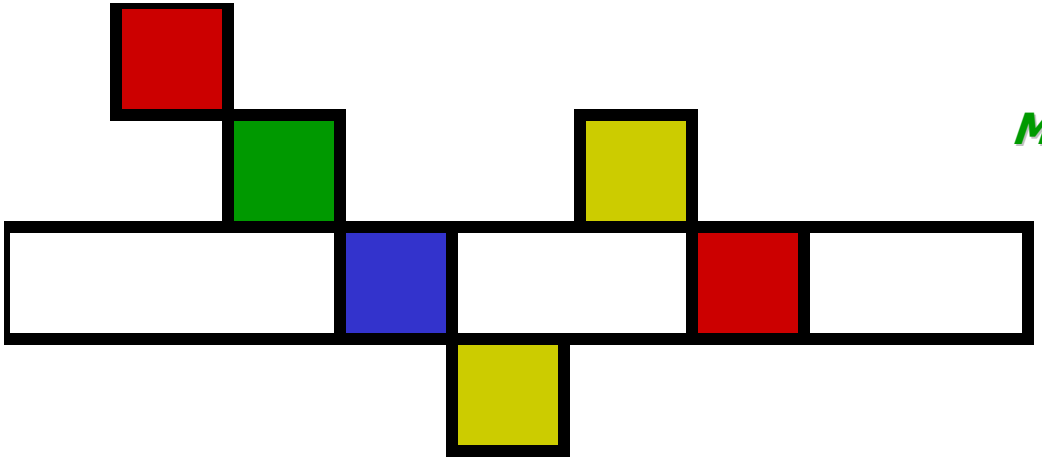

Rolando Hernandez
Master of Science, Artificial Intelligence
CEO & Chief Rules Architect

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The Knowledge-Based 21st Century Enterprise

Case studies:

How five global leaders leveraged rule-based and knowledge-based technologies to maintain their competitive edge

The Knowledge-Based 21st Century Enterprise Knows How to Transform Tacit Knowledge into Visible Knowledge (i.e. Information)

- **KNOWLEDGE**
  - **INFORMATION**
    - Tangible
    - Visible knowledge
    - Public
    - Can be accessed by third persons
    - Once shared, it belongs to everybody
    - Can be seen "above the water"
  - **TACIT KNOWLEDGE**
    - Intangible
    - Invisible
    - Private
    - Can be accessed on the first-person basis only
    - Hidden "underwater"

Source:
Understanding Knowledge Societies
In twenty questions and answers with
the Index of Knowledge Societies,
Department of Economic and Social Affairs
Division for Public Administration and Development
Management, United Nations, New York, 2005
c

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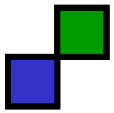
Data-Based → Rule-Based → Knowledge-Based



DATA	INFORMATION	KNOWLEDGE	INTELLIGENCE
DP DATA PROCESSING AUTOMATING	MIS Management Information Systems ONLINE TRANSACTION PROCESSING (OLTP) REPORTING NETWORKING Relational Database, Client/Server	IT - Information Technology ONLINE ANALYTICAL PROCESSING (OLAP) ANALYZING WAREHOUSING DECISION SUPPORT MINING Knowledge Management Decision Support CRM & SCM, Internet	IT - Intelligent Technology ONLINE DECISION PROCESSING (OLDP) DECISIONING RECOMMENDING ADVISING SCHEDULING OPTIMIZING DIAGNOSING TROUBLESHOOTING CONTROLLING Business Rule Engine Real-Time Decisioning System Knowledge-Based Expert Advisor A.I., Expert System, BRE, BRMS SME/Business Ownership of Business Rules
Mainframe Era 1970s	PC Revolution 1980s	World Wide Web 1990s	Smart & Wireless Revolution - 2000s

DATA BASED SYSTEMS *Rules hard-wired in code, stored procedures, or triggers*

RULE BASED SYSTEMS *Simplistic Rules & Broad Scope of Reasoning* *Externalized Rules*

KNOWLEDGE BASED SYSTEMS *More Complex Rules & Deep Scope*

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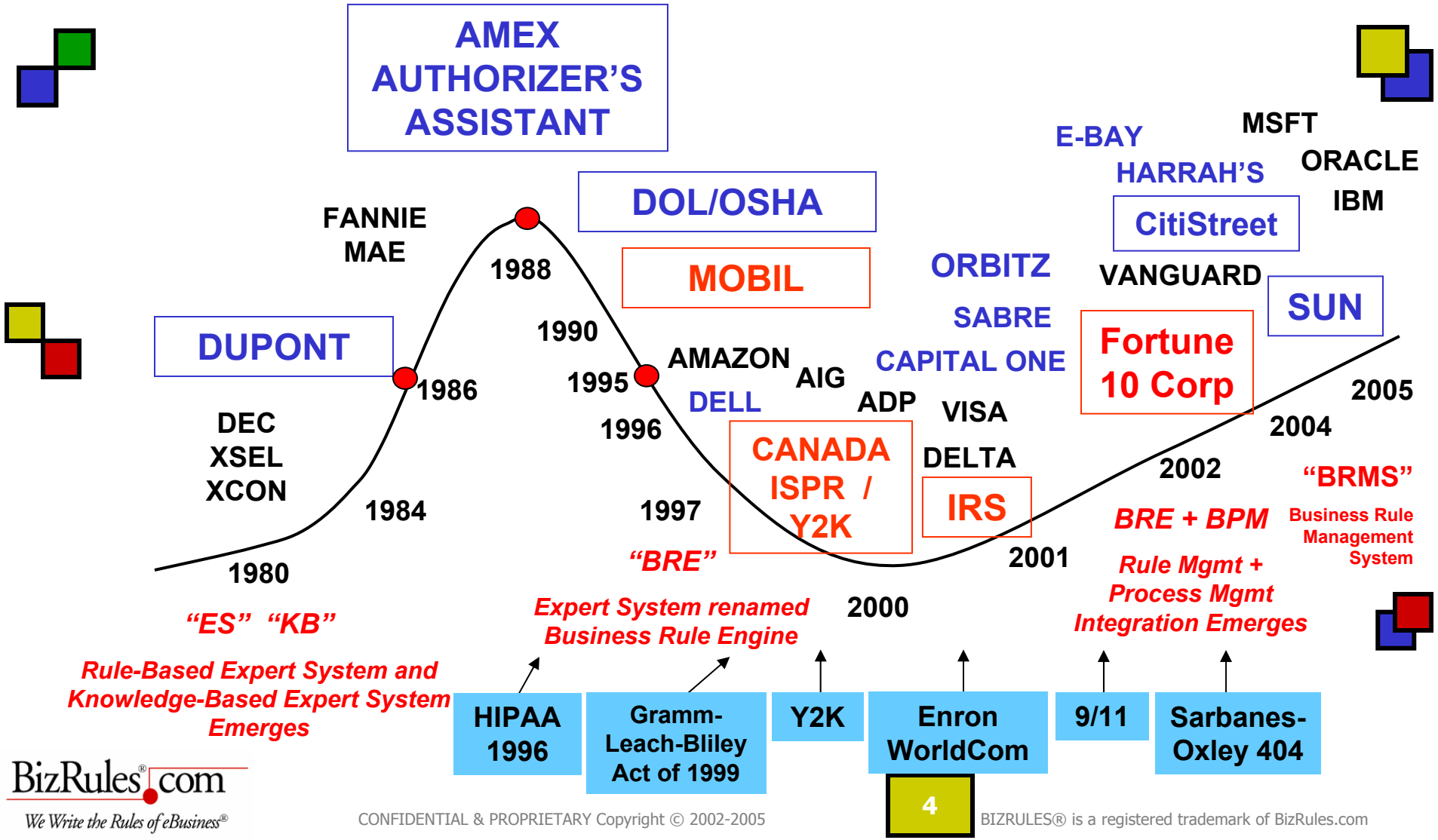
Business Rules Hype Cycle
Rule-Based Systems & Knowledge-Based Expert Systems



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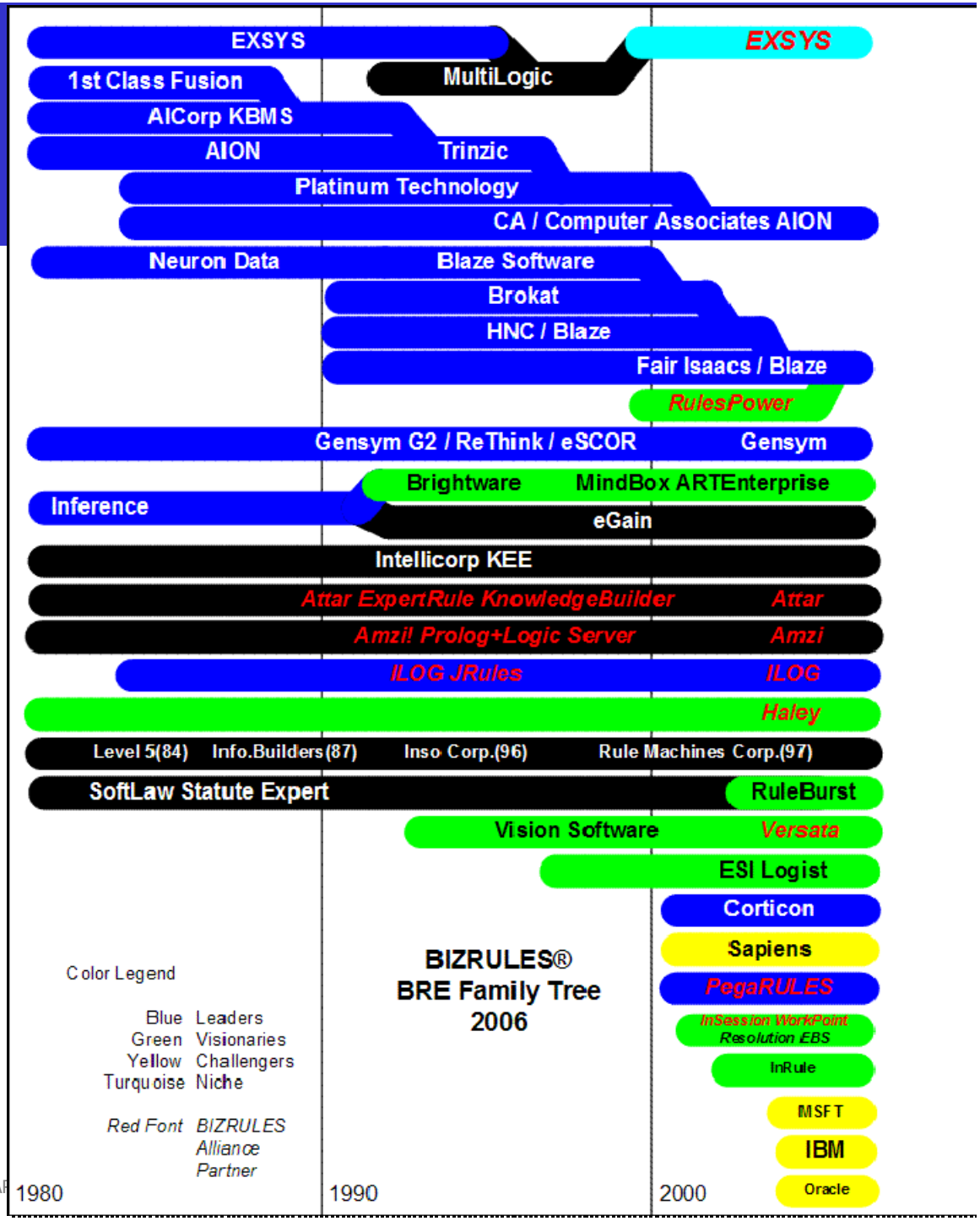
BRE Family Tree 2006

http://bizrules.info/page/art_brefamilytree.htm



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The Knowledge-Based Society

- Digitization
- Transformation
- Optimization
- Modernization
- Knowledge Automation
- Globalization
- Reinvention
- Reformation

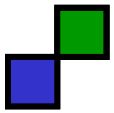
The Knowledge-Based 21st Century Enterprise

- **Business Challenges**
  - **Decisioning**
  - **Compliance**
  - **Advising**
- **Relentless Pressures**
  - **Cut Costs**
  - **Increase Revenues**
  - **Satisfy Customers**

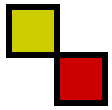
- **Technology Solutions**
  - **Rule Management**
    - **Business Rule Engines**
    - **Business Rule Management Systems**
  - **Process Management**
    - **Business Process Management Systems**
    - **Business Process Automation**
  - **Knowledge Management**
    - **Knowledge Automation**
    - **Expert Systems**

The Knowledge-Based Employee

Top Business Challenges 2000-2010



- Agility
- Highly competitive global marketplace
- Improving regulatory compliance with tougher laws
  - Such as SOX, HIPAA, Gramm-Leach-Bliley Act of 1999



- Documenting & enforcing rules, controls, processes
- Assisting employees to follow the rules
- Reducing financial and legal risks
- Improving governance
- Enabling the Real-Time Enterprise
- Real-Time detection, decision, action
- Ensuring privacy preferences

Top Business Challenges 2000-2010

- Pace of change increasing
- Complexity increasing
- Retaining knowledge lost due to downsizing
- Growing the value of knowledge capital
- Building knowledge-based systems to support knowledge-based workers
- Delivering value-added expertise
- Information overload → People want answers, not more information
- Consumers demand quality, service, price, expertise
- Hold everyone accountable for results
- Making decisions conscientiously, quickly, correctly

Top Business Challenges 2000-2010

- Providing innovative products faster
- Delivering more services at lower cost (eGov)
- Delivering exceptional service (eBiz)
- Enabling customer self-service
- Aligning business and IT
- Relentless push to cut IT/Dev/Maint expenses
- Need to reduce systems development time to mkt
- IT/Business Process outsourcing / offshoring
- Encouraging innovation and risk-taking
- Driving the market rather than being driven by it
- Preventing outright fraud and business mistakes

What do we mean by "Preventing Business Mistakes" ?

- **$25 to Paris? United Airlines will honor the "fantasy fares"**
  - **143 tickets were sold during a 55-minute period on Jan. 31, 2001**
- **AT&T fined $780,000 by FCC for violating Do Not Call List**
  - **AT&T broke the rules by calling 29 consumers on 78 occasions after they asked not to be called**
  - **The proposed fine includes $10,000 for each violation**
  - **Nov. 3, 2003**

Business Mistakes caused by poor rules management

- **Staples, Inc. to Pay $850,000 Penalty For Alleged Mail Order Rule Violations**
  - **FTC Complaint Charges Office Supply Company Misled Consumers and Businesses About "Real Time" Inventory Availability, Misrepresented Delivery Times on its Web Site**
  - May 22, 2003

- **Salomon Brothers trader who single handily caused a 15 point drop in the Dow Jones Industrial Average in the last 5 minutes of trading due to misunderstanding the units of a "sell" order.**
  - **He mistakenly sold 11 million shares ($500,000,000) of stock instead of 11 million dollars of stock. The Wall Street computers did the rest.**

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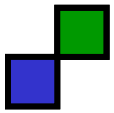
Business Mistakes caused by poor rules management

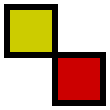
- **CVS to Pay $110 Million to Shareholders.**
  - Shareholders asserted that the nation's largest pharmacy chain delayed accounting for discounted merchandise in order to prop up earnings.
  - June 7, 2005.

- **Metric mishap caused loss of NASA orbiter**
  - (CNN) -- NASA lost the $125 million Mars Climate Orbiter because a Lockheed Martin engineering team used English units of measurement while the agency's team used the more conventional metric system for a key spacecraft operation.
  - Sept. 30, 1999

There is a solution to all these problems

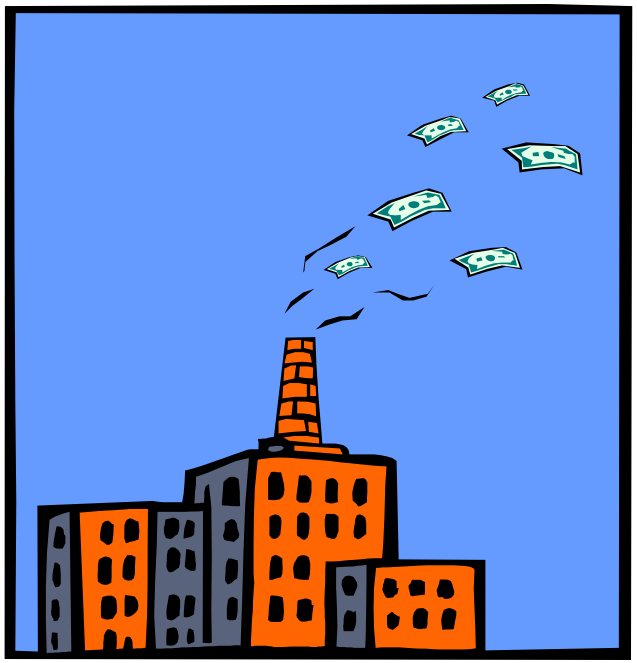


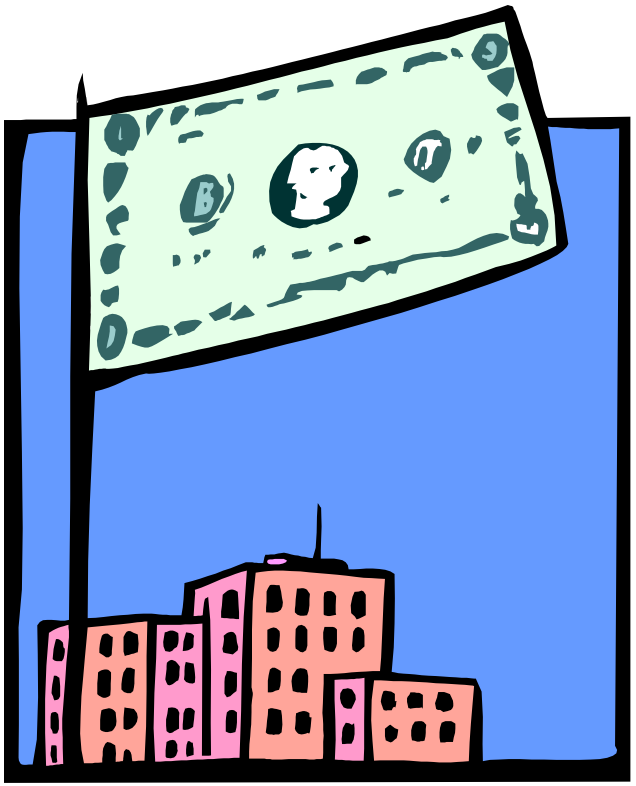
- **Business Rule Management (BRM), Business Process Management (BPM) and Knowledge Management (KM)**
- **Just as Six Sigma was the answer for quality, Business Rules Engines are the answer for:**
  - **Preventing business mistakes**
  - **Compliance**
  - **Developer/Programmer productivity**
  - **Time to market**
  - **Decisioning → Making the correct decision based on the business rules, policy or law**



- **Knowledge Automation Expert Systems are the answer for:**
  - **Answering → Getting an expert answer**
  - **Advising → Getting or giving expert advice**
  - **Recommending → Making an expert recommendation**
  - **Downsizing → Knowledge capture and sharing**

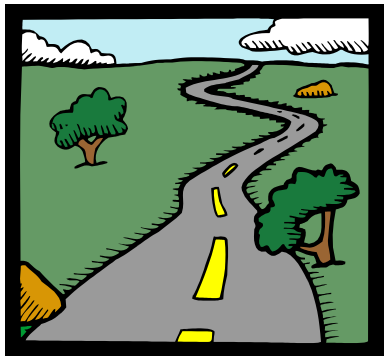
How can business rules increase productivity and reduce costs?

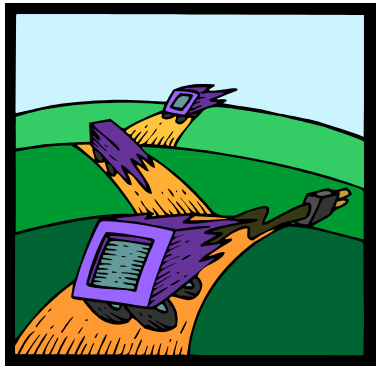


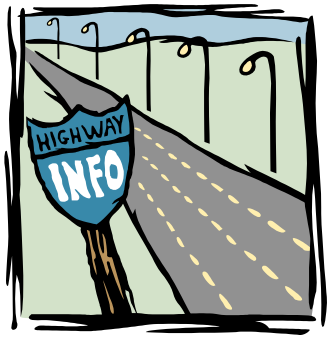


Idea credit to Douglas Kim, Pegasystems

How can Business Rules approach help CEOs and CFOs comply with Sarbanes-Oxley and other Regulations?







Idea credit to C.

What's the True Strategic Value & ROI for Rules, Process, and Knowledge Management?

- Prevents business mistakes
- Ensures compliance with regulations, legislations, policies, and guidelines
- Ensures correct and consistent decision-making
- Automates decision-making & knowledge-based business processes
- Captures corporate knowledge before it's lost
- Reduces systems development & maintenance costs by 20-50%
- Frees up staff to spend more time on higher value-added work

Jim Sinur, Senior VP and Distinguished Analyst, Gartner

- **"Every U.S. business must comply with thousands of federal business regulations. Process management technologies and business rules engines can help companies understand new rules and enforce compliance policy."**

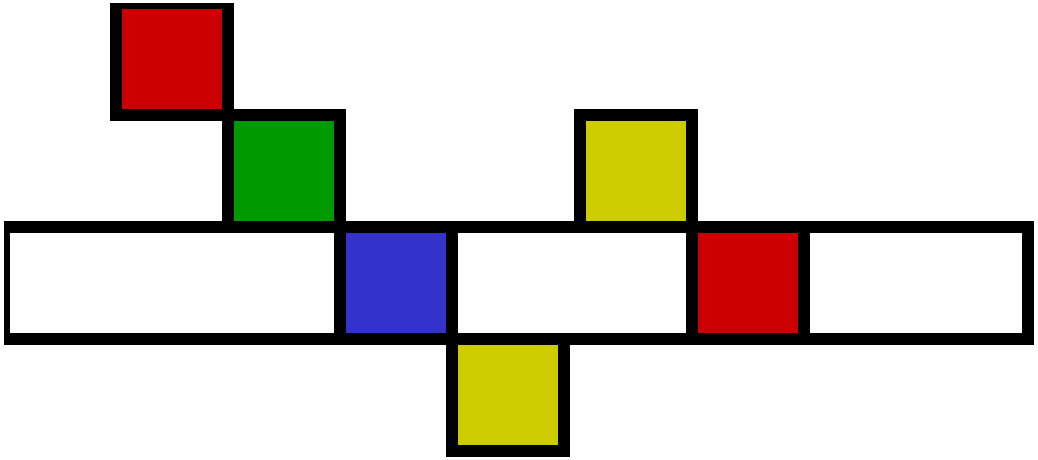
Recent Gartner Report on SARBANES-OXLEY

Business Rule Engines put enterprise decision-making on Autopilot

- **How can we expect staff to follow the rules when most of us don't know or can't remember all the rules?**

How can the Knowledge-Based 21st Century Enterprise possibly manage & change all the internal business rules and external rules?

- Privacy & Permissions
- Products / Regions / Brands
- Pricing / Discounts / Promotions
- Customer / Individual / Groups
- Commissions / Contracts
- Agency / Distributor / Reseller
- Revenue Management & Yield Management
- Tax & Compliance
- Credit Card Processing/Chargeback
- CRM / One-to-One Marketing
- Marketing
- Accounting / Tax Provision
- Operations
- Manufacturing
- Supply Chain
- Govt Compliance/Regulatory/SARBOX
- Eligibility & Entitlement
- Fraud Detection
- Product Recommendation
- Decision-Making
- Customer Service
- HR, Insurance, Medical, Retirement
- Environmental, Health & Safety
- EPA, FTC, DOL-OSHA, FDA, SEC, cGMP
- Sarbanes-Oxley, HIPAA, Can-Spam
- Executive Policies
- Standard Operating Procedures
- Travel / Reimbursement Rules
- Security
- Sensitive (Trade Secret) rules
- Systems Constraints/Workarounds
- VIP / Repeaters / Top Performers
- Etc. etc. etc

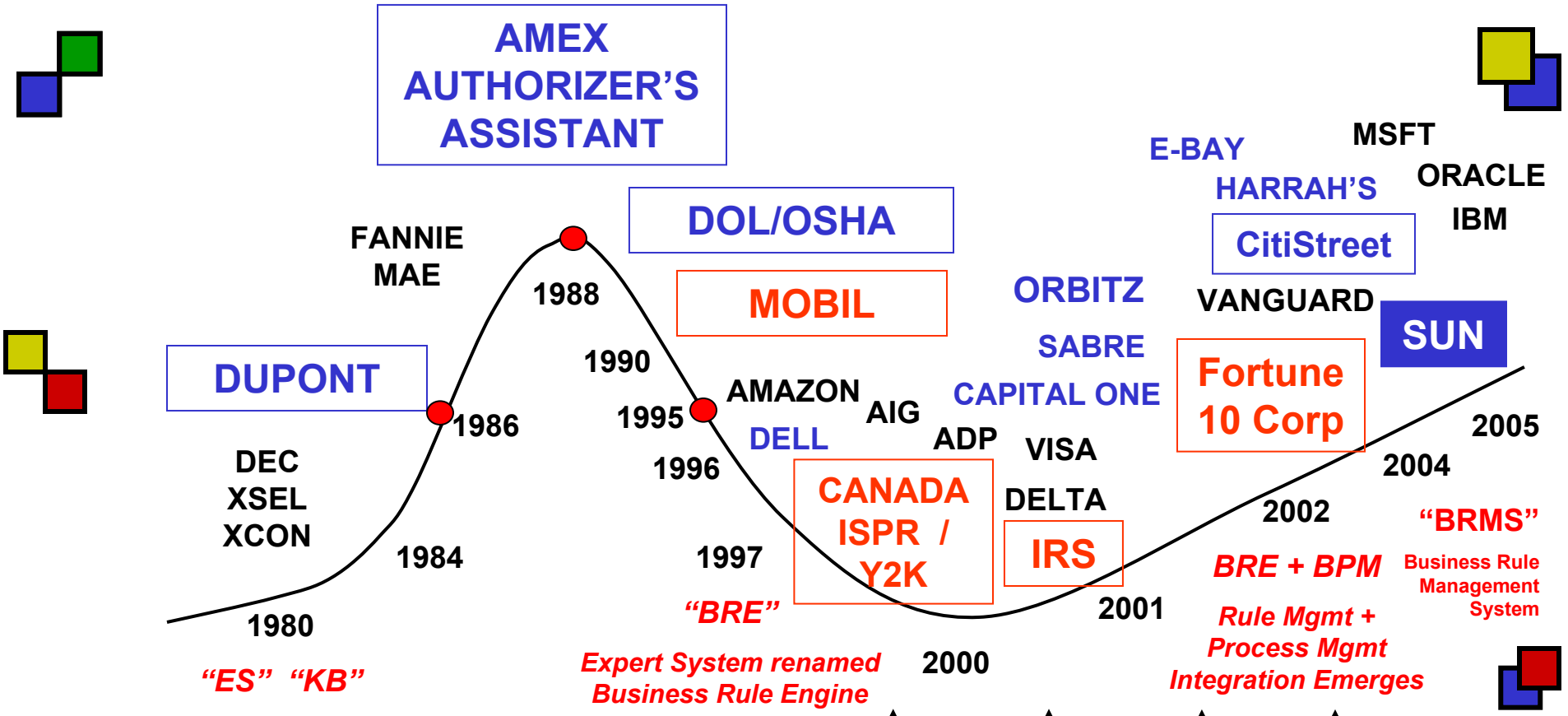


CASE STUDIES

9

HOW FIXE GLOBAL LEADERS LEVERAGED RULE-BASED AND KNOWLEDGE-BASED TECHNOLOGIES TO MAINTAIN THEIR COMPETITIVE EDGE

Business Rules Hype Cycle
Rule-Based Systems & Knowledge-Based Expert Systems



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Sun Microsystems Vision = BRMS + BRE

Previous Situation

- Sun Preventive Services enables Sun customers to significantly improve system uptime and availability, and reduce incident volume and cost
- Deliver enhanced risk management and risk analysis services to its customers
  - hardware, software and patch-level assessment
  - examination of a variety of other critical systems data in order to identify and remediate potential IT issues before they can affect downtime
- In 1999, Sun decided to build in-house rule-engine:
  - "Sun Risk Analysis System"
  - Written PERL / Java
  - 6 developers
  - 2.5 years to develop the initial Customer Service Application

Business Challenge

- Rule maintenance became harder and harder
  - Creation, maintenance, and management of rules knowledge became the much bigger problems
- Lots of resources were applied to building and maintaining rules development, management, and testing systems
- Times for converting content and human knowledge getting extraordinarily long
- Unique developer/programmer level talent needed to code the rules
- Many developer/programmer resources being consumed
  - Maintaining Rules management infrastructure
  - Codifying knowledge into rules

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Sun Microsystems Vision = BRMS + BRE

Existing Situation

- By 2004, Java rules systems had evolved and matured quite rapidly since in-house system was created in 1999
- Decision made to revisit "make versus buy"
- Considered both commercial and non-commercial BREs (open source, freeware, another in-house development, etc.)
- Signed the deal for BRE in late 2004…

Envisioned/Deployed

- Rules Management
- Fair Isaac Blaze Advisor

Why Sun Did not go with an Open Source, non-commercial BRE

- Licensing considerations for in-product and/or embedded use
- No single integrated solution for:
  - Robust rules management infrastructure
  - Rules development and testing environments
  - Versatility in data input mechanisms
- Concerns over costs of building and maintaining all the components beyond the core rules engine
  - Already experienced this firsthand with the in-house system

Sun Microsystems Vision = BRMS + BRE

ROI
Changing rules in a BRE is "10-20 times better" than changing hard-coded rules

Results

- It's for internal use only: BRE gives us competitive advantage/ differentiator
- Late 2004: Bought BRE
- Jan 2005: BRE installed
- Feb 2005: Learning/What-if it did this…
- Mar-Jun 2005: Re-developed the entire Customer Service Application using BRE
  - 6 developers
  - 4 months

Lessons Learned

- "Rules management is every bit as important as the rules engine, if not more so"
- BRE "will give us the ability to scale and broaden our rules-based systems in ways we did not have the time, or resources, to consider before"

Future Plans

- Migrate from application specific (Sun Risk Analysis System) use to more general web services based services
- Plan to expand BRE-based app from problem/risk analysis rules to more general, true, business rules:
  - Policies
  - Entitlements
  - Constraints
- Broader use within Customer Networked Services
- Broader use within other Sun Microsystems organizations

Paris E. Bingham, Jr
Principal Engineer / Technologist
Customer Networked Services (CNS)
Technology Office
Sun Microsystems, Inc.

Sun Microsystems Vision = BRMS + BRE

Q: Is the ROI for rules really that high?

A: "Rule changes and rule management is in the order of magnitude faster than before. It's much more than twice as good, it's more like a magnitude of 10-20 times better."

Q: If the ROI for business rules is that great, why aren't more companies doing rules?

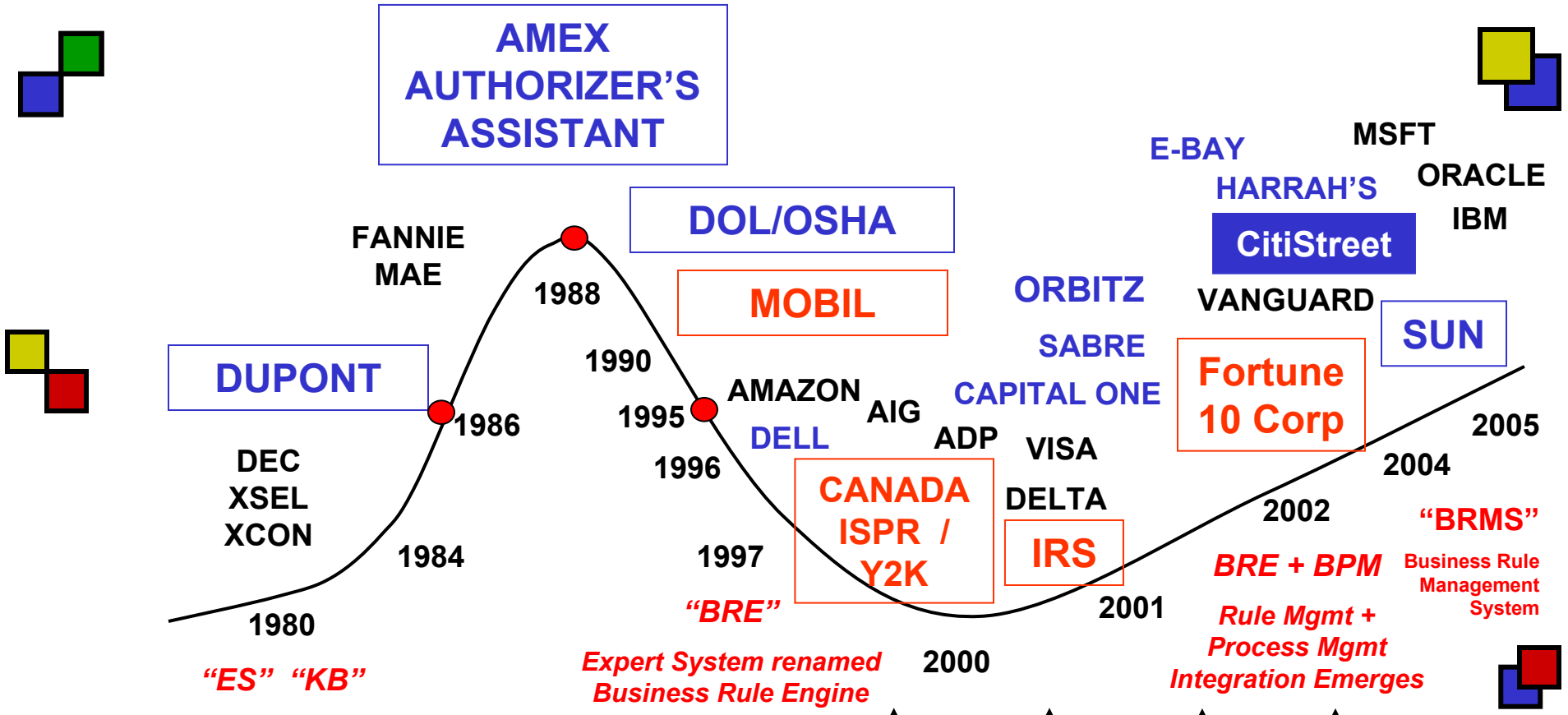
A: "It's a big paradigm shift for the developer. We're dealing with a culture shift problem where developers like to see more coding. We need to get a mind shift so developers can add dynamic business logic into the code instead of hard-coding business logic.

The first culture shift is programmers coding rules and giving up that control and visibility into the rules.

The second shift is the capturing of the knowledge and getting that into the system."

Paris E. Bingham, Jr
Principal Engineer / Technologist
Customer Networked Services (CNS) Technology Office
Sun Microsystems, Inc.

Business Rules Hype Cycle
Rule-Based Systems & Knowledge-Based Expert Systems



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CitiStreet
Vision = SME Knowledge + BRE

Previous Situation

- CitiStreet in Quincy, Mass., a global benefits services provider owned by Citigroup and State Street Corp.
- Administers complex benefit plans for Fortune 500 companies, such as
  - Pension plans
  - Health & Welfare Benefits
    - Open Enrollment
  - 401(k) retirement plant
- Previously, business analysts wrote requirements, designers created documents based on the requirements, and IT developers did the coding.
- Legacy pension calculator ran
  - NT
  - C++

Envisioned/Deployed

- Rules Management
- ILOG JRules

Business Challenge

- Time and effort to implement a new client's Pension Calculator took too long
- Shrink implementation timeframes
- Reduce costs by reducing IT effort in coding, testing, debugging
- Empower business people with pension knowledge to build the pension calculator
- CitiStreet manages thousands of business rules related to client policies, government regulations and customer preferences

CitiStreet

Vision = SME Knowledge + BRE

ROI

"We've effectively eliminated the detail design function and 80% of the development function"

Results

- **"It used to take CitiStreet six months to set up benefit plan calculations for clients; it now takes three months"**
- **Now analysts use JRules to create or change rules, without help from developers**
- **IT is involved in managing the systems and platforms, but it's less involved in rules management**
- **Leverage IT resources into more value added tasks, such as building tools to support the business**
  - **Automated regression testing tools**
  - **etc.**

- **Increased the transparency of a very complex process**
  - **Business people can easily see how the calculations are being performed**
- **Transforms the knowledge so it is**
  - **Tangible**
  - **Visible**
  - **Can be seen "above the water"**

Lessons Learned

- **Get help getting started. Business rules are a paradigm shift, leverage people with experience**
- **Manage and mentor your rule writers**
  - **Put "rule writers" (pension analysts) in a single group so that experience can be shared, and peer reviews can be done**
- **Promote and enforce standards and best practices**
  - **Poorly written rules may work, just as poorly written spreadsheets may come up with the right answer. That doesn't make it the right solution**
- **Implement a "business-side" unit test environment independent of IT**
  - **"Write a rule test a rule"**

Andy Marsh
Director of Client Project Management
CitiStreet Total Benefits Outsourcing Division

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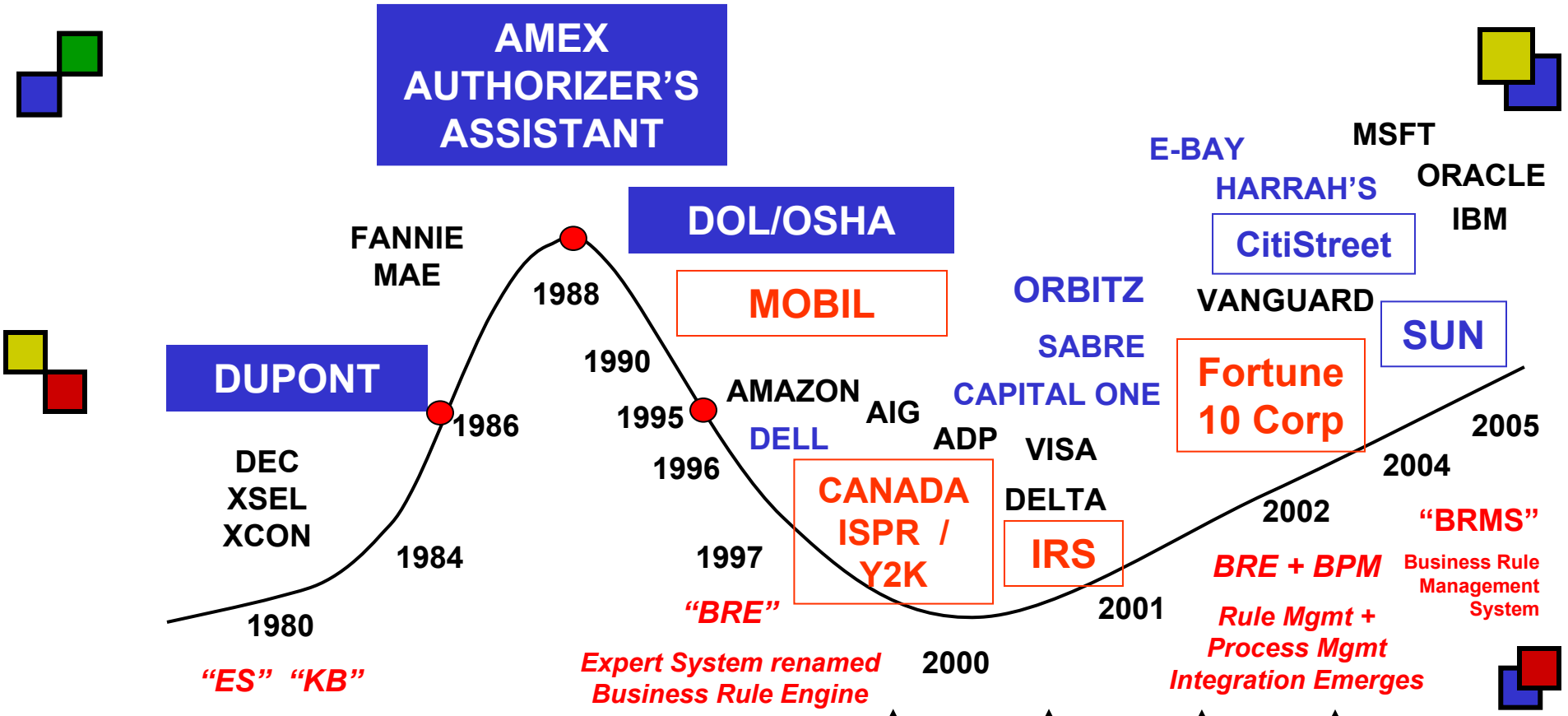
Business Rules Hype Cycle
Rule-Based Systems & Knowledge-Based Expert Systems



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DuPont

- **"For every $10,000 spent to develop expert systems, we realize $1 Million in savings and profits - adding up to over a $1 Billion."**

$10,000 → $1 million
$100,000 → $10 million
$1,000,000 → $100 million
$10,000,000 → $1 billion

ROI
Savings & Profits: $1 billion
Cost: $10 million
ROI: 100 to 1

DuPont Packaging Advisor 1987

- Helps the customer evaluate alternative choices
- Helps determine the quantities required to meet performance requirements, and estimate material costs
- Management believes that 30 percent of DuPont's resin sales in the following year were attributable to accounts where Packaging Advisor helped open the door
- DuPont believes this is the first expert system designed as a keystone in a new product's marketing communications strategy
- EXSYS

American Express Authorizer's Assistant 1988

- Rule-Based Expert System handles all AMEX credit card authorizations worldwide
- Uses business rules to simulate the decision process of experienced credit agents
- In operation for over 10 years without having to rewrite the original rulebase
- Less than ~~five~~ three people maintain the core application, which now supports all AMEX card products worldwide
- Core application contains over 3,000 business rules, and the entire system contains about 35,000 business rule
- "This system has never been down in 13 years."
- MindBox

Marilyn Stark, Director
American Express

OSHA/Department of Labor Expert Advisors 1990s

- Department of Labor's Employment Laws Assistance for Workers and Small Businesses (ELAWS) consists of a set of online advisors that provide information to small business owner in preparation for their interaction with DOL employment law experts.
- Expert Advisors have been working 24/7 running early 1990's
- "Savings to small businesses from the OSHA Hazard Awareness Advisor alone total between $40 million and $83 million per year" according to OSHA".
- Hazard Awareness Advisor went live around 1995-1997…
  still running today…
  Only changed once…
- EXSYS

ROI
Savings: $40-83 million per year

"It's a tool that can deliver expertise just as if an expert or a panel of experts were present assisting somebody." - - Edward Stern, OSHA

DuPont AMEX OSHA Lessons Learned

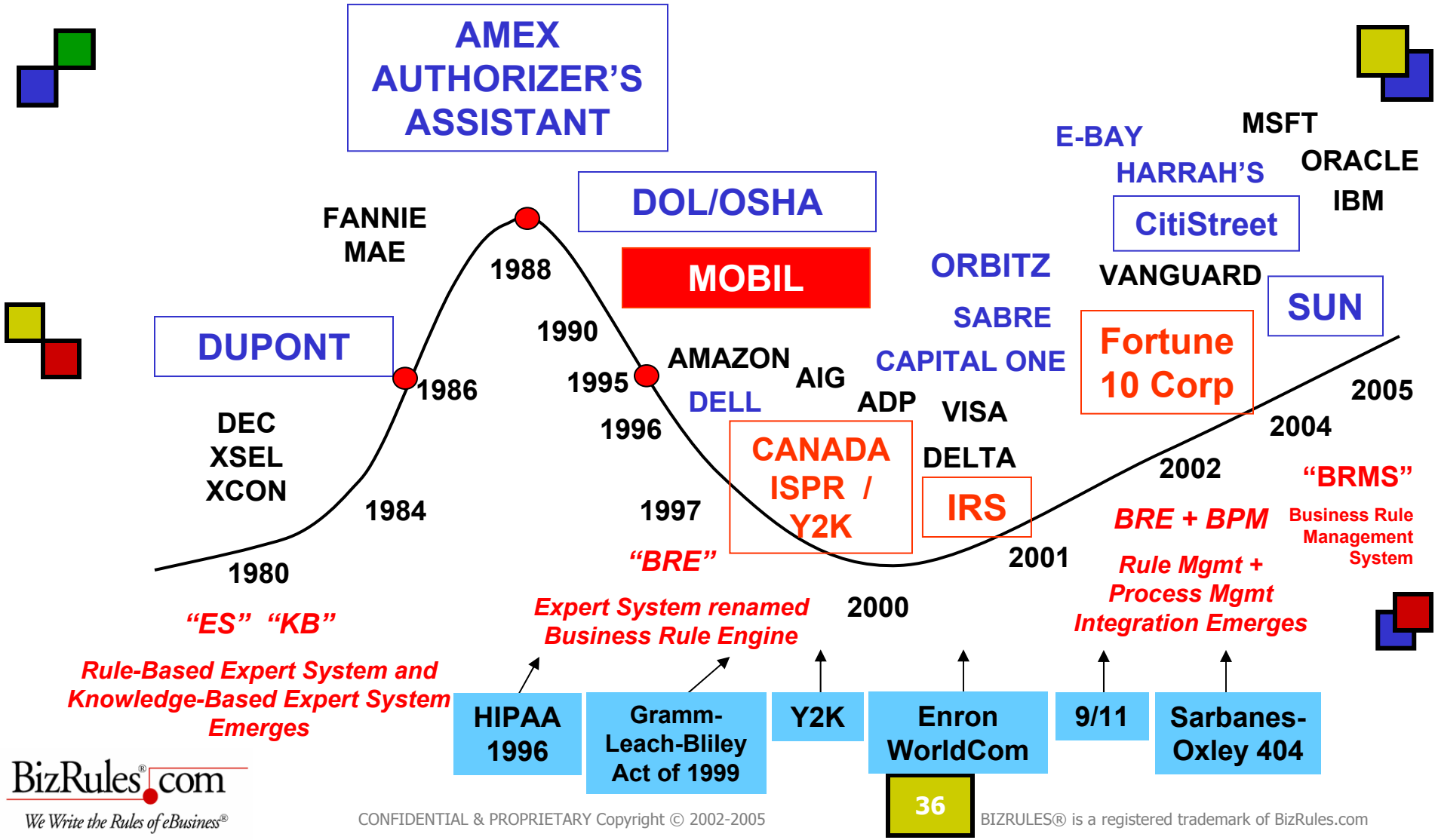
Expert Systems

- Very Large ROI
- Low Development Costs
- Very Low Maintenance Costs
- If properly maintained and kept current, expert systems can have a very long lifetime
- Rule-Based Expert Systems are a proven, industrial strength technology

For

- Advising
- Knowledge automation (DuPont)
- Service Delivery (OSHA)
- Decisioning/Transacting (AMEX)

Business Rules Hype Cycle
Rule-Based Systems & Knowledge-Based Expert Systems



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Mobil Oil Corp:
Vision = Knowledge = Power

Business Challenge

- Share knowledge from top Mobil SMEs across all affiliates in all countries
- Elicit, document, and automate knowledge from top SMEs nearing retirement
- Enable Field Engineers to make expert level decisions, advice, and recommendations

Envisioned/Deployed

- Knowledge Management Expert Systems
- AION

For

- Knowledge automation
- Transformation
- Optimization
- Globalization
- Reinvention

Mobil Oil Lube Knowledge Base
Before

Vision in 1991
After

Product data sheets

Technical memos

Lab test reports

Technical files

Equipment builder books

Technical bulletins

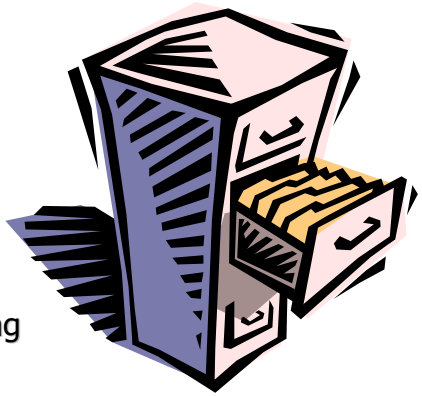
Customer service reports

Industry manuals

Technical troubleshooting books

Product recommendation charts

Troubleshooting manuals

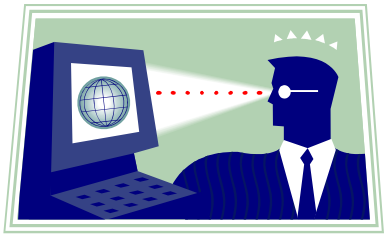


Expert Problem Diagnosis

Expert Advice

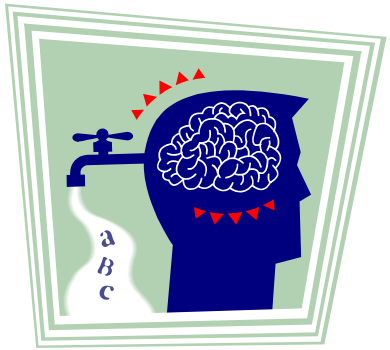
Expert Product Recommendations

The Lube Knowledge Base



Mobil Oil Lube Knowledge Base

Suite of Expert Systems Fully Deployed by 1995



Rolling Oils Expert System

Compressor Expert System

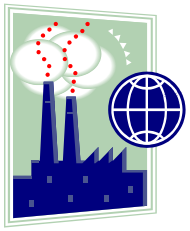
Grease Expert System

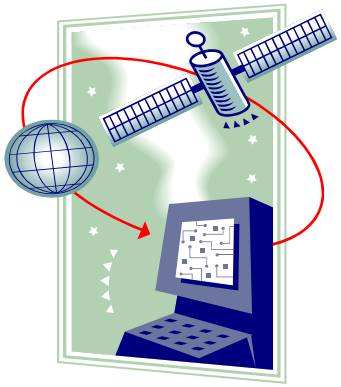
Hydraulics Expert System

Cruise Ship Diesel Engine Lubrication Expert System

Cutting Oils Expert System

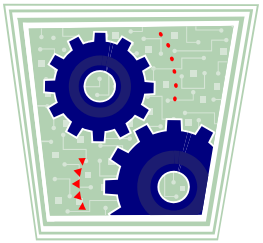
Environmental Health & Safety Expert System





Worldwide Product Database

Equipment Builders Database



Common RuleSets (Gears, Bearings, Cylinders, Pistons, Seals, etc.)

Security

Library & Reference Manuals

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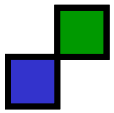
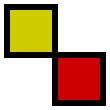
Mobil Oil Lube Knowledge Base (LKB) Goals



- **Capture expertise from top marketers & engineers and make it available worldwide**

- **Train field reps**



- **Improve customer service & service quality**
- **Provide consistent solutions**
- **Minimize paperwork/looking through thick manuals**

Mobil Oil Goals

- Develop a strategic Knowledge Management Program with the following goals:
- Maintain Mobil's competitive edge in the worldwide lube market
- Provide current product and customer data to the field sales force
- Capture individual expertise and share that knowledge throughout the Mobil system
- Enable marketers to increase face to face selling time

Lessons Learned:
Mobil Oil Lube Knowledge Base (LKB)

- You need breadth-type experts, and depth-type experts
- Experts "see" rules in their head as decision trees or decision tables
- SME interviewing is a critical success factor
- Experts are too busy/not able to author rules in ES/BRE (1993)
- Need to develop strategy, standards, and change mgmt processes
- Need to develop Knowledge Engineering methodology

Lessons Learned:
Mobil Oil Lube Knowledge Base (LKB)

- Use multiple experts for international systems
- Knowledge acquisition is the critical task; coding rules is easy
- Development costs can be cut over 50% by reusing object-oriented rulesets (1995)
- Initial learning curve, but extremely high productivity payoff

Lessons Learned:
Mobil's Experience with AIONDS

- **RAD/iterative prototyping methodology**

1. Build first system
2. Build first common code library
   - You have to build it before you can reuse it
3. Build next system by re-using code library as much as possible
4. Enhance library with any new functionality
   - Repeat steps 3 & 4, each time, growing the reuse "rule library and code library"

Mobil Oil Lube Knowledge Base
Lessons learned: BRE/ES, KA/KR/KE, Reusing OO code & Rules really works…

Actual Results with AIONDS

ROI
System #1: 3 people 207 days
System #2: 2 people 112 days
ROI: At least 2 to 1

System	Compressor Equipment Troubleshooting Knowledgebase	Grease Product Recommendation Knowledgebase	EHS Safety Audit Knowledgebase
Scope	Full-size	Full-size	Prototype
Rules	300	300	100
Experts	8	9	1
Clients	2	1	1
Users	> 200	> 200	< 20
IT Team	3	2	1
Dev Days	207	112	60
Budget	5% Over	9% Under	1% Over

The secret to success was…

Reusing terms, facts, rules, and code

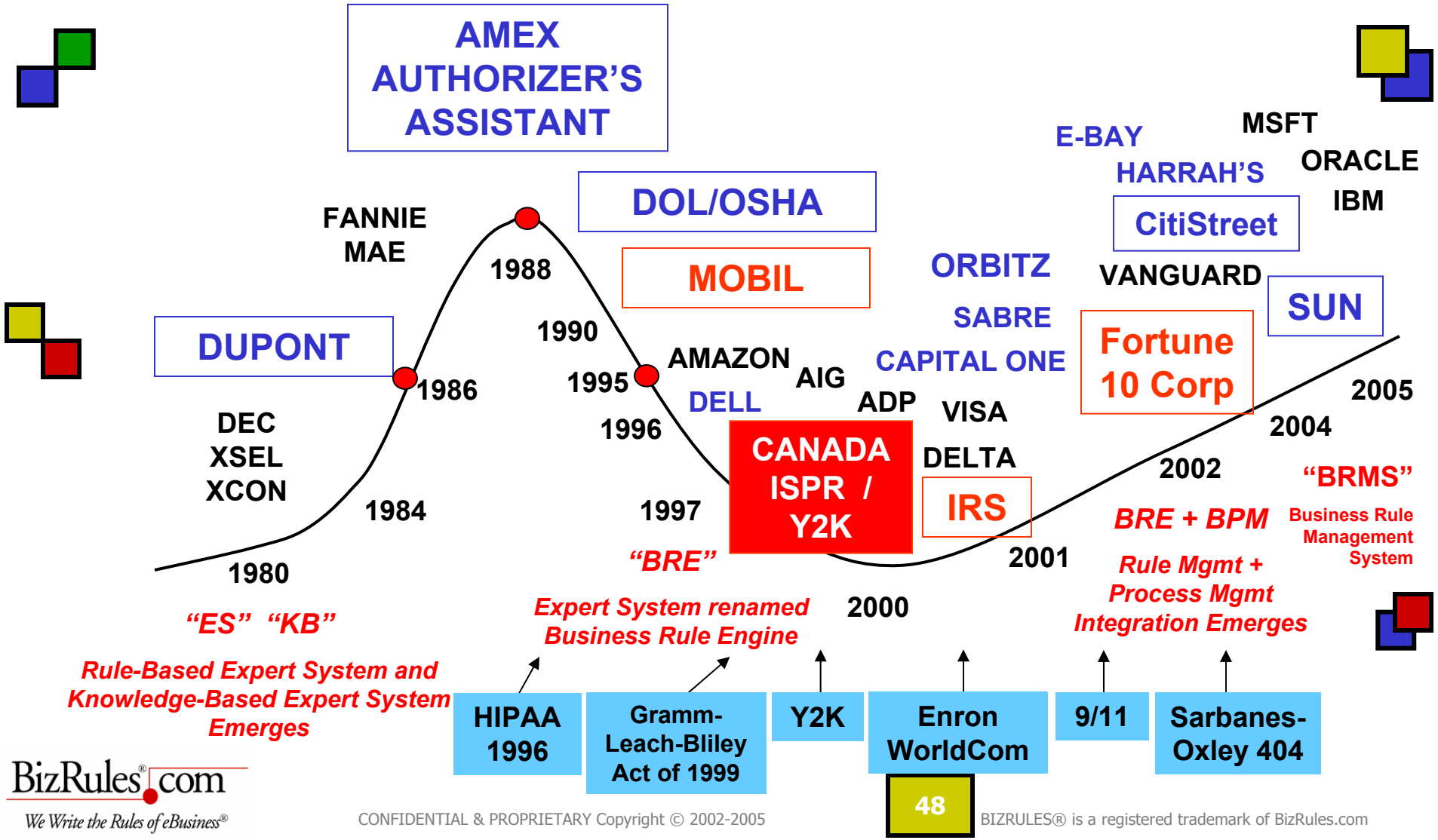
Lube Knowledge Base / ES Critical Success Factors

Critical Success Factors	Issues
■Knowledge Acquisition (KA) involving multiple, geographically-dispersed experts	■KA Methodology ■KA technique selection ■KA planning/coordination ■KA analysis and synthesis
■Structural and behavioral *Diagnostic Problem Solving Model* development	■Diagnostic problem solving approaches ■Representation of structural knowledge ■Representation of behavioral knowledge

Lube Knowledge Base / ES Critical Success Factors

Critical Success Factors	Issues
▪Expert system software technical design	▪Expert system architecture ▪Knowledge base structure ▪Modular ES design strategies ▪Rule processing – forward-chaining, backward-chaining, bi-directional chaining, inference engine control ▪Object processing – class/instance data model, inheritance, demons, attached procedures, message passing ▪Procedure processing – processed, functions, control structures
▪Expert system programming	▪Inference engine programming ▪Modular code development ▪Efficient data structures ▪Data encapsulation / Polymorphism ▪Test and evaluation

Business Rules Hype Cycle
Rule-Based Systems & Knowledge-Based Expert Systems



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Canada Social Security Modernization Vision = Knowledge Automation

Business Challenge

- Improve efficiency
- Reduce errors
- Reduce fraud

Envisioned/Deployed

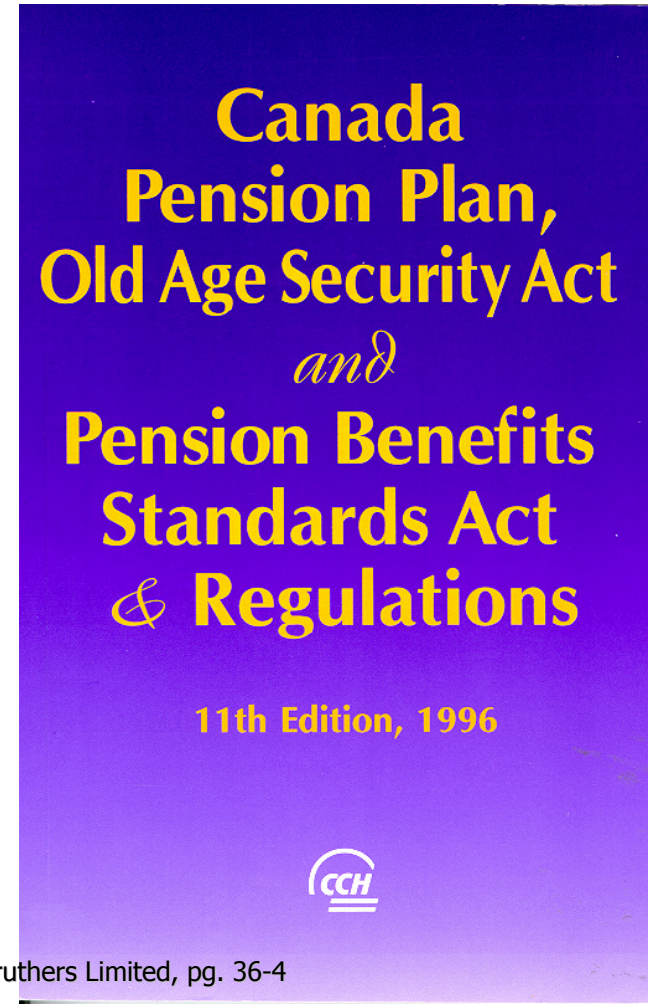
- Knowledge Management Expert Systems
- AION

For

- Knowledge automation
- Transformation
- Optimization
- Modernization

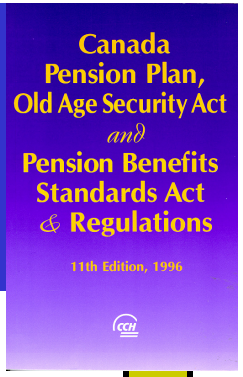
Canada Income Security Programs Redesign (ISPR)

- In the mid-1990's Canada started re-engineering their 1960's legacy social security system to handle Y2K
- They decided to use a Business Rule Engine as the core technology to handle all the **eligibility & entitlement business rules**
- **$39.4 Billion or $39,400,000,000 in benefits paid in 1996-1997**
- **120 million payment transactions/yr.**
- **10 million checks a month**



Federal Guidebook: A Guide to the Canadian Federal Government and its Decision-makers, 1996, J-K Carruthers Limited, pg. 36-4

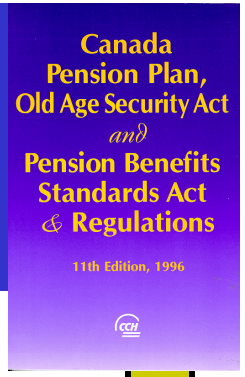
Major Crown Project: Reengineer Social Security



- **Reengineer ISP & build new system: Client Services Delivery Network (CSDN)**
- **EDS won $103 Million contract to build & deliver CSDN**
- ***LESSON: EDS was selected over Arthur Anderson mainly because their proposal included a rulebase engine to handle the complex & dynamic business rules requirements***

"ISP Redesign", Presentation to 1995 Platinum Technology User Conference, Phoenix, by Andre LeMay & Phil Vincent

Canada Social Security
CSDN Business Case



- **Improved efficiency**
  - $40 Million/yr or $683 Million/15yrs
  - 600 positions over 5 years

ROI
$85 million per year

- **Error & fraud reductions due to new rulebase**
  - $45 Million/yr or $703 Million/15yrs
- **$200 Million project used BRE to handle eligibility and entitlement rules**

"ISP Redesign", Presentation to 1995 Platinum Technology User Conference, Phoenix, by Andre LeMay & Phil Vincent

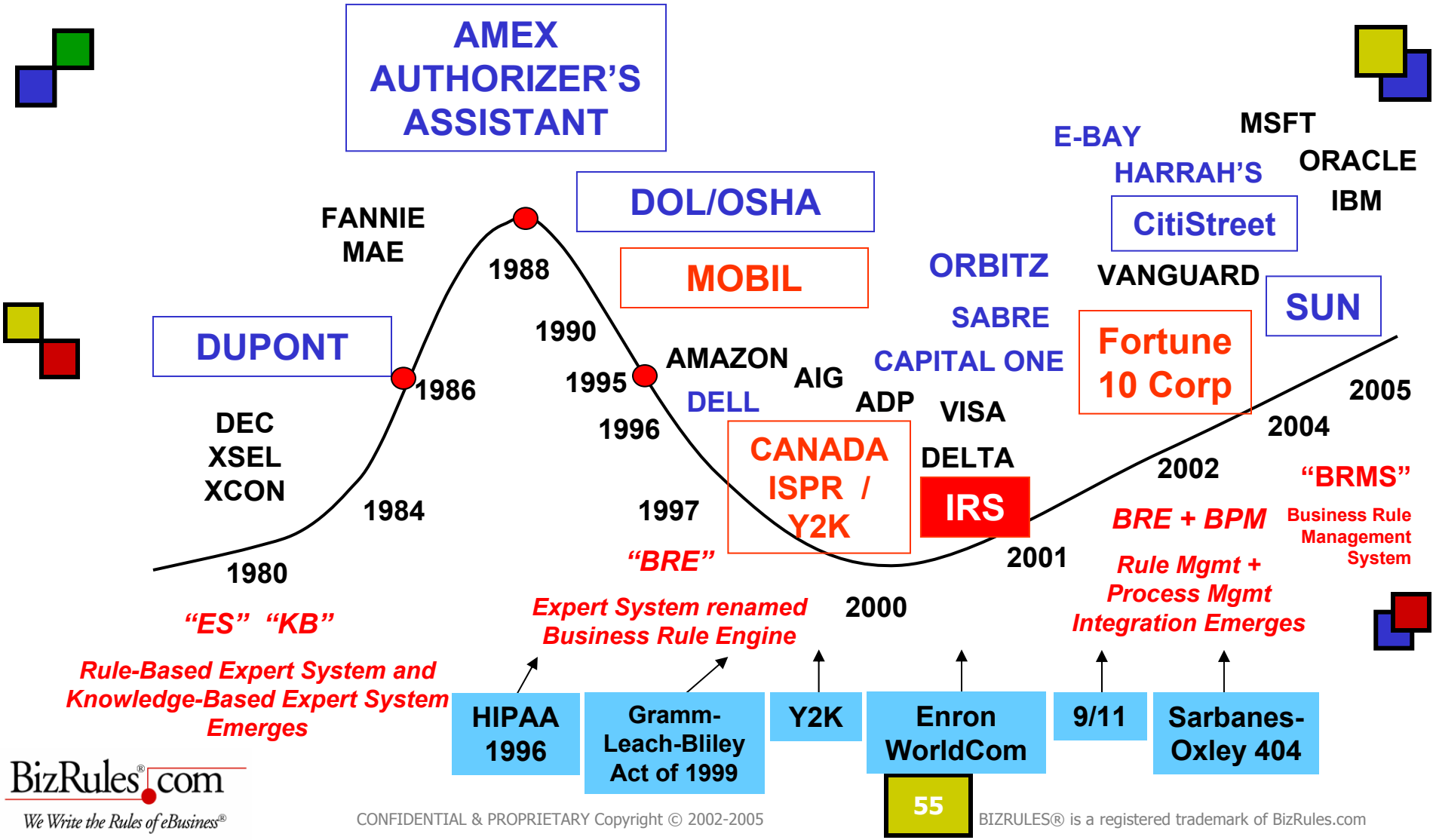
Canada Social Security Modernization

- **Used ES to automate the business rules for the Government of Canada's Social Security Modernization Project.**
- **Social Security Benefits**
- **Disability Benefits**
- **$300 million project programmed using Powerbuilder/ES/BRE**
  - **The rulebase component was a tiny tiny tiny tiny tiny part of the whole thing…**

Canada Social Security Modernization Business Goals/Benefits

- **Early on, the Rulebase significantly reduced project risk and cost**
  - The Govt had to cancel the **$400 million** modernization project during development…
- **But the investment in harvesting, documenting, and coding business rules paid off: Even though all the PowerBuilder code was scrapped, all the rules and the rulebase were retained as corporate assets.**
  - **When the second project started, the Govt was able to save a lot of time and money by re-using the Rules and Rulebase we previously developed…**
- **The Rulebase framework is still in use today, and it is now in use by other government agencies…**
  - Rules architecture was robust enough that it was reused on other Govt. of Canada projects, such as for **Veterans Administration Entitlement Programs**
- **Today, System delivers $39 Billion in benefit checks to 10 Million Canadians/yr.**

Business Rules Hype Cycle
Rule-Based Systems & Knowledge-Based Expert Systems



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U.S. Internal Revenue Service Vision = BRMS + BRE

Business Challenge

- Take the tax agency from a paper-pushing system to an interactive online program for taxpayers.
- Deliver tax refunds in as little as two days instead of five weeks.
- Enable taxpayers to receive e-mail messages from the IRS about their returns and track the status of refunds online.
- Enable IRS Business Analysts/SMEs (non-programmers) to author and modify IRS business rules without reprogramming or recompiling.

Envisioned/Deployed

- Business Rule Management System
- Business Rule Execution System
- BRMS? BRE?

For

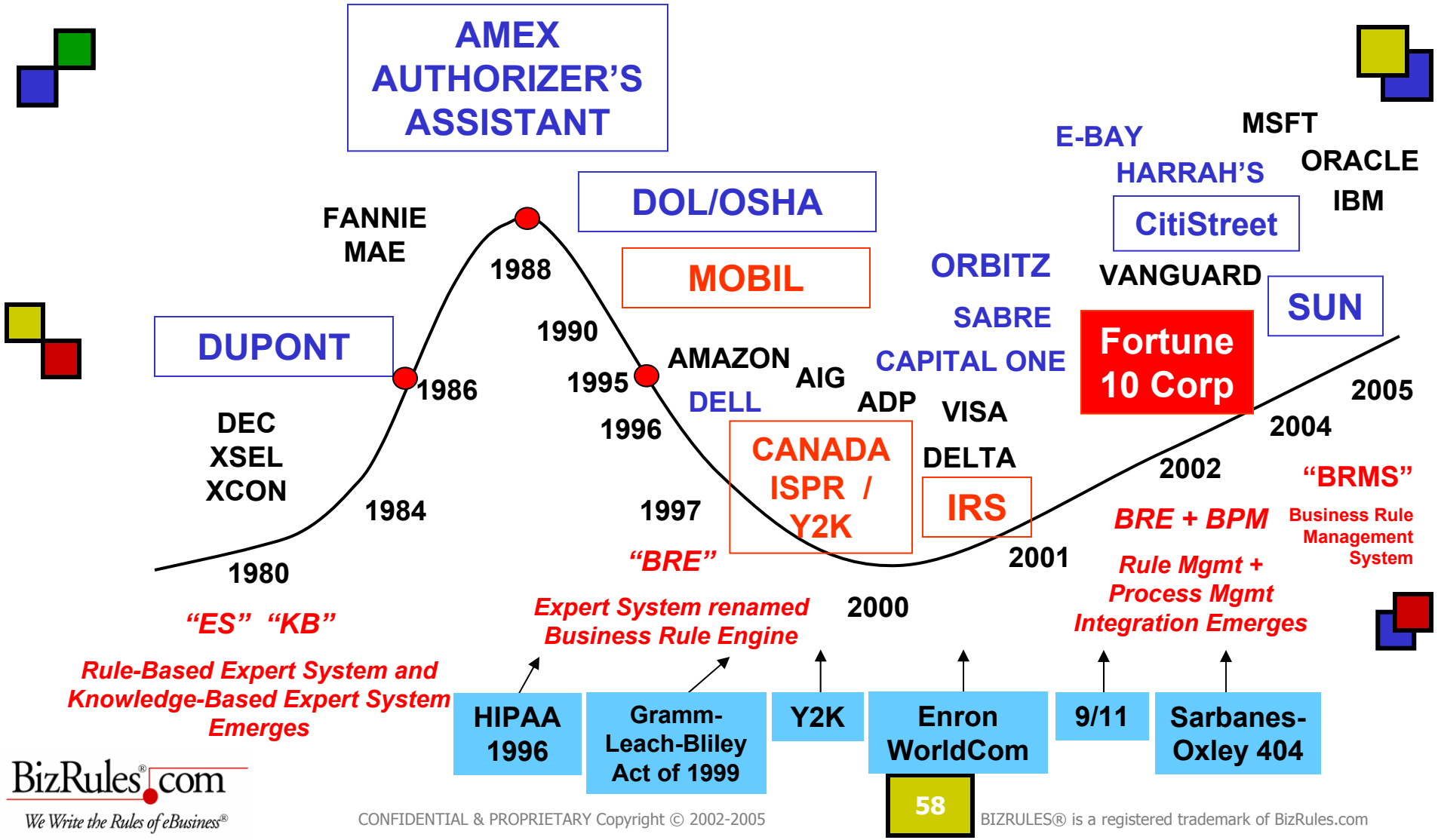
- Modernization
- Transformation
- Optimization
- Reinvention
- Digitization

U.S. Internal Revenue Service Modernization

- The largest civilian modernization plan in history, the **15-year $10 billion IRS PRIME Business Systems Modernization Project**
  - Complex business rules architecture, methodology, and strategy
  - 250,000 IRS business rules process all US Individual Taxpayer tax returns (1040 series)
  - 700-800 rules for the 1040-EZ alone
  - Custom IRS Business Rule Harvesting Methodology
- **The good news**
  - **Top IRS SMEs assigned to this project full-time**
  - **They are using the business rules approach**
- **The bad news**
  - **No engine for CADE yet; rules are still in C++**
  - **Was difficult to extract rules from use cases**
    - **Use cases are great documenting for object-oriented systems, but they are not as useful for documenting business rules or how an enterprise works**
  - **30,000 pages in the Tax Code**

ROI
?

Business Rules Hype Cycle
Rule-Based Systems & Knowledge-Based Expert Systems



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Fortune 10 Corp:
Vision = Rules + Process + Knowledge

Business Challenge

- **How do you manage global tax compliance across multiple tax jurisdictions, multiple ERP system platforms, and multiple P&L's?**
- **How do you manage risk across**
  - **100s of Legal Entities and P&Ls?**
  - **over 200 countries?**
  - **A variety of products, services, and IP?**
- **How do you manage a tax return consisting of over 20,000 pages across many countries in every region of the world?**
- **How do you close the books on time, every time?**

How do you go as fast as you can, as is your duty to shareholders, without speeding... without crossing the line... and without breaking the rules?

How do you automate the enforcement of the rules to prevent business mistakes?

How do you manage the business rules for Global Statutory Compliance, including Sarbanes-Oxley:

- **So they could be changed by the Business Unit without IT re-programming?**
- **So they could be shared (not duplicated) across multiple ERPs and other applications?**
- **To minimize costs?**

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Fortune 10 Corp:
Vision = Rules + Process + Knowledge

Business Challenge

- Ensure employees follow the rules, policies, procedures, and laws → Governance
- The people who know how everything works are leaving → Downsizing
- The experts who know the rules are retiring → Knowledge Retention
- Put management/SME decisions on auto-pilot → Knowledge automation
- System changes are time-consuming → Time to market
- Maintaining business rules in many different places → Cost

Eliciting SME knowledge and aligning their rules to the automated system → Quality

Vision

The client sees business rules as the solution for governance, downsizing, time to market, system maintenance costs

Fortune 10 Corp:
Vision = Rules + Process + Knowledge

Vision

- Instead of trying to build the ultimate ERP and code all the rules into all the ERPs, the client decided to
  - Isolate all the rules and centralize them in a Business Rule Engine
  - Integrate the BRE with the ERPs and other applications that need the rules
  - Use business rules approach and knowledge acquisition methodology to elicit and document the rules from global tax SMEs

Benefits

- Cost is reduced because the rules are in one place
- Time to market is reduced because changing one rule is easier than changing the same rule in multiple ERPs and applications
- Invisible knowledge is transformed into visible knowledge

ROI
Cost to hard-code global tax rules: $ _____
Cost to manage rules using BRE: $ _____
ROI: 10 to 1

Fortune 10 Corp:
Vision = Rules + Process + Knowledge

Business Challenge

- Deliver US and Int'l Tax Knowledge over Web
- Automate routine tax advice
- Give Tax SMEs more time for higher-value more complex cases
- Enable Tax SMEs to manage tax rules

Envisioned/Deployed

- Rules Management
- Process Management
- Knowledge Management
- PegaRULES

For

- Digitization
- Transformation
- Optimization
- Modernization
- Globalization
- Reinvention
- Knowledge automation
- Statutory compliance
- Regulatory compliance

Fortune 10 Corp: Tax/Finance Strategy = Leverage BR Methodology + BRE/BPM to digitize and optimize the corporation

- TAX PLANNING RULES
- ENTITY MGMT RULES
  - Incorporate Statutory Entities
  - Create/Manage/Dissolve SEs
  - Create/Manage/Reorg Depts.
  - Create/Manage Cost Centers
- Locate (Buy/Lease)
  - PROPERTY TAX RULES
- Hire / Pay Salary
  - PAYROLL TAX RULES
- Buy / Make Parts
- Invent
  - IP MGMT RULES
  - R&D TAX CREDIT RULES
- Pre-Sales
- TAX ANALYSIS RULES
  - PRE-SALES / WHAT-IF
  - POST-SALES / ACTUALS
  - CONTRACTS TAX RULES
- Sell… Sign Contract
- Build Product… Install Product
- Provide Service
- Bill AUTOMATED BILLING RULES
- TAX TRANSACTING RULES
  - CIT, SALES & USE, WH, PAYROLL, VAT, FTR, TP
- Quarter/Year-End Close
  - CLOSING PROCESS
- TAX REPORTING RULES
  - FAS109 Accounting for Income Taxes → FAS109 RULES
  - BRANCH REPORTING RULES
  - CLOSING RULES
- SEC Reporting
- Compliance / Audit
  - SARBANES-OXLEY RULES
  - CORPORATE FORMALITIES RULES

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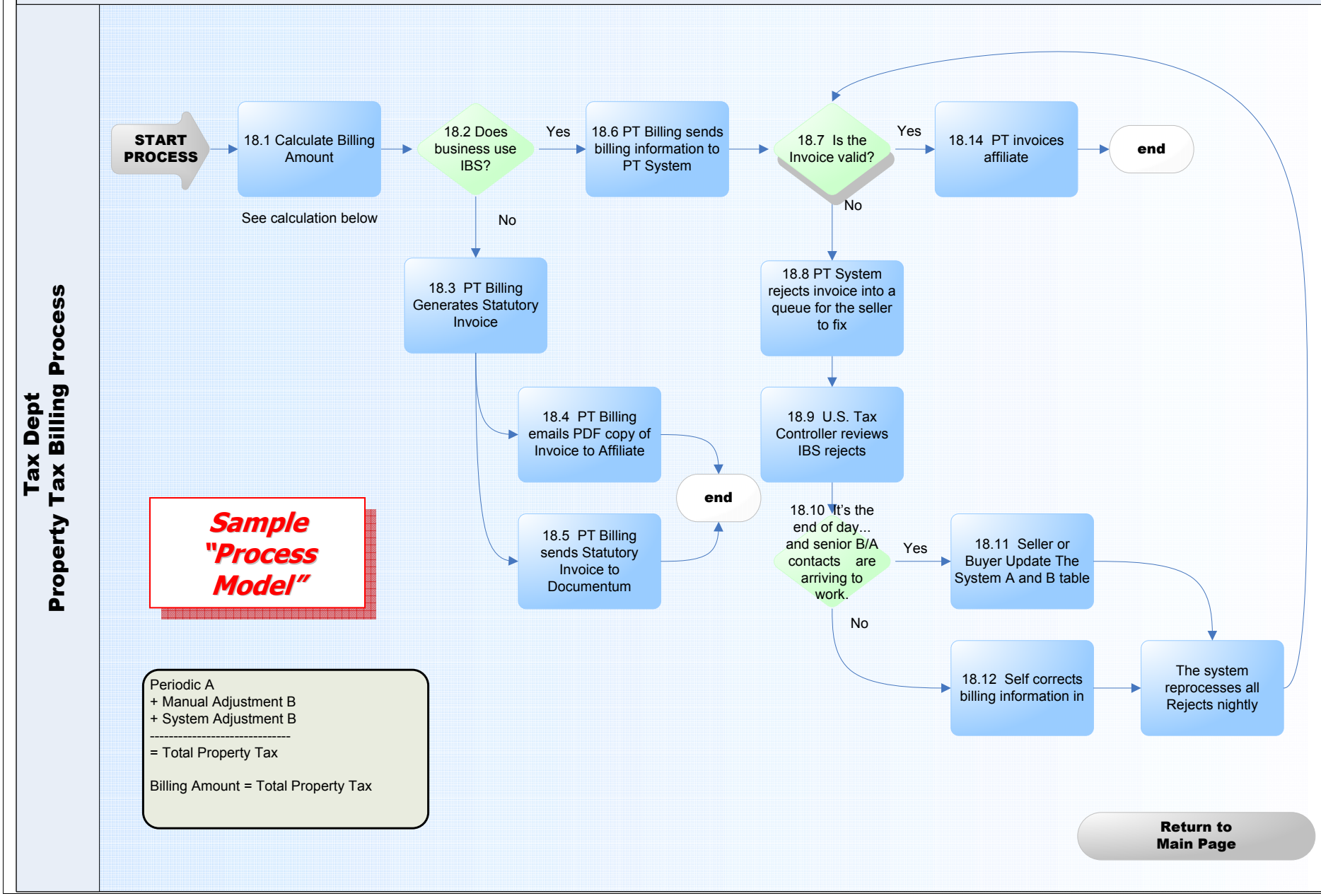
Fortune 10 Corp: Tax/Finance Controllership, Governance, Compliance

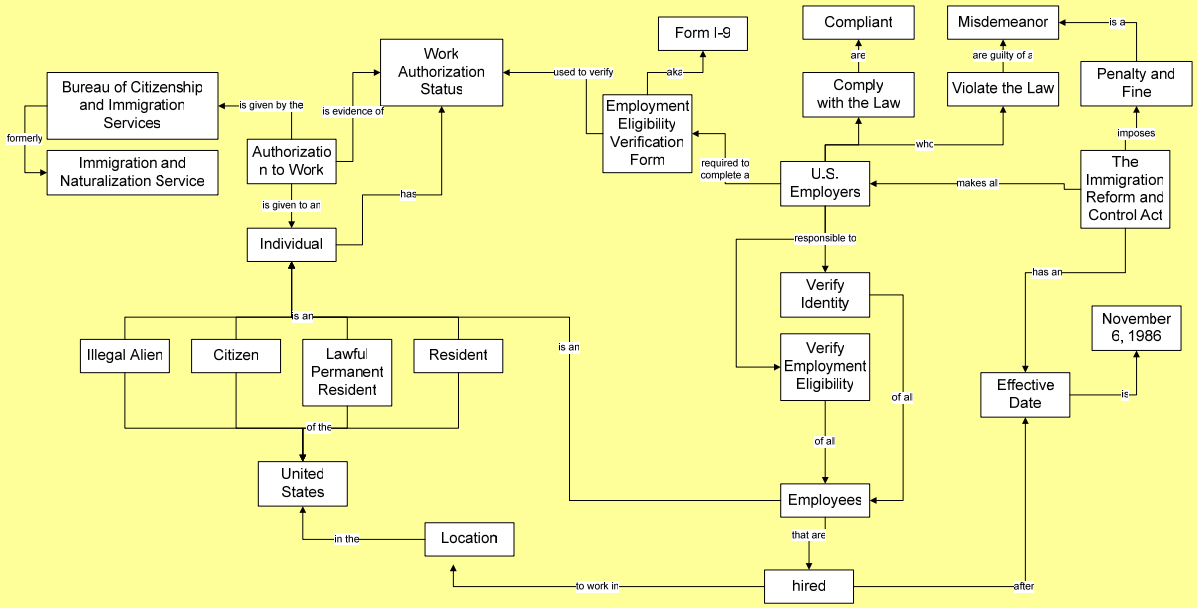
- Rules
- Policies
- Procedures
- Knowledge
  - Knowledge Acquisition
  - Knowledge Representation
  - Knowledge Engineering

- Sales
- Tax
- Finance
- Legal
- HR
- Accounting

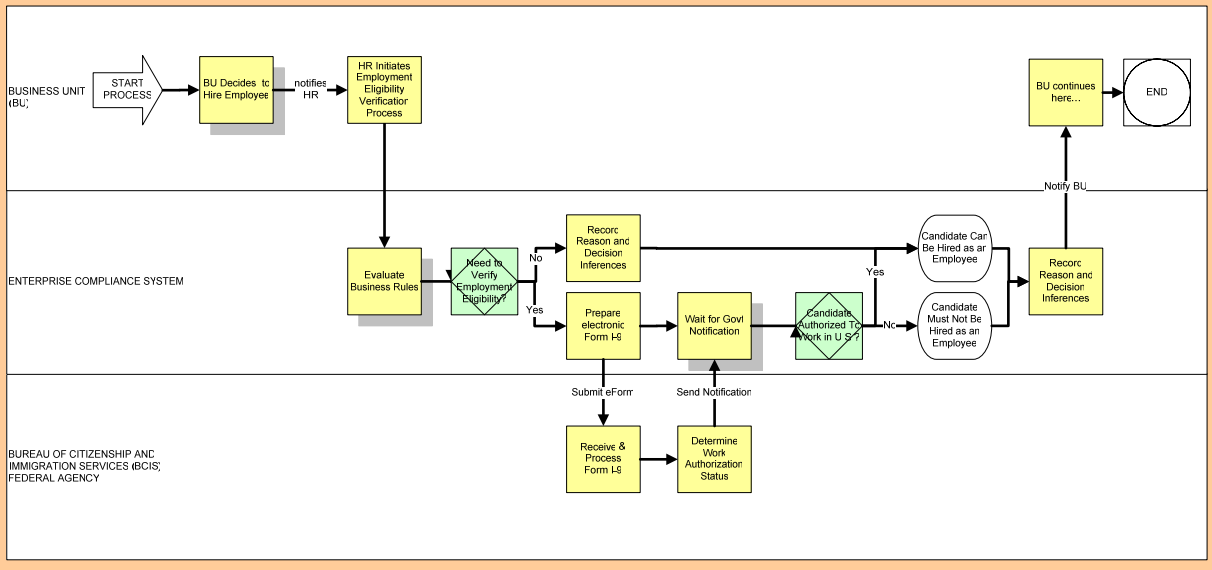
Tax Dept - Property Tax Business Process Model
18.0 Property Tax Billing Processes Internal Billing



Employment Eligibility Verification BUSINESS MAP (FACT MODEL)



DIGITIZED PROCESS



TERMS

Authorization To Work
Illegal Alien
Individual
U.S. Citizen
Lawful Permanent Resident
Bureau of Citizenship and Immigration Services
U.S. Employers
Employing
Employment Eligibility
Identify
Employees
Hired to Work
Employment Eligibility Verification Form (Form I-9)
Work Authorization Status
Guilty
Misdemeanor

FACTS

An Illegal Alien is an Individual, who is not a Citizen or a Lawful Permanent Resident and who has not been given Authorization To Work by the Bureau of Citizenship and Immigration Services (formerly, the Immigration and Naturalization Service).

RULES

U.S. Employers must verify the Employment Eligibility and Identify of all Employees Hired to Work in the United States after November 6, 1986.

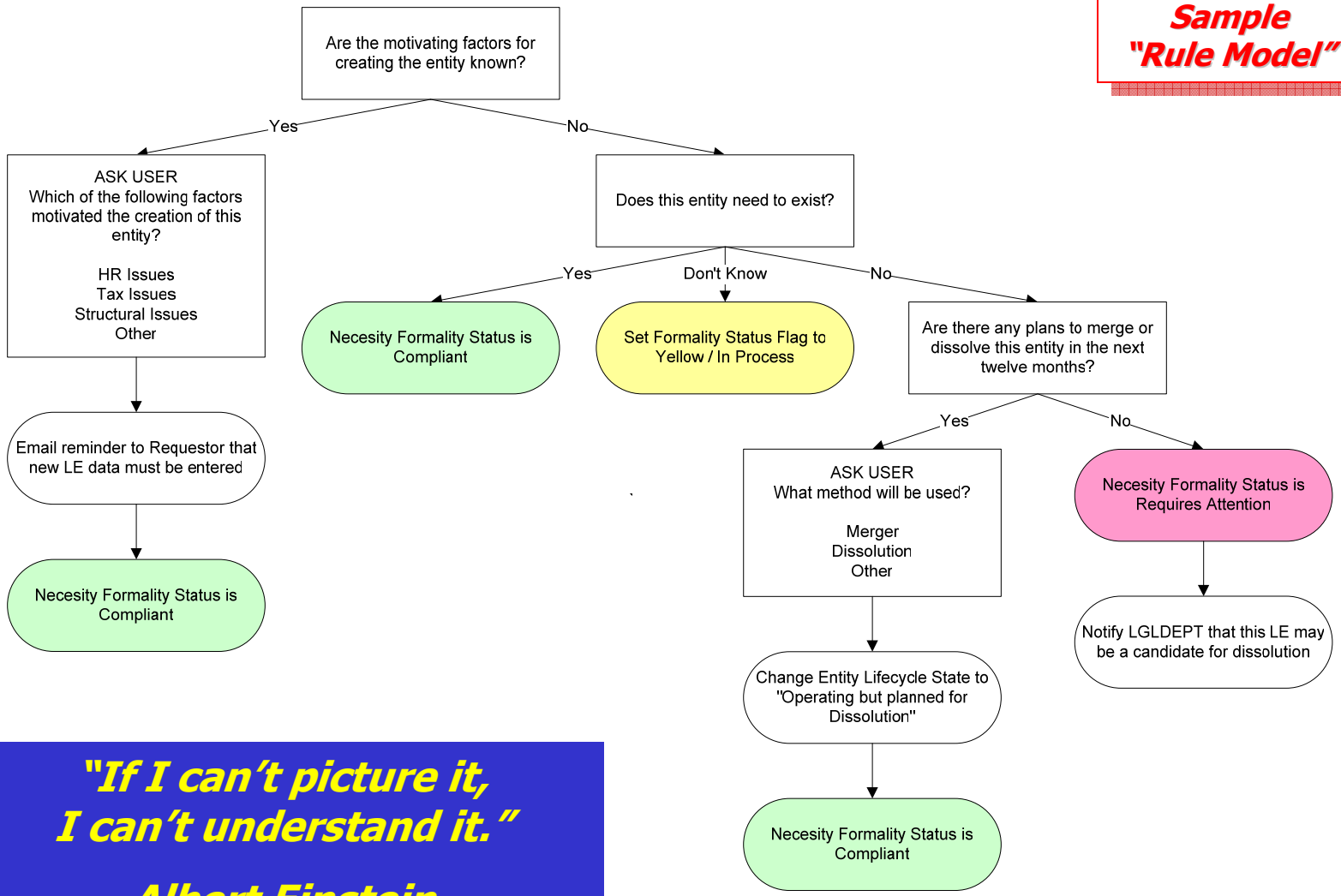
Employers are required to complete Employment Eligibility Verification Forms (Form I-9) for all Employees, including U.S. Citizens.

Anyone Employing an Illegal Alien without Verifying his or her Work Authorization Status is Guilty of a Misdemeanor.

Sample "Fact Model"

LEGAL ENTITY MANAGEMENT SYSTEM - BUSINESS RULE MODEL
SOX & GLOBAL STATUTORY COMPLIANCE 02 - NECESSITY OF ENTITY FORMALITY RULES

Sample "Rule Model"



"If I can't picture it, I can't understand it."

Albert Einstein

Fortune 10 Corp: Tax/Finance
Tax Management Rules

- **Contracts Tax Rules (Inquiry→Sales→Order)**
  - **Selected as the first Business Rules project by the Tax Dept.**
    - **To replace legacy "Tax Advising" system developed by Lead SME**
    - **IT could not make change fast enough because of constant tax changes**
  - **Business rule approach to**
    - **Harvest rules & processes from Lead SME & Global Subject Matter Experts**
    - **Document rules & processes for Global Tax Management**
    - **Automate rules & processes using BRE/BPM rule engine**
  - **Rules cover 120 countries and these tax types:**
    - CIT Corporate Income Tax, WH Withholding, VAT, VAT WH, Sales, USST US Sales Tax, Retention, NWT Net Worth, GRT Gross Rcpts Tax, EPS Employee Profit Share, FTR Foreign Tax Relief, Banking, Stamp, TP Transfer Pricing, etc.
  - **From Inquiry to Order Phase to Order to Remittance Phase**
  - **Expert Rules analyze every transaction/deal to determine optimal Statutory Entities, Management Entities, and Contract Structures in order to manage tax compliance**

Contract rules recommend what Contract Structure and Legal Entities to use in the Deal to manage tax risk

Fortune 10 Corp: Maintenance Contracts Services Billing Rules (Fulfillment)

- **Automated Billing Engine Rules (Fulfillment)**

Rules in the Signed Contract specify Actual Billing terms

  - **Billing rules for each Contract worldwide automatically generate invoice, line items, and taxable amounts**
  - **Harvest billing rules from Legal Contracts**
  - **Integration with Finance Oracle ERP**
  - **Develop Enterprise Rules Architecture**

Fortune 10 Corp: Tax/Finance Entity Management Rules

Entity Management rules are used to create and manage LEs

Entity Management Rules

- **Business Rules for establishing, managing, and dissolving Statutory Entities and Management Entities worldwide, in compliance with Sarbanes-Oxley**
- Rule harvesting to extract rules from Sources of Record (specs, etc.)
- Rules methodology to document the business rules so they can be coded in the Business Rules Engine (BRE)

Fortune 10 Corp: Tax Reporting/Filing IRS Reporting

Tax Reporting rules calculate Income Tax

- **Rules for IRS Corporate Income Tax Reporting (Quarterly and Yearly)**
- **GAAP Rules**
- **FAS109 Reporting Rules / Provision**

  - **Business Rules for calculating Income Statement by Country**
  - **Business Rules for determining Foreign Tax Credits**
  - **Business Rules for calculating US Corporation Income Tax line items for the Headquarters of this multi-national**
  - Rule harvesting to extract rules from Tax SMEs
  - Documenting the business rules & processes so they can be coded in the Business Rules Engine (BRE)

Fortune 10 Corp: Tax/Finance
Global Statutory Compliance Rules

Sarbanes-Oxley Rules

- Adapting the rule harvesting methodology to **document SOX Controls and Processes, and verify those processes are in place**, in order to assure compliance with SOA and other regulations

- Using business rules approach to document the enterprise's rules and processes and controls so they can be easily understood by all, especially auditors

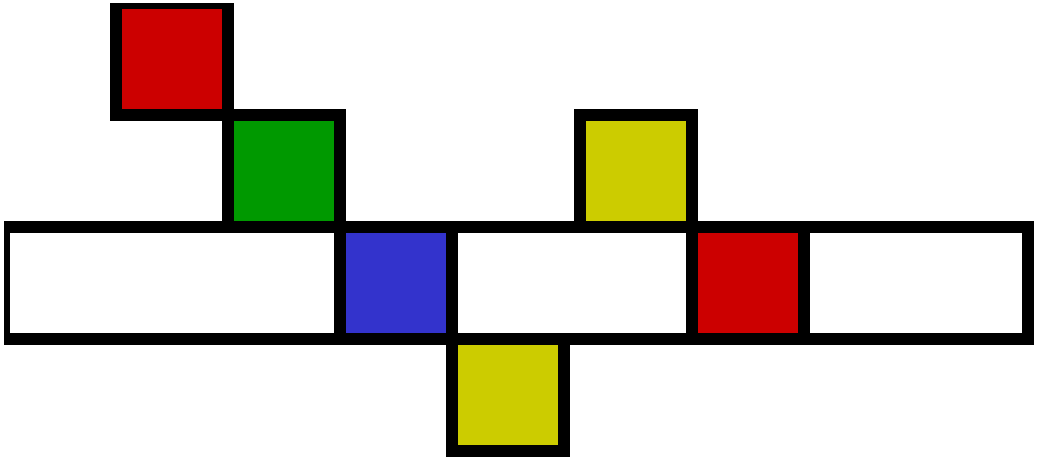
Fortune 10 Corp: Tax/Finance
IP Management Rules

Intellectual Property Management Rules

- **Rules for managing IP assets worldwide**
- **R&D Tax Credit rules**

- Rule harvesting to extract rules from existing System of Record (existing documentation)

- Rule methodology approach to document and manage the business rules so they can be coded in the Business Rules Engine (BRE)

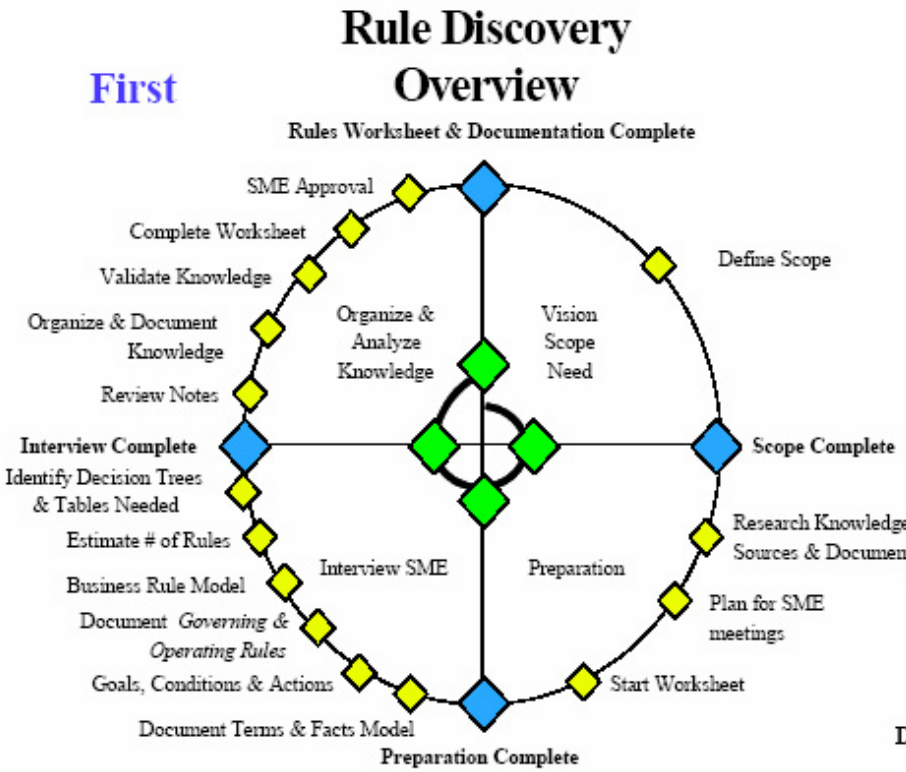


DESIGN PRINCIPLES, FRAMEWORK, METHODOLOGY, TEMPLATES, AND BEST PRACTICES

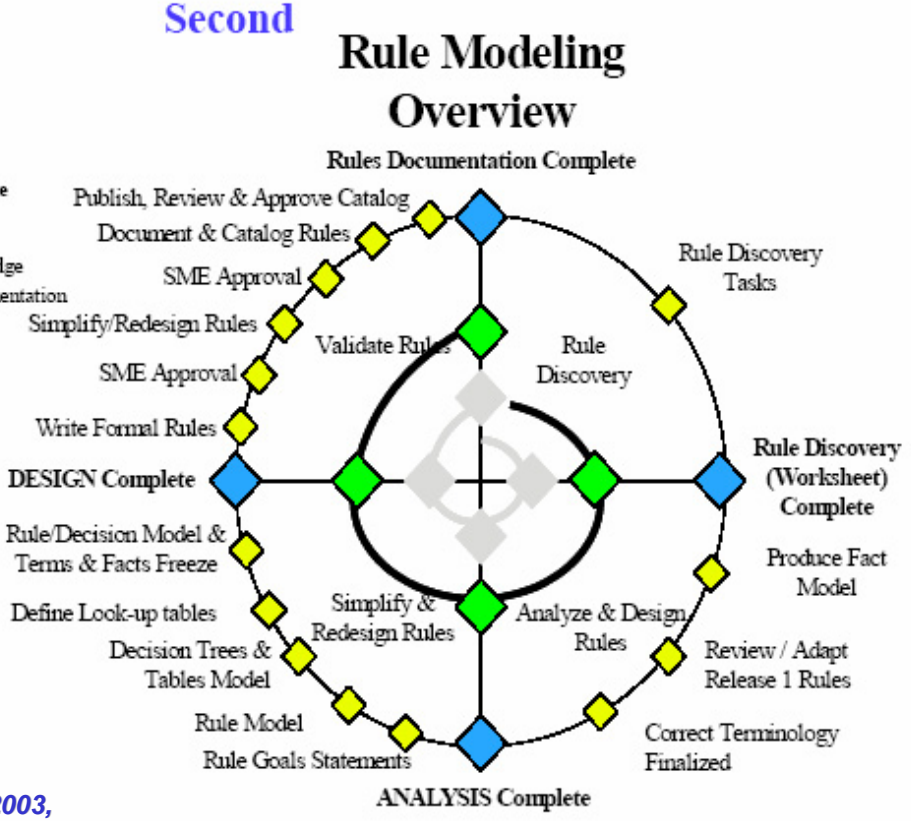
HOW THESE FIVE GLOBAL LEADERS TRANSFORMED KNOWLEDGE AND MANAGED KNOWLEDGE

Business Rule Harvesting Detail for Rule Discovery and Rule Modeling

First



Second



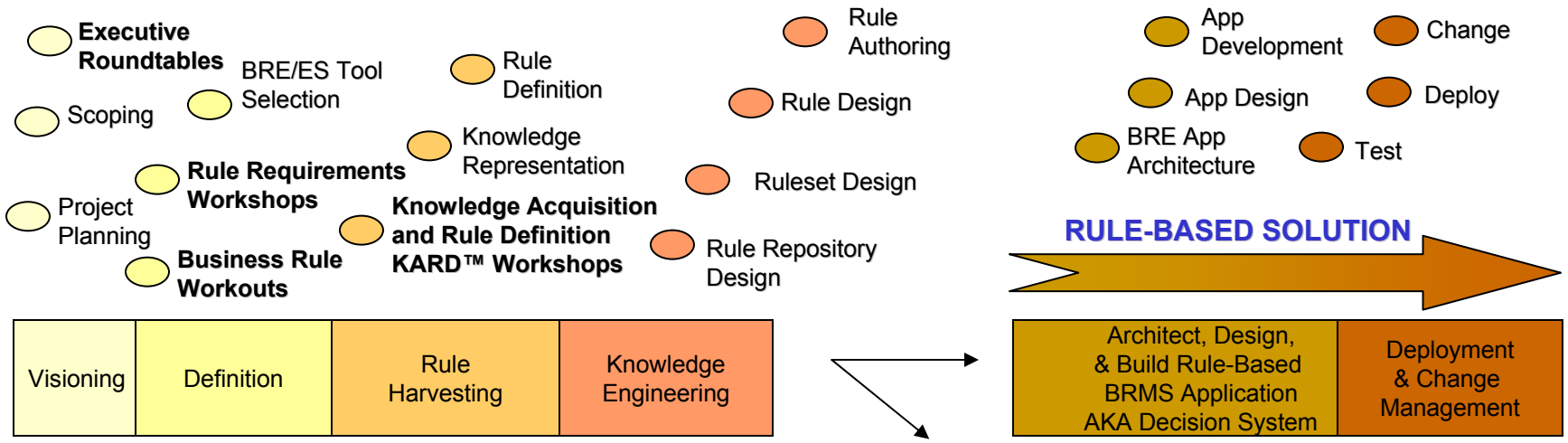
Note: This slide is from a presentation given by IRS/CSC at BRF2003, showing steps in the BIZRULES® VISION™ Methodology. These schematics are from Release 5 of the methodology.

X Data-Based systems are limited to processing data… and outputting information

√ Rule-Based systems process Data + Rules… and output decisions

√ Knowledge-Based systems process Data + Rules + Knowledge…
and output answers + recommendations + expert advice

Example: BIZRULES® VISION™ Methodology for Building Rule-Based & Knowledge-Based Systems



RULE-BASED SOLUTION

- Real-Time Decisioning System
- Rule Digitization
- Enterprise Common Rules
- Simplistic Rules
- Database Integration

KNOWLEDGE-BASED SOLUTION

- Expert Advisor System
- Knowledge Automation System
- Knowledge Automation
- Departmental Rules
- Complex Rules
- Deep Logic
- Database Integration

KNOWLEDGE-BASED SOLUTION

Architect, Design, & Build Knowledge-Based Expert Advisor AKA Expert System

Knowledge Output

Answers

Recommendations

Expert Advice

Rule Output

Decisions

Real-Time Decisions

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This schematic is from Release 7 of the BIZRULES® VISION™ methodology

Rule–Based BRE/BRMS vs. Knowledge-Based ES: Simplistic, common rules shared enterprise-wide vs. Deep, complex rules for a specific business purpose

- **RULE-BASED "BUSINESS RULE ENGINES" ARE BEST FOR**
  - Making the correct Decision based on the business rules, policy or law
  - Simplistic or common rules shared enterprise-wide in real-time (i.e. pricing & promotion rules for one transaction)
- **KNOWLEDGE-BASED "EXPERT SYSTEMS" ARE BEST FOR**
  - Getting an Expert Answer or making an expert-level Decision
  - Deep complex rules for a specific business purpose (i.e. Pricing & promotion plan for FY2006)
  - Recommending the best, optimal answer out of many possible alternatives

Rule–Based BRE/BRMS vs. Knowledge-Based ES: (1) Transacting vs. Planning… (2) Deciding vs. Answering & Recommending…

- **RULE-BASED "BUSINESS RULE ENGINES" ARE BEST FOR**
  - DECIDING / TRANSACTING (OLTP) / APPROVING
  - REPORTING
  - COMPLYING (REAL-TIME) / MONITORING (REAL-TIME)

- **KNOWLEDGE-BASED "EXPERT SYSTEMS" ARE BEST FOR**
  - ANSWERING / EXPERT DECIDING / APPROVING / JUDGING
  - CONFIGURING / RECOMMENDING
  - PLANNING / DESIGNING / MANAGING
  - DIAGNOSING / TROUBLESHOOTING
  - SCORING / PERSONALIZING / WRITING / SERVICING
  - ADVISING

Design Principle #1
Change

- Primary design point is to facilitate change
  - **The single greatest cost in both time and resources in the IT environment is changing the system as the business processes surrounding it change**
  - **Consequently, the overriding concerns for IT become "designing for change and meeting business requirements"**
- Performance, storage and cost of implementation are secondary

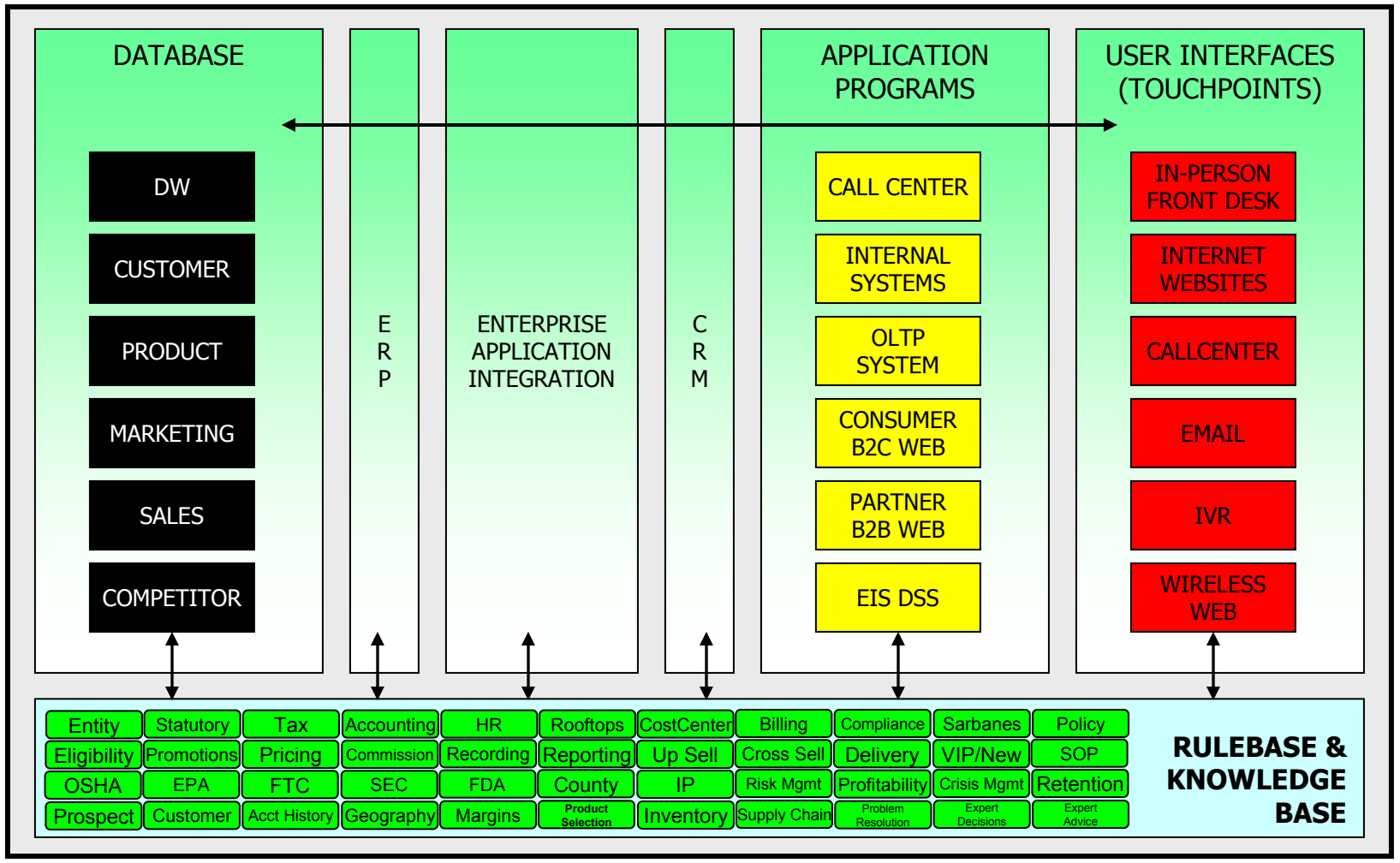
Source:
A Conceptual Architecture for the Information Technology of the State of Ohio

Design Principle #2
Reuse

- Design business rules and other recurring application logic in a consistent manner, encapsulated in a highly granular form
  - **Business rules must be separated from the presentation and data access logic**
  - **Business rules are the focal points of reuse ability**
    - no programmer should ever recode a business rule that already exists

Source:
A Conceptual Architecture for the Information Technology of the State of Ohio

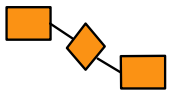
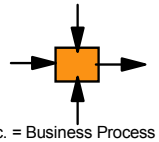
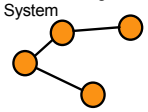
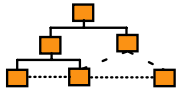
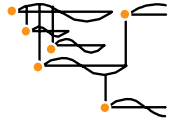
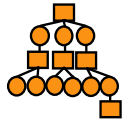
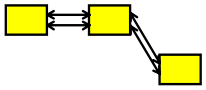
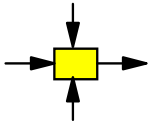
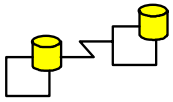
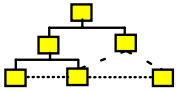
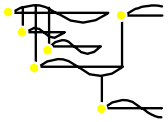
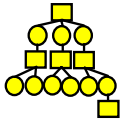
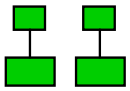
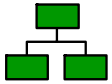
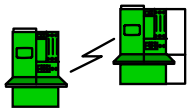
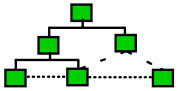
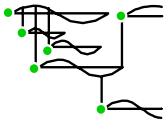
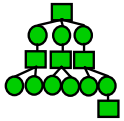
Design Principle #3
Enterprise Rules Integration



Design Principles #4-6

- **#4. You need a framework to work in or else you get lost**
  - Zachman Enterprise Architecture Framework (ZEAF) is as good as any
  - Framework should Business-centric and platform-independent
- **#5. You need a business rules methodology that fits in to your enterprise architecture framework**
  - To know what rules need to be transformed from tacit knowledge to information
  - To know how to elicit rules from SMEs (KA)
  - To know how to represent/engineer those rules for rule engines (KR)
  - To know what rules you have to program (KE)
- **#6. You need models or blueprints of the business rules in order to change rules (i.e. a "rules architecture")**
  - You can't change or modify a complex system unless you know what it is like today
  - If you have the plans, you need to verify they are up-to-date and accurate; if they are not you need to redraw them
  - If you don't have the plans, you need to create them first before making any changes

ENTERPRISE ARCHITECTURE - A FRAMEWORK ™

	DATA *What*	FUNCTION *How*	NETWORK *Where*	PEOPLE *Who*	TIME *When*	MOTIVATION *Why*	
SCOPE (CONTEXTUAL) *Planner*	List of Things Important to the Business  ENTITY = Class of Business Thing	List of Processes the Business Performs  Function = Class of Business Process	List of Locations in which the Business Operates  Node = Major Business Location	List of Organizations Important to the Business  People = Major Organizations	List of Events Significant to the Business  Time = Major Business Event	List of Business Goals/Strat  Ends/Means=Major Bus. Goal/ Critical Success Factor	SCOPE (CONTEXTUAL) *Planner*
ENTERPRISE MODEL (CONCEPTUAL) *Owner*	e.g. Semantic Model  Ent = Business Entity Reln = Business Relationship	e.g. Business Process Model  Proc. = Business Process I/O = Business Resources	e.g. Business Logistics System  Node = Business Location Link = Business Linkage	e.g. Work Flow Model  People = Organization Unit Work = Work Product	e.g. Master Schedule  Time = Business Event Cycle = Business Cycle	e.g. Business Plan  End = Business Objective Means = Business Strategy	ENTERPRISE MODEL (CONCEPTUAL) *Owner*
SYSTEM MODEL (LOGICAL) *Designer*	e.g. Logical Data Model  Ent = Data Entity Reln = Data Relationship	e.g. Application Architecture  Proc .= Application Function I/O = User Views	e.g. Distributed System Architecture  Node = I/S Function (Processor, Storage, etc) Link = Line Characteristics	e.g. Human Interface Architecture  People = Role Work = Deliverable	e.g. Processing Structure  Time = System Event Cycle = Processing Cycle	e.g., Business Rule Model  End = Structural Assertion Means =Action Assertion	SYSTEM MODEL (LOGICAL) *Designer*
TECHNOLOGY MODEL (PHYSICAL) *Builder*	e.g. Physical Data Model  Ent = Segment/Table/etc. Reln = Pointer/Key/etc.	e.g. System Design  Proc.= Computer Function I/O = Data Elements/Sets	e.g. Technology Architecture  Node = Hardware/System Software Link = Line Specifications	e.g. Presentation Architecture  People = User Work = Screen Format	e.g. Control Structure  Time = Execute Cycle = Component Cycle	e.g. Rule Design  End = Condition Means = Action	TECHNOLOGY MODEL (PHYSICAL) *Builder*
DETAILED REPRESEN-TATIONS (OUT-OF-CONTEXT) *Sub-Contractor*	e.g. Data Definition  Ent = Field Reln = Address	e.g. Program  Proc.= Language Stmt I/O = Control Block	e.g. Network Architecture  Node = Addresses Link = Protocols	e.g. Security Architecture  People = Identity Work = Job	e.g. Timing Definition  Time = Interrupt Cycle = Machine Cycle	e.g. Rule Specification  End = Sub-condition Means = Step	DETAILED REPRESEN-TATIONS (OUT-OF-CONTEXT) *Sub-Contractor*
FUNCTIONING ENTERPRISE	e.g. DATA	e.g. FUNCTION	e.g. NETWORK	e.g. ORGANIZATION	e.g. SCHEDULE	e.g. STRATEGY	FUNCTIONING ENTERPRISE

Complete "Data Model" Architecture

	DATA *What*	FUNCTION *How*	NETWORK *Where*	PEOPLE *Who*	TIME *When*	MOTIVATION *Why*	
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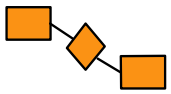
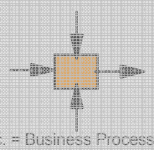
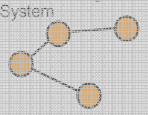
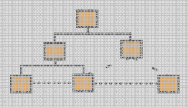
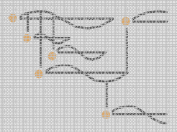
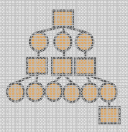
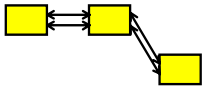
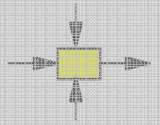
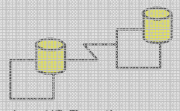
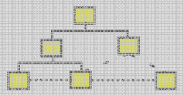
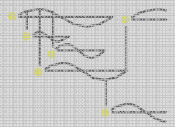
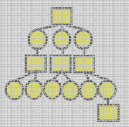
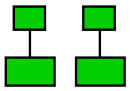
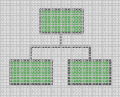
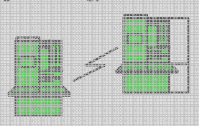
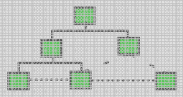
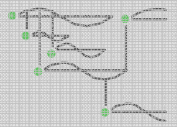
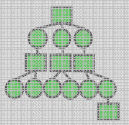
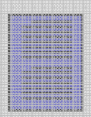
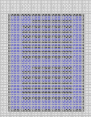
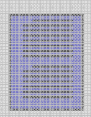
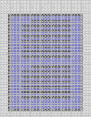
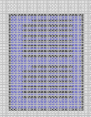
ENTERPRISE MODEL (CONCEPTUAL) *Owner*	e.g. Semantic Model  Ent = Business Entity Reln = Business Relationship	e.g. Business Process Model  Proc. = Business Process I/O = Business Resources	e.g. Business Logistics System  Node = Business Location Link = Business Linkage	e.g. Work Flow Model  People = Organization Unit Work = Work Product	e.g. Master Schedule  Time = Business Event Cycle = Business Cycle	e.g. Business Plan  End = Business Objective Means = Business Strategy	ENTERPRISE MODEL (CONCEPTUAL) *Owner*
SYSTEM MODEL (LOGICAL) *Designer*	e.g. Logical Data Model  Ent = Data Entity Reln = Data Relationship	e.g. Application Architecture  Proc = Application Function I/O = User Views	e.g. Distributed System Architecture  Node = I/S Function (Processor, Storage, etc) Link = Line Characteristics	e.g. Human Interface Architecture  People = Role Work = Deliverable	e.g. Processing Structure  Time = System Event Cycle = Processing Cycle	e.g., Business Rule Model  End = Structural Assertion Means =Action Assertion	SYSTEM MODEL (LOGICAL) *Designer*
TECHNOLOGY MODEL (PHYSICAL) *Builder*	e.g. Physical Data Model  Ent = Segment/Table/etc. Reln = Pointer/Key/etc.	e.g. System Design  Proc.= Computer Function I/O = Data Elements/Sets	e.g. Technology Architecture  Node = Hardware/System Software Link = Line Specifications	e.g. Presentation Architecture  People = User Work = Screen Format	e.g. Control Structure  Time = Execute Cycle = Component Cycle	e.g. Rule Design  End = Condition Means = Action	TECHNOLOGY MODEL (PHYSICAL) *Builder*
DETAILED REPRESEN-TATIONS (OUT-OF-CONTEXT) *Sub-Contractor*	e.g. Data Definition  Ent = Field Reln = Address	e.g. Program  Proc.= Language Stmt I/O = Control Block	e.g. Network Architecture  Node = Addresses Link = Protocols	e.g. Security Architecture  People = Identity Work = Job	e.g. Timing Definition  Time = Interrupt Cycle = Machine Cycle	e.g. Rule Specification  End = Sub-condition Means = Step	DETAILED REPRESEN-TATIONS (OUT-OF-CONTEXT) *Sub-Contractor*
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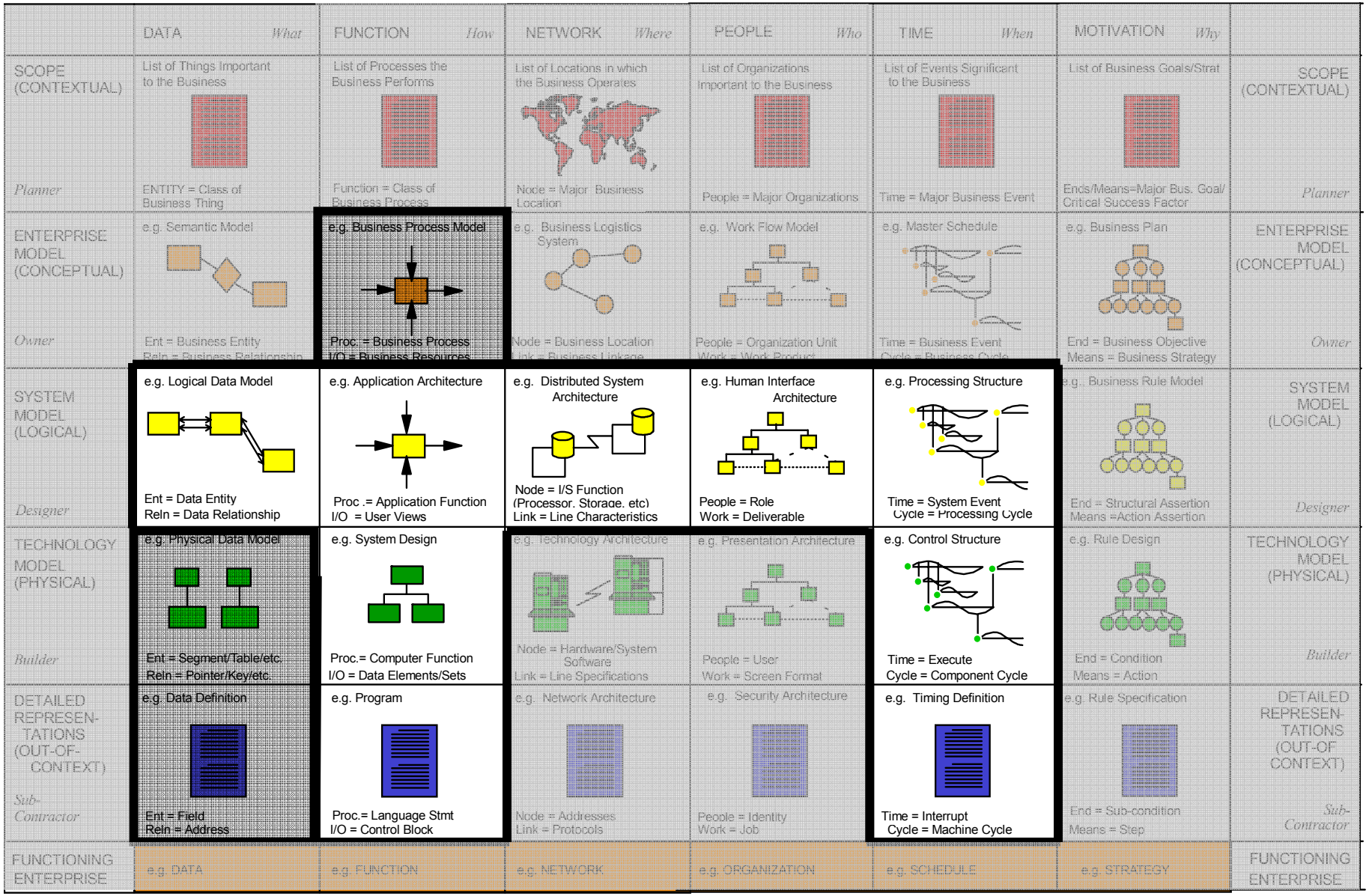
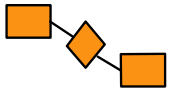
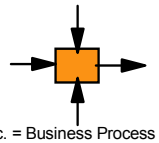
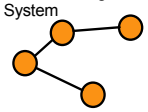
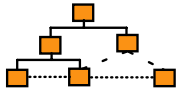
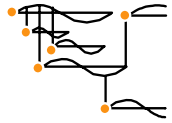
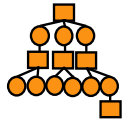
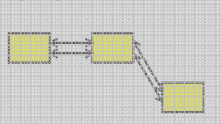
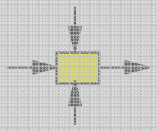
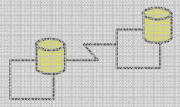
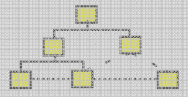
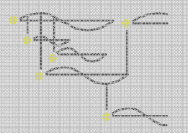
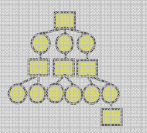
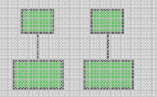
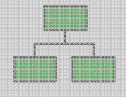
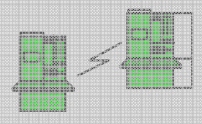
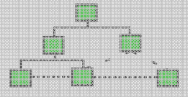
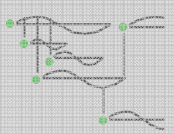
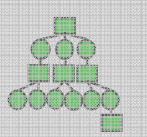
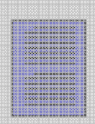
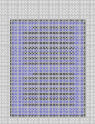
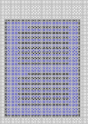
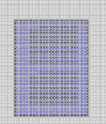
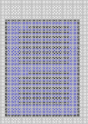
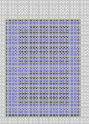
Object Oriented Modeling (UML)

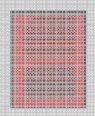
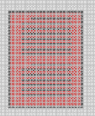
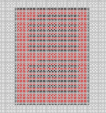
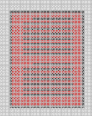
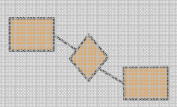
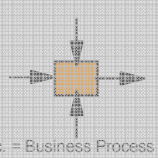
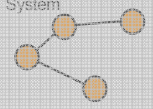
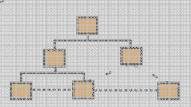
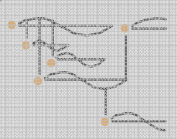
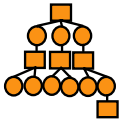
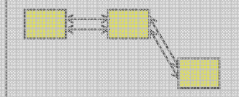
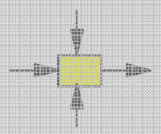
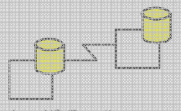
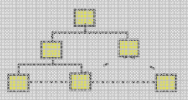
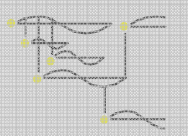
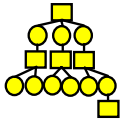
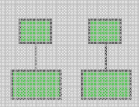
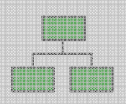
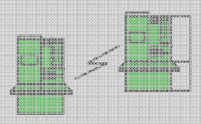
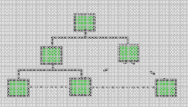
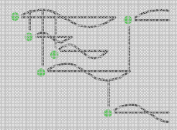
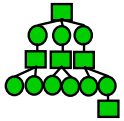
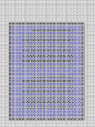
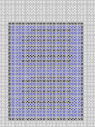
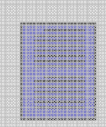
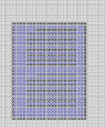
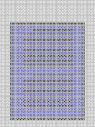


BI

Complete "Business Process Model" Architecture

	DATA *What*	FUNCTION *How*	NETWORK *Where*	PEOPLE *Who*	TIME *When*	MOTIVATION *Why*	
SCOPE (CONTEXTUAL) *Planner*	List of Things Important to the Business  ENTITY = Class of Business Thing	List of Processes the Business Performs  Function = Class of Business Process	List of Locations in which the Business Operates  Node = Major Business Location	List of Organizations Important to the Business  People = Major Organizations	List of Events Significant to the Business  Time = Major Business Event	List of Business Goals/Strat  Ends/Means=Major Bus. Goal/ Critical Success Factor	SCOPE (CONTEXTUAL) *Planner*
ENTERPRISE MODEL (CONCEPTUAL) *Owner*	e.g. Semantic Model  Ent = Business Entity Reln = Business Relationship	e.g. Business Process Model  Proc. = Business Process I/O = Business Resources	e.g. Business Logistics System  Node = Business Location Link = Business Linkage	e.g. Work Flow Model  People = Organization Unit Work = Work Product	e.g. Master Schedule  Time = Business Event Cycle = Business Cycle	e.g. Business Plan  End = Business Objective Means = Business Strategy	ENTERPRISE MODEL (CONCEPTUAL) *Owner*
SYSTEM MODEL (LOGICAL) *Designer*	e.g. Logical Data Model  Ent = Data Entity Reln = Data Relationship	e.g. Application Architecture  Proc = Application Function I/O = User Views	e.g. Distributed System Architecture  Node = I/S Function (Processor, Storage, etc) Link = Line Characteristics	e.g. Human Interface Architecture  People = Role Work = Deliverable	e.g. Processing Structure  Time = System Event Cycle = Processing Cycle	e.g., Business Rule Model  End = Structural Assertion Means =Action Assertion	SYSTEM MODEL (LOGICAL) *Designer*
TECHNOLOGY MODEL (PHYSICAL) *Builder*	e.g. Physical Data Model  Ent = Segment/Table/etc. Reln = Pointer/Key/etc.	e.g. System Design  Proc.= Computer Function I/O = Data Elements/Sets	e.g. Technology Architecture  Node = Hardware/System Software Link = Line Specifications	e.g. Presentation Architecture  People = User Work = Screen Format	e.g. Control Structure  Time = Execute Cycle = Component Cycle	e.g. Rule Design  End = Condition Means = Action	TECHNOLOGY MODEL (PHYSICAL) *Builder*
DETAILED REPRESEN-TATIONS (OUT-OF-CONTEXT) *Sub-Contractor*	e.g. Data Definition  Ent = Field Reln = Address	e.g. Program  Proc.= Language Stmt I/O = Control Block	e.g. Network Architecture  Node = Addresses Link = Protocols	e.g. Security Architecture  People = Identity Work = Job	e.g. Timing Definition  Time = Interrupt Cycle = Machine Cycle	e.g. Rule Specification  End = Sub-condition Means = Step	DETAILED REPRESEN-TATIONS (OUT-OF-CONTEXT) *Sub-Contractor*
FUNCTIONING ENTERPRISE	e.g. DATA	e.g. FUNCTION	e.g. NETWORK	e.g. ORGANIZATION	e.g. SCHEDULE	e.g. STRATEGY	FUNCTIONING ENTERPRISE

Complete "Business Rule Model" Architecture

	DATA *What*	FUNCTION *How*	NETWORK *Where*	PEOPLE *Who*	TIME *When*	MOTIVATION *Why*	
SCOPE (CONTEXTUAL) *Planner*	List of Things Important to the Business  ENTITY = Class of Business Thing	List of Processes the Business Performs  Function = Class of Business Process	List of Locations in which the Business Operates  Node = Major Business Location	List of Organizations Important to the Business  People = Major Organizations	List of Events Significant to the Business  Time = Major Business Event	List of Business Goals/Strat  Ends/Means=Major Bus. Goal/ Critical Success Factor	SCOPE (CONTEXTUAL) *Planner*
ENTERPRISE MODEL (CONCEPTUAL) *Owner*	e.g. Semantic Model  Ent = Business Entity Reln = Business Relationship	e.g. Business Process Model  Proc. = Business Process I/O = Business Resources	e.g. Business Logistics System  Node = Business Location Link = Business Linkage	e.g. Work Flow Model  People = Organization Unit Work = Work Product	e.g. Master Schedule  Time = Business Event Cycle = Business Cycle	e.g. Business Plan  End = Business Objective Means = Business Strategy	ENTERPRISE MODEL (CONCEPTUAL) *Owner*
SYSTEM MODEL (LOGICAL) *Designer*	e.g. Logical Data Model  Ent = Data Entity Reln = Data Relationship	e.g. Application Architecture  Proc = Application Function I/O = User Views	e.g. Distributed System Architecture  Node = I/S Function (Processor, Storage, etc) Link = Line Characteristics	e.g. Human Interface Architecture  People = Role Work = Deliverable	e.g. Processing Structure  Time = System Event Cycle = Processing Cycle	e.g., Business Rule Model  End = Structural Assertion Means =Action Assertion	SYSTEM MODEL (LOGICAL) *Designer*
TECHNOLOGY MODEL (PHYSICAL) *Builder*	e.g. Physical Data Model  Ent = Segment/Table/etc. Reln = Pointer/Key/etc.	e.g. System Design  Proc.= Computer Function I/O = Data Elements/Sets	e.g. Technology Architecture  Node = Hardware/System Software Link = Line Specifications	e.g. Presentation Architecture  People = User Work = Screen Format	e.g. Control Structure  Time = Execute Cycle = Component Cycle	e.g. Rule Design  End = Condition Means = Action	TECHNOLOGY MODEL (PHYSICAL) *Builder*
DETAILED REPRESEN-TATIONS (OUT-OF-CONTEXT) *Sub-Contractor*	e.g. Data Definition  Ent = Field Reln = Address	e.g. Program  Proc.= Language Stmt I/O = Control Block	e.g. Network Architecture  Node = Addresses Link = Protocols	e.g. Security Architecture  People = Identity Work = Job	e.g. Timing Definition  Time = Interrupt Cycle = Machine Cycle	e.g. Rule Specification  End = Sub-condition Means = Step	DETAILED REPRESEN-TATIONS (OUