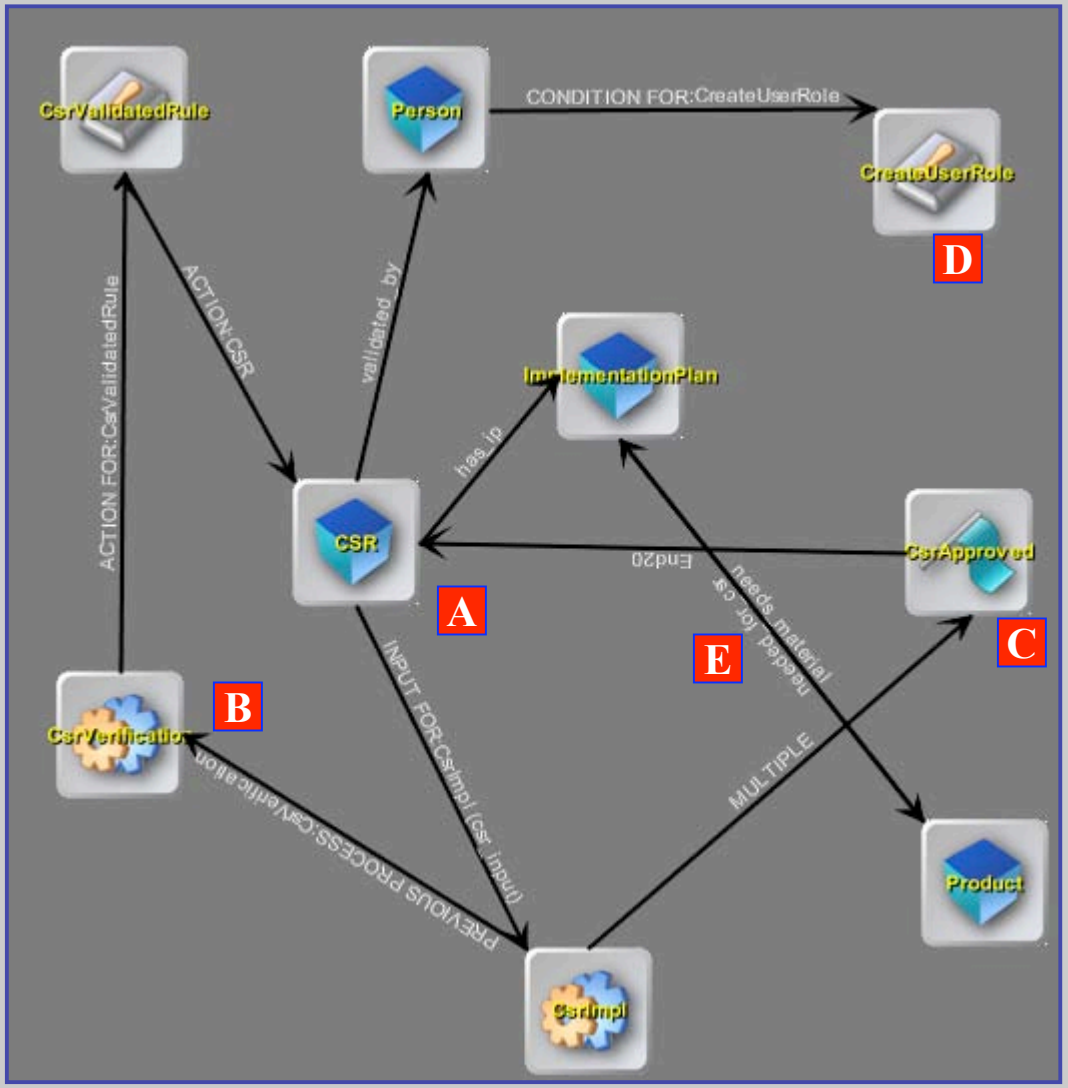


(3) Composite queries (EII)

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

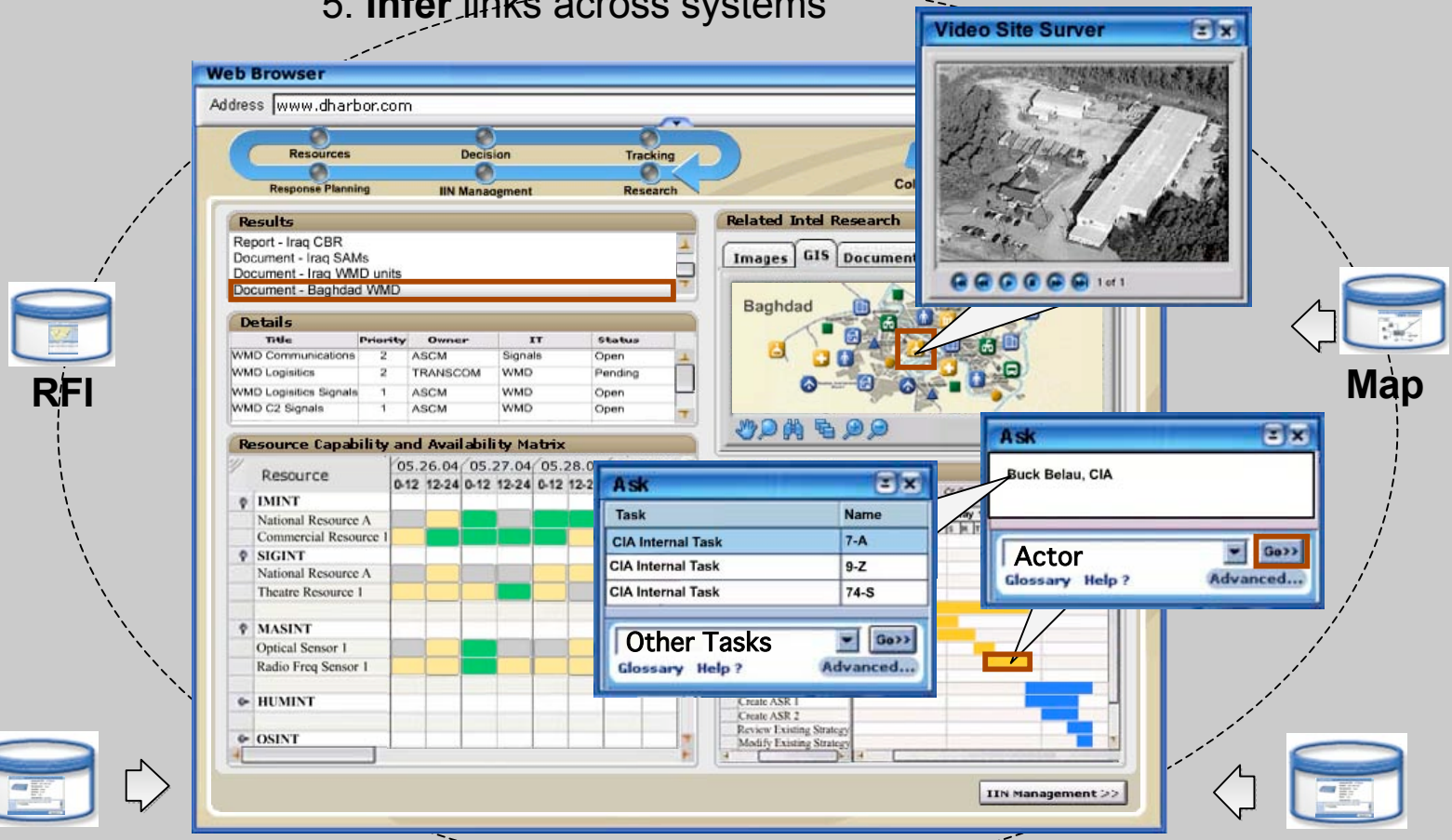
Business ontology: it leaves data in its physical source(s), but logically relates different *kinds* of information

- **A** **Entities**: Unified business concepts that map to one or more back end systems
- **B** **Processes**: Also known ad workflows, where entities are used as actors, resources, inputs and outputs
- **C** **Events**: Business events capture exceptions and serve as triggers for rules.
- **D** **Rules**: Business rules that are used to coordinate multiple workflows, define conditions and their associated actions
- **E** **Relationships**: In an Ontology all concepts are related either explicitly or implicitly



For example: a composite application for Defense

1. **Fuse** services from multiple applications
2. **Correlate** information in context
3. Drill down in **Real-Time**
4. **Ask** questions across databases
5. **Infer** links across systems

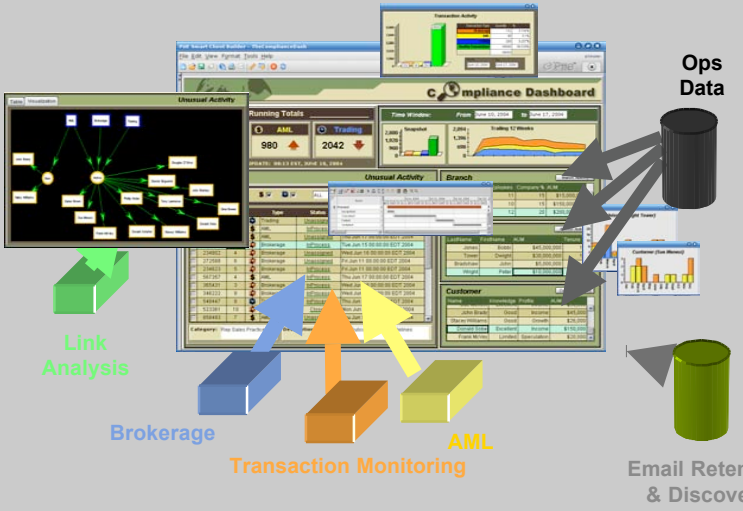


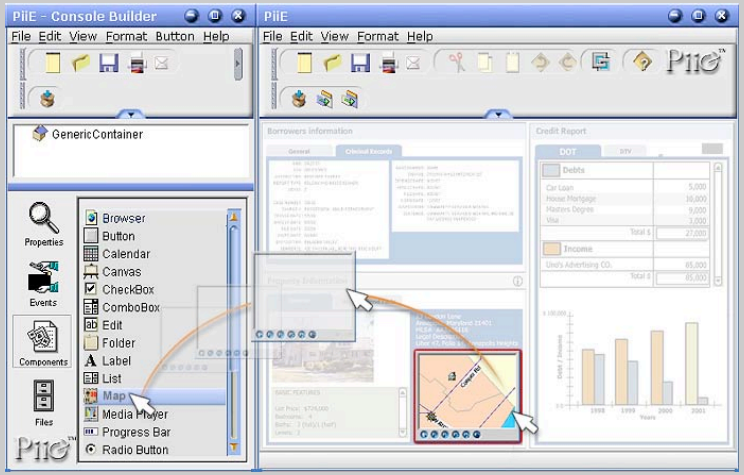
Key benefits: both business *and* IT

Value to users:

See information in context

- **Live app functionality in the UI**
- **Real-time interaction among systems**
- **Ask questions on objects**
- **Understand and act in context**
- **Situational awareness**





Value to IT:

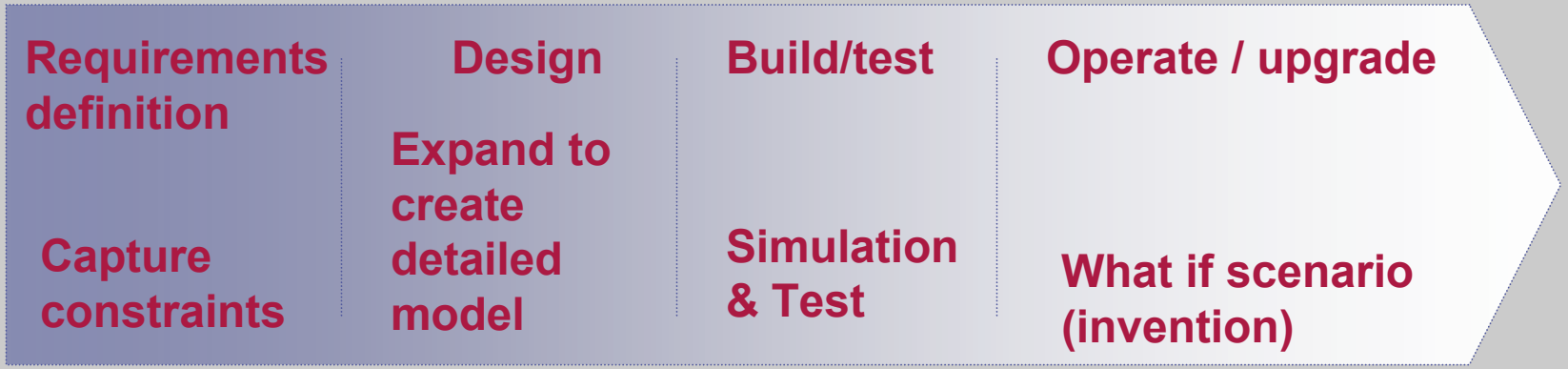
"Upside-down" integration

- **Radically reduce time, cost, skill to build**
- **Point and click assembly**
- **SOA to isolate changes**
- **Combine UI, workflow, data, and events**
- **Integrate incrementally**

Example-2: Semantic Enterprise Integration

Model-based support for vehicle and mission support life-cycles…

Typical lifecycle



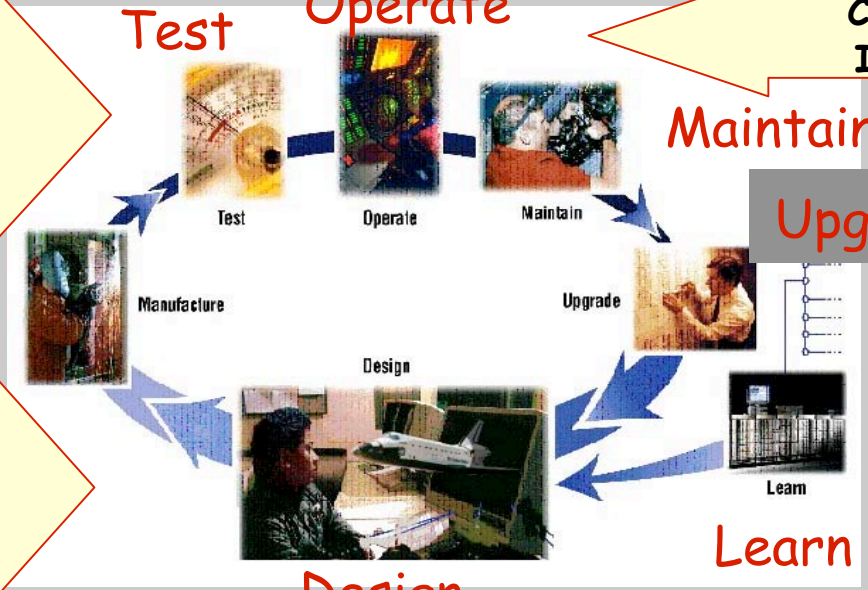
Model-based procurement

Model-based operations & sustaining engineering

Problems of engineering complex systems…

System Engineering:
Reliability, Performance, Risk Mitigation, Impact Analysis, FMEA

Command and Control, Incident Management



Acquisition:
Analysis, Trades, Decision Support, Lessons Learned

Acquisition:
Analysis, Trades, Decision Support, Lessons Learned

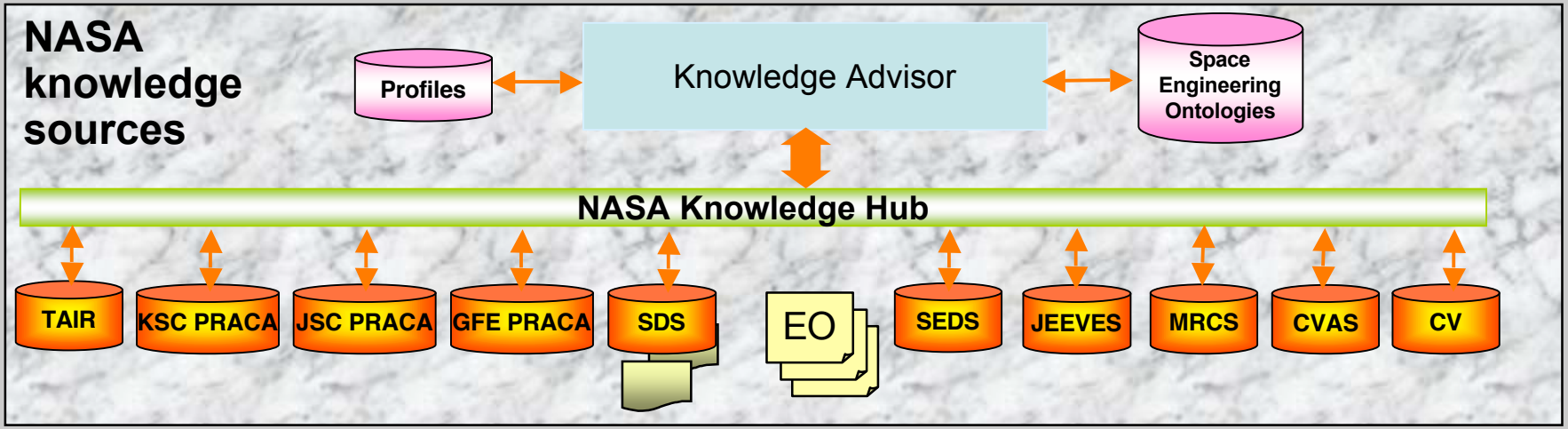
NASA and Contractor Personnel

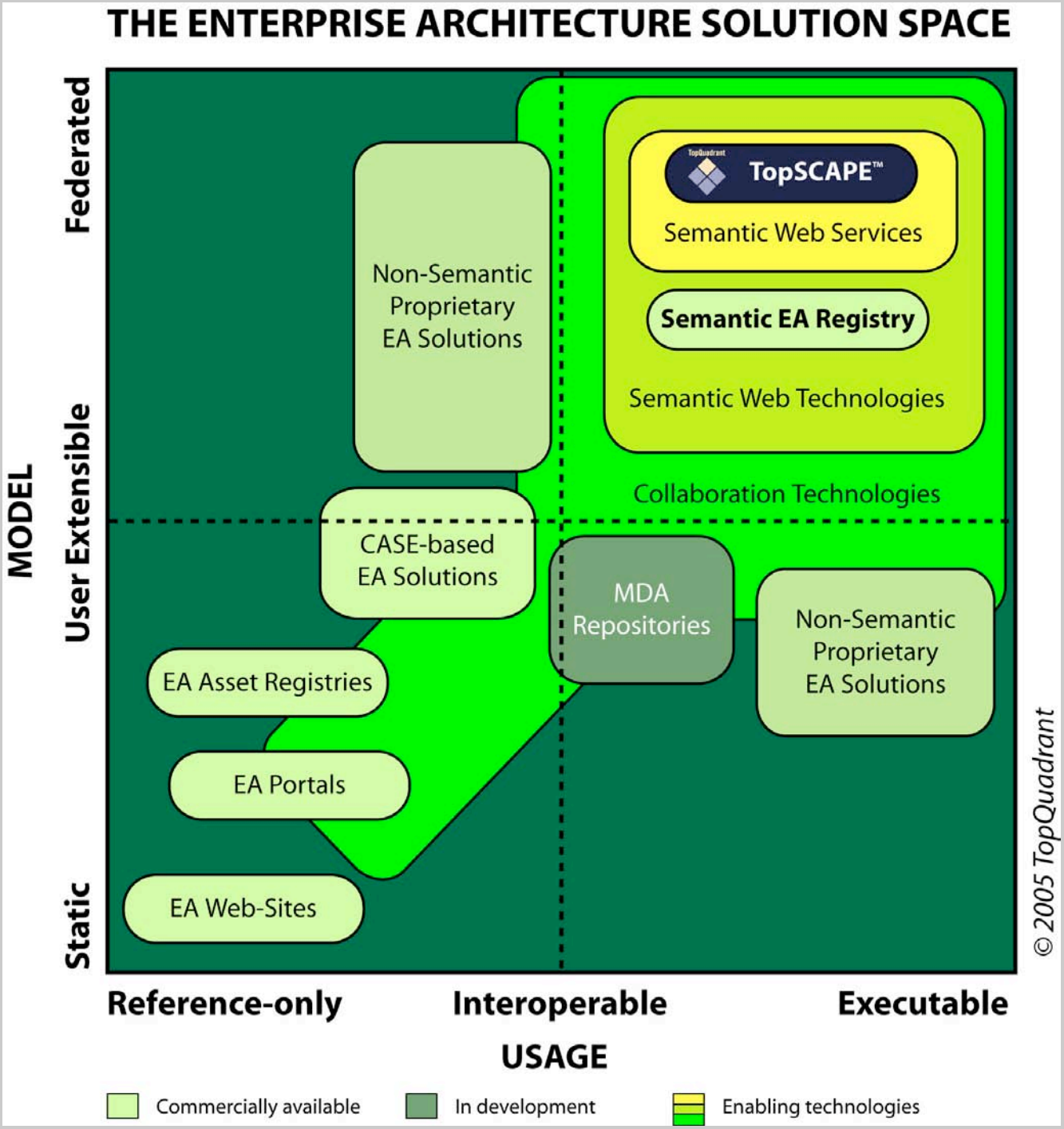
NASA Systems

TAIR | KSC PRACA | JSC PRACA | GFE PRACA | SDS | EO | WAVE | SEDS | MRCS | CVAS | CV

The Solution…

- Ontology architecture
  - *Enterprise-wide, lifecycle-wide, "incremental and iterative"*
- Ontology models
  - *Model-based support of engineering activities - multi-discipline*
- Build semantic engine infrastructure
- Needs you to:
  - *Start learning, start thinking "federated", deploy early and often*




THE ENTERPRISE ARCHITECTURE SOLUTION SPACE
MODEL
Federated
User Extensible
Static
TopSCAPE™
Semantic Web Services
Semantic EA Registry
Semantic Web Technologies
Non-Semantic Proprietary EA Solutions
Collaboration Technologies
CASE-based EA Solutions
MDA Repositories
Non-Semantic Proprietary EA Solutions
EA Asset Registries
EA Portals
EA Web-Sites
Reference-only
Interoperable
Executable
USAGE
Commercially available
In development
Enabling technologies
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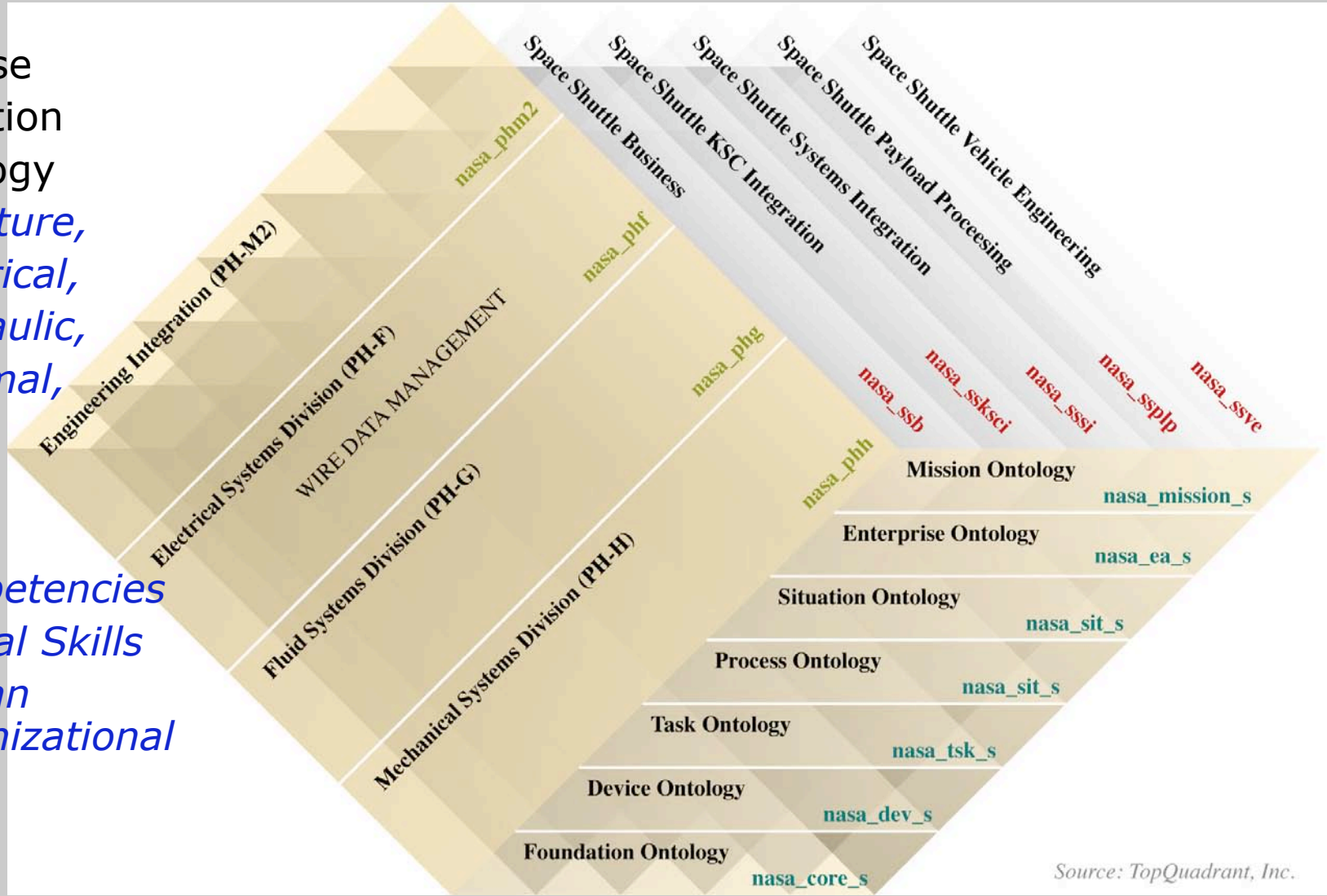
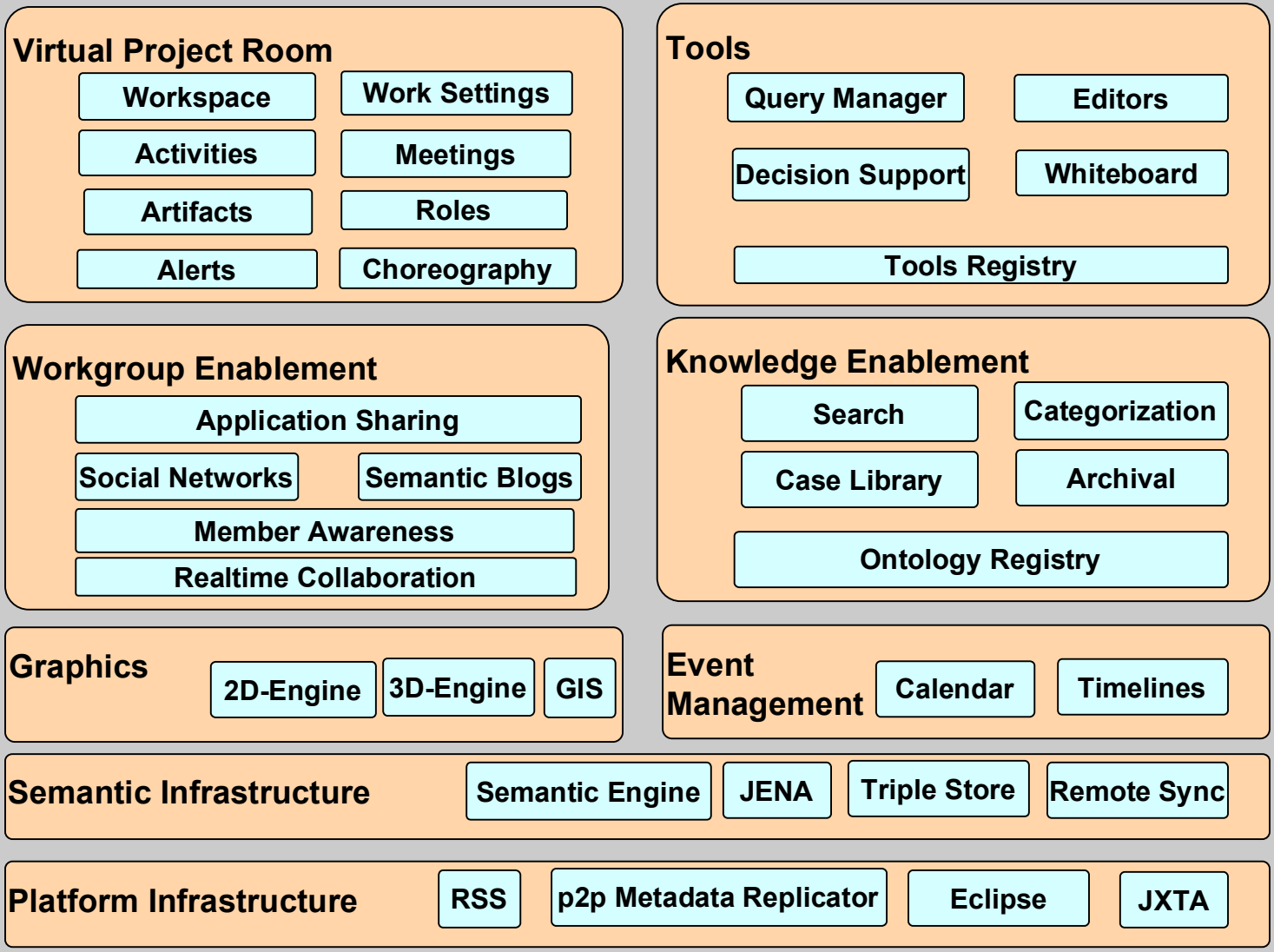
Ontologies: Backplane of semantic enterprise

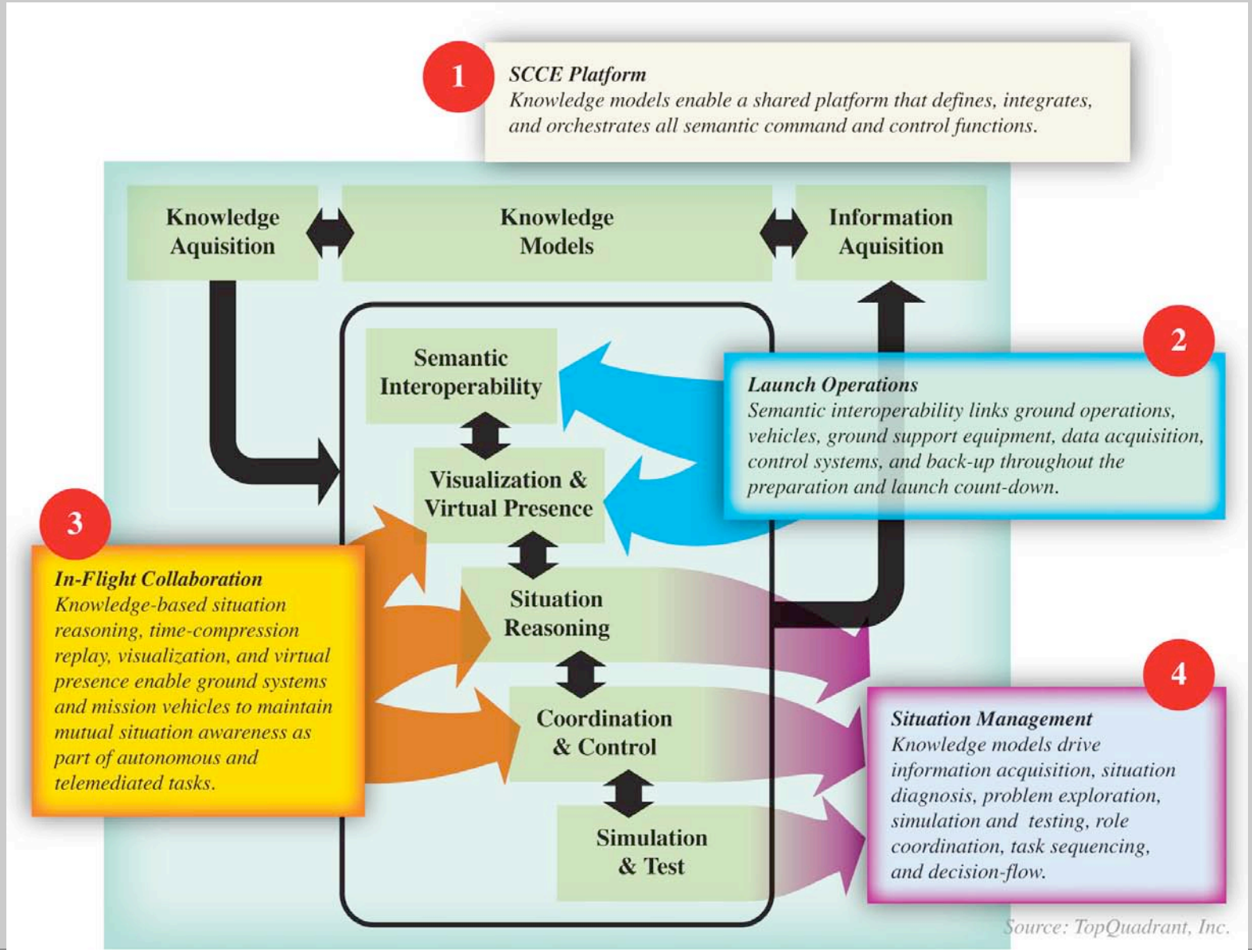
- Enterprise
- Information
- Technology
  - *Structure,*
  - *Electrical,*
  - *Hydraulic,*
  - *Thermal,*
  - *…*
- Lifecycle
- Social
  - *Competencies*
  - *Critical Skills*
  - *Human Organizational Risks*



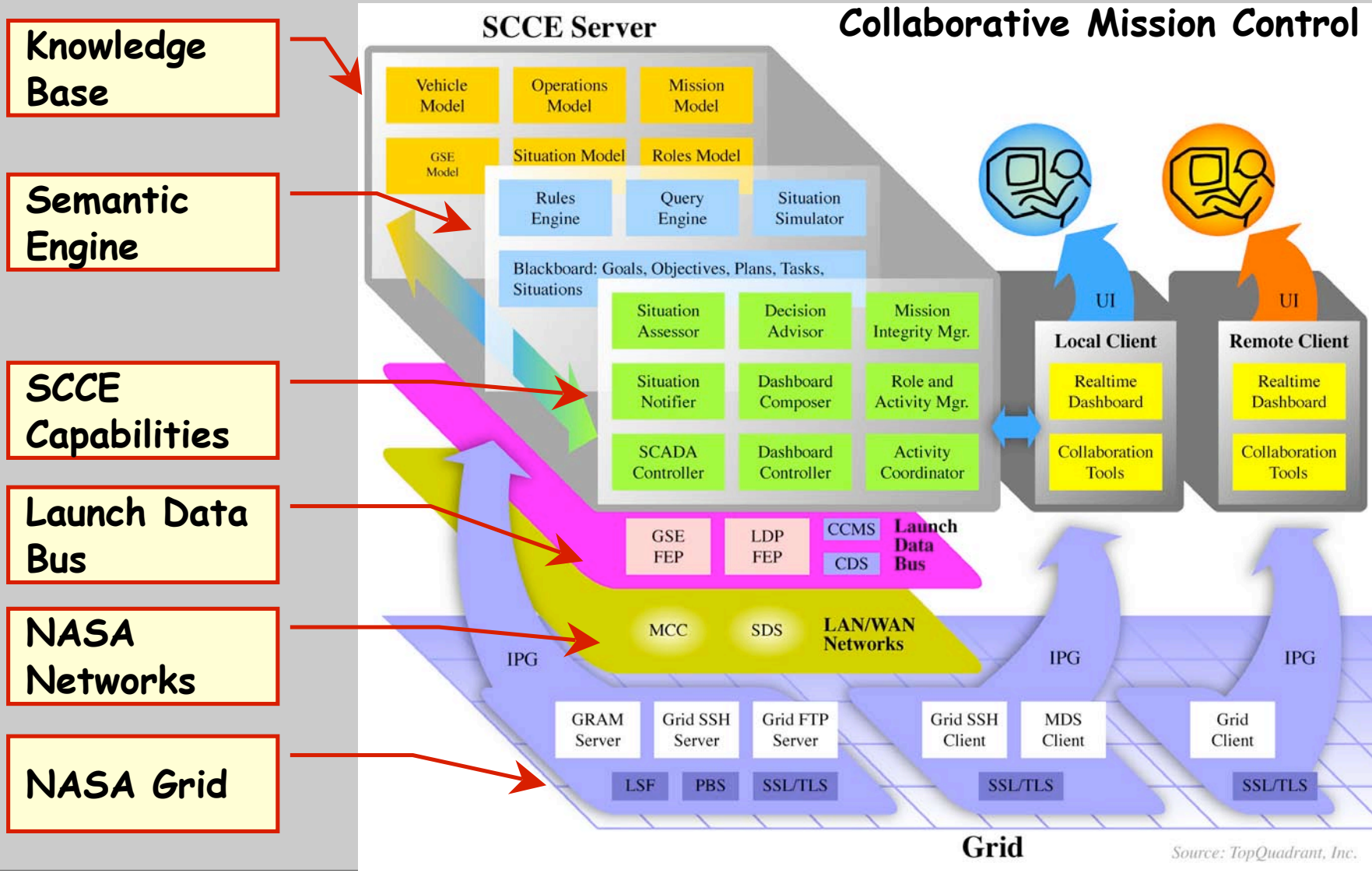
Semantic collaborative environment architecture:



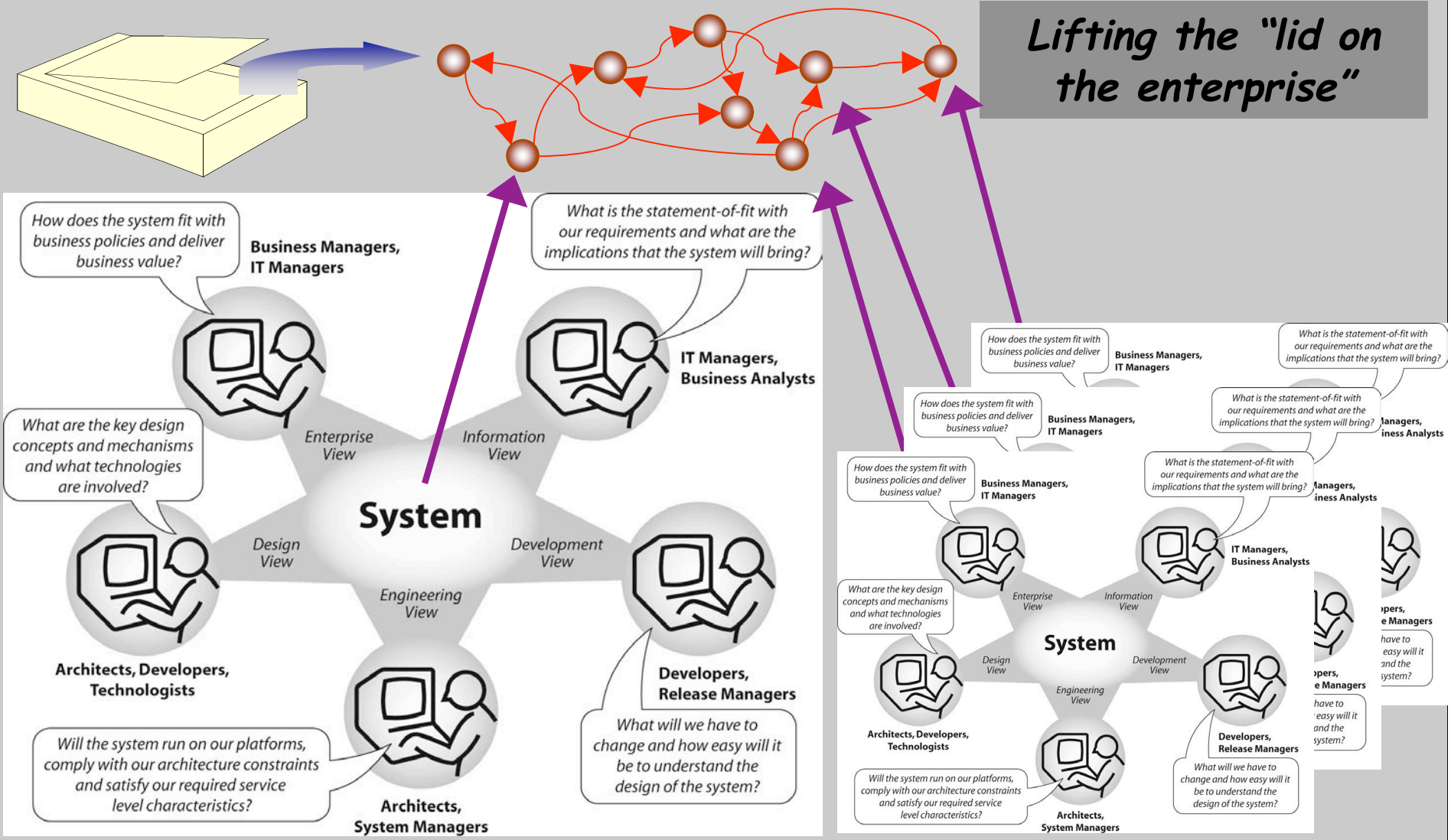
Semantic command and control: knowledge-based capabilities



Semantic command and control: conceptual architecture



Semantic enterprise architecture is the only way to manage *systems of systems*…



3. Some case study precis

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SEMANTIC EAI

BUSINESS PROBLEM

- Global 2000 corporation needed to speed the process and reduce the cost and effort required to integrate enterprise business processes and applications across multiple locations.
- Maintaining point-to-point data transformation was becoming unsustainable. It was becoming cost-prohibitive to make changes in underlying data sources, message formats, and business rules since critical business logic and metadata was locked into proprietary applications and middleware.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based semantic information model providing leverage for integrating enterprise applications and data.
- *Efficiency gain* — High-level ontology-mapping reduces time and effort to integrate. 2-5X faster solution delivery. Reduced training and support and operating costs. Faster time to upgrade and enhance.
- *Effectiveness gain* — Enterprise processes and data sources map to each other through a common metamodel. Semantic development environment accelerates new & composite application deployment. Semantic portal puts information in context of total process, other applications, and all data sources.
- *Edge* — Reduce TCO by 20-65%. Financial exposure and developmental risk mitigated.

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IT INFRASTRUCTURE RATIONALIZATION

BUSINESS PROBLEM

- A global financial services provider needed to overcome shackles of its client-server architecture.
- It needed only 6 databases to operate, but found it had more than 80 copies of some of these.
- New infrastructure solution and roadmap needed to decouple applications from data, eliminate redundancies, and provide higher quality data.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology meta-modeled information integration mapping data sources and interrelationships.
- *Efficiency gain* — Operations, maintenance, and future development costs greatly reduced. Savings over 5 years in $10s of millions.
- *Effectiveness gain* — Ontology decoupled applications from data. Eliminated 1/2 of redundant databases. Ontology permits creation of data transformations and "virtual databases" and 'virtual data warehouses" providing real-time integrated queries across federated sources, with improved data control and quality.
- *Edge* — Faster time to deployment than conventional approaches. Substantially reduced TCO.

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SCALABLE SEMANTIC SEARCH

BUSINESS PROBLEM

- Manufacturer needed a federated enterprise search capability that would scale to massive numbers of records, but whose performance (numbers of queries per second) would not degrade as with RDBMS or OODBMS indexing.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-driven graph database search.
- *Efficiency gain* — RDBMS and OODBMS search required indexing at each step; thus performance degraded as L log (N) where L is the path length and N is the number of records. Semantic graph database performed at scale because it required no indexing, eliminating the log (N) from the performance equation.
- *Effectiveness gain* — Graph-based search proved more than 10X faster than traditional query and delivered relatively constant performance regardless of number of records being searched.
- *Edge* — Scalable federated enterprise search.

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VIRTUAL DATA CENTERS

BUSINESS PROBLEM

- A financial services firm needed scaleable architecture for provisioning and managing IT across 1000s of databases, applications, and locations.
- Current fragmented situation was an operational cost time bomb.

SEMANTIC SOLUTION

- *Semantic solution — Ontology-based semantic service grid; policy-driven virtual data centers; autonomic components (self describing, self-provisioning)*
- *Efficiency gain — Development cost 25% of traditional. Operational savings > $4M per year (fewer people).*
- *Effectiveness gain — Running 24 hours/day for several years.*
- *Edge — More sustainable IT infrastructure. Reduced TCO. Resources freed for new development.*

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SEMANTIC SCM VIA SERVICE PLATFORM

BUSINESS PROBLEM

- Fortune 1000 company needed to integrate data and processes internally and with supply chain partners, while minimizing capital investment, time-to-solution, and total cost of ownership.

SEMANTIC SOLUTION

- *Semantic solution* — Semantic web service based shared resource platform for EAI, BPM, and B2B.
- *Efficiency gain* — No hardware, software, staffing. No maintenance or upgrade fees. TCO reduced up to 70%.
- *Effectiveness gain* — Fast partner on-boarding. Simple, self-service provisioning. Flexible change management.
- *Edge* — Service-oriented shared resource architecture enables faster ROI. No up-front investment. No fire-wall exposure. Readily scaleable, subscription based.

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SIMULATION-BASED ACQUISITION

BUSINESS PROBLEM

- Government agency needs solution to better manage the lifecycle of complex systems-of-systems acquisitions.
- Solution must allow agency management to carefully align technologies to strategy, make better design decisions sooner, mature technologies well before deployment, build in partnership with an extended network of industry suppliers, accelerate time to deployment, and drive down lifecycle costs.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-driven simulation based acquisition (SBA) environment.
- *Efficiency gain* — External representation of concepts, relationships, logic and constraints speeds collaborative development and allows economical sharing, reuse, and evolution of capabilities across stages and organizations involved in a project.
- *Effectiveness gain* — Semantic models represent architecture, technology, and performance data for many purposes: proposal submission, engineering analysis, modeling, simulation, assessment, reporting and decision-making.
- *Edge* — Substantially reduce the time, resources and risk associated with the entire acquisition process. Increase the quality, worth and supportability of solution, while reducing their total ownership costs throughout the total life cycle.

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EMERGENCY MANAGEMENT

BUSINESS PROBLEM

- Utility needed to manage emergencies (e.g. outages, breaches, service disruptions, etc.).
- Must make time-critical decisions that require total access to information in real-time, and in a context that supports its effective use.
- Solution must integrate disparate data, content and applications, and be deliverable within reasonable cost, time, effort, and risk.

SEMANTIC SOLUTION

- *Semantic solution* — Business ontology that connects data and processes providing real-time comprehensive integrated situation awareness. Semantic development environment for building composite applications and portal UIs.
- *Efficiency gain* — Semantic solution development is 2-5X faster and less costly. Having information in context eliminates searching for, and correlating sources. Faster response to query.
- *Effectiveness gain* — Ontology-based integration delivers real-time, 360 view from all relevant sources giving total picture for sense-making and decision support. Information in context enables faster, better decision-making. Productivity gain.
- *Edge* — Reduced TCO. Business risk mitigated.

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REGULATORY COMPLIANCE

BUSINESS PROBLEM

- Public corporation needed to integrate policies, information, and processes into one view that provides legally defensible evidence of compliance with regulations such as Sarbanes-Oxley, HIPPA, Gram-Leech-Bliley.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based regulatory and standards models, semantic information and process models create "virtual databases" and metaview needed for compliance reporting and auditing.
- *Efficiency gain* — Reduced cost to establish compliance. Reduced cost to comply. Reduced cost to adapt as regulatory requirements, and internal systems change.
- *Effectiveness gain* — Ontologies map relationships between data sources and processes. Provide a unified view across all compliance-affected operations. Facilitates near real-time regulatory reporting and compliance audits. Provides foundation for cost-effective integration of process & data as well as process upgrades.
- *Edge* — Reduced TCO frees resources. Litigation risk mitigated.

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CUSTOMER SELF-SERVICE CALL CENTER

BUSINESS PROBLEM

- A manufacturer needed to improve quality of customer service while reducing costs.
- Complex products and multiple product lines caused increased need for customer service, which is costly to provision, even with outsourcing.
- Cross-industries 40-80% of customers say they are dissatisfied with customer support.
- Also, 2/3 change provider after unsatisfactory service.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based self-service access to integrated content combined with case-based reasoning across similar problems to provide customer self-service.
- *Efficiency gain* — Electronic self-service reduces costs by more than 1/2. Cost savings through call avoidance was $3M in first year. Maintenance of knowledgebase at 1/5 person-year.
- *Effectiveness gain* — 3/4 of the customers and 2/3 of the employees rate intelligent customer self-service as “good” or “very good.”
- *Edge* — Positive ROI in less than 12 months. Risk of customer defections mitigated.

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SEMANTIC ENTERPRISE PUBLISHING

BUSINESS PROBLEM

- Global corporation needed to improve the effectiveness of lifecycle product communication while taking cost, time, and effort out of the process.
- Technical knowledge management spans content creation, content management, localization, cross-media publishing, and project and process management across geographic regions, business units, and supply-chain relationships.
- In support of PLM and global CRM, the strategy is to create once, localize once, store once, and deliver in multiple ways including web, CD, email, and print.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based platform for PLM and CRM technical knowledge creation, versioning, and cross-media delivery. Semantic metatagging. Semantic provisioning of multi-lingual text, graphics, documents, web pages, and interactive media.
- *Efficiency gain* — Save 1/4 to 1/2 of media communication spend. Semantic technology process improvements, sourcing and procurement standardization, integrated communications management . Save 1/4 to 1/2 of labor for authoring, graphics and illustration, production, and administration.
- *Effectiveness gain* — Time-to-market faster by 2-to-10 times. Concurrent support for multiple product launches in multiple geographic regions using multiple media channels.
- *Edge* — ROI of semantic technology-based solution is 2-5X faster.

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KNOWLEDGE-CENTERED ENGINEERING

BUSINESS PROBLEM

- Large manufacturer needed a faster, more efficient engineering lifecycle that could scale to handle very large complex projects.
- Across the engineering lifecycle, a part design can translate into hundreds of drawings, schematics, and documents prepared for different disciplines, or usages at different stages.
- Currently, the workflow is document-centric, utilizing CAD and CAE tools as electronic pencils for creating and recreating documents.
- As project size and complexity grows, internal document maintenance and management consumes 80-90% of resources.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based engineering captures, represents, and maintains total product knowledge in a language-neutral, federated repository. Semantic applications generate all categories of engineering drawings, specifications, project documents, and technical literature as needed.
- *Efficiency gain* — Up to 5-10X faster design, build cycle. Up to 5-10X reduction in project costs. Up to 5-10X fewer engineering resources.
- *Effectiveness gain* — Knowledge-centered engineering enables control of larger and more complex projects than with conventional methods.
- *Edge* — ROI from taking huge amounts of labor, cost, and time out of the process. Lifecycle knolwedge-base removes errors and inconsistencies; gives visibility to all parts and phases of the project; and stops knowledge erosion due to personnel changes.

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VIRTUAL PRODUCT DEVELOPMENT

BUSINESS PROBLEM

- R&D unit of first-tier aerospace manufacturer needed to reduce product development cycle time and cost, while improving quality.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-integrated collaborative infrastructure, 3-D modeling, simulation and virtual reality tools
- *Efficiency gain* — Product cycle time and costs reduced by more than 50%.
- *Effectiveness gain* — Eliminate the need to build costly prototype hardware. Produce more efficient, supportable, higher performance systems with first-time quality.
- *Edge* — Customer and stakeholder access to virtual prototypes improves product quality and mitigates development and business risk.

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DESIGN ADVISORS

BUSINESS PROBLEM

- Auto manufacturer needed to reduce the cycle time, cost, and labor required to develop new parts and product designs.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology, rule, and parametric based design advisors
- *Efficiency gain* — 20-40% gain in productivity. 25-95% savings in total cost of design.
- *Effectiveness gain* — Design advisors in use and proven effective for transmissions, crankshafts, powertrain components, drive line layouts, rack density, hood and decklid, stamping dies, direct field vision, tool design, injection molding, and many other applications.
- *Edge* — 50-75% gain in quality attaining 6-sigma certification.

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LITIGATION DISCOVERY

BUSINESS PROBLEM

- Legal firm needed to improve the speed and comprehensivenes of their pre-trial discovery process.
- The discovery phase of the litigation process is critical for preparing a winning argument.
- Litigation teams must examine volumes of documents in a short period of time in order to identify all that are relevant to their case.
- Failure to identify and examine all relevant documents can incur significant risks to firm and its client.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based directed discovery applies a knowledgebase of legal expertise together with case-specific criteria to automate scanning, evaluation, and identification of all documents relevant to the case out of the total collection. Benchmarking used to establish accuracy, follows set-up.
- *Efficiency gain* — Up to 2-3X faster document review. Up to 2-3X more accurate, comprehensive, and consistent review process across all stages of litigation.
- *Effectiveness gain* — Semantic/ AI-based system misses between 80% and 95% fewer actually relevant documents than humans typically do.
- *Edge* — ROI from acceleration of discovery process, reduced cost to litigate, and improved odds (competitive advantage.) Mitigates legal and financial risks.

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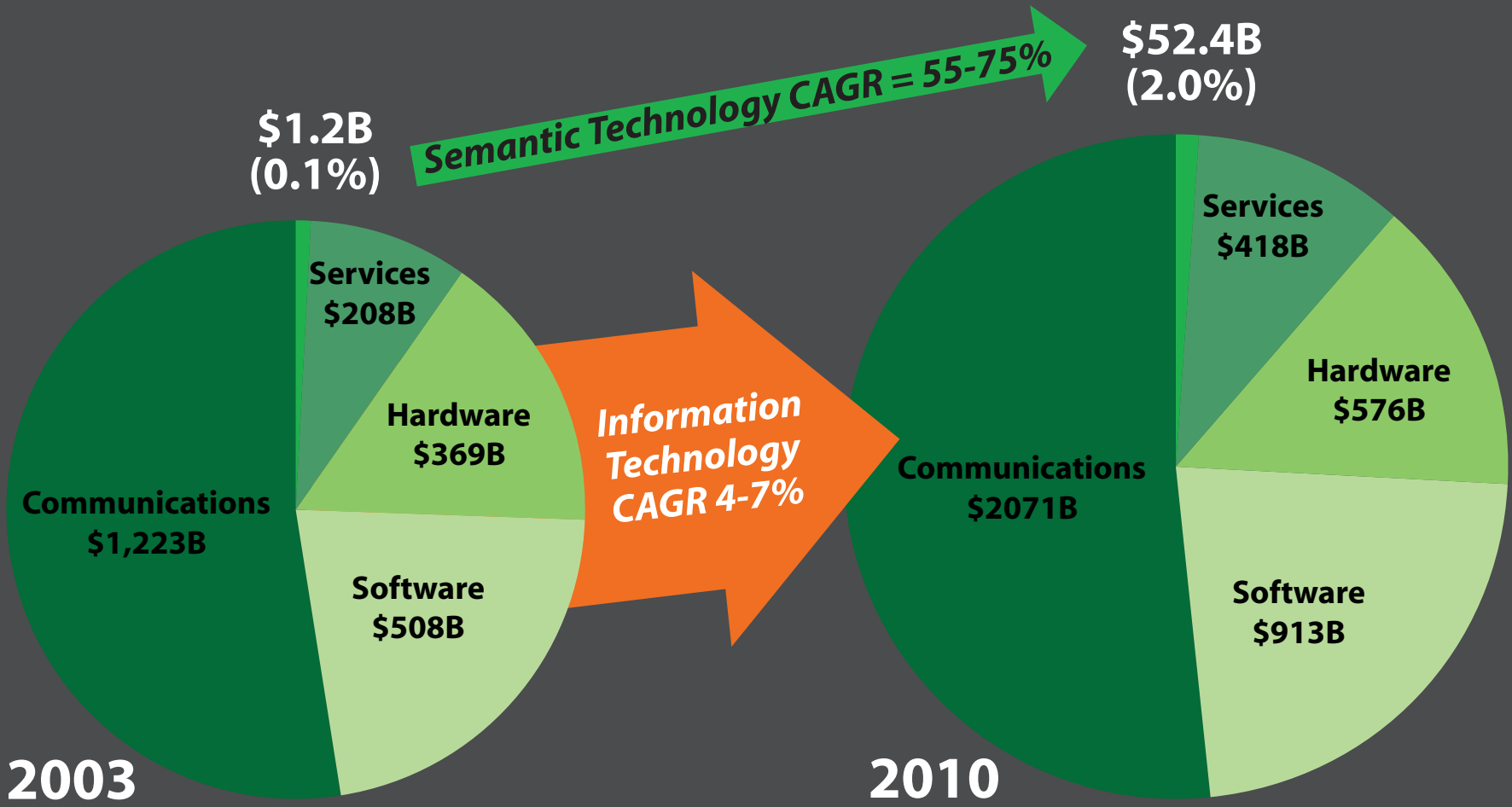
MARKET GROWTH TO 2010

For semantic and information technologies



Sources: WITSA, IDC, Gartner, Meta Group, VSS, McKinsey, TopQuadrant

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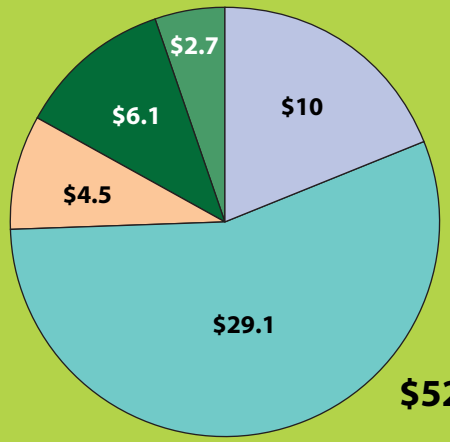
SEMANTIC TECHNOLOGY MARKET TO 2010 ($B)

Horizontal

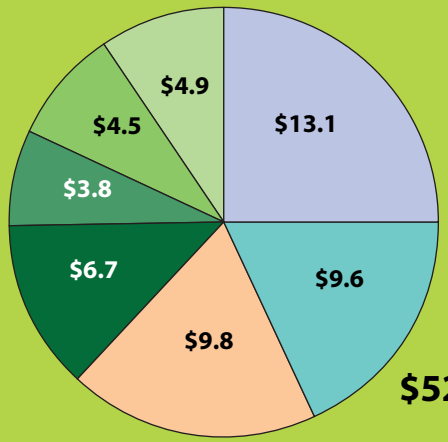


$52.4 Total

- Discover & Access
- Reasoning
- Provision & Communication
- Integration & Interoperation
- New Infrastructure

Source: TopQuadrant

Vertical

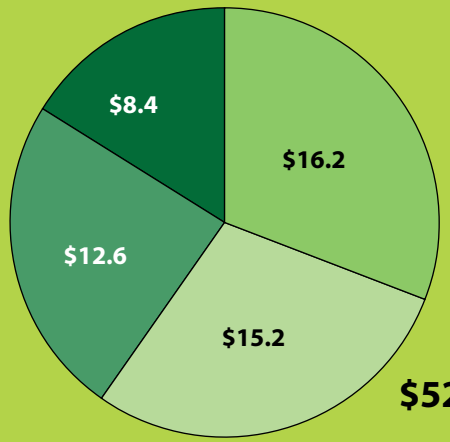


$52.4 Total

- Services
- Transport, Com
- Trade
- Manufacturing
- Government
- Finance
- Consumer

Source: TopQuadrant

Regional



$52.4 Total

- Europe
- North America
- Asia
- ROW

Source: TopQuadrant

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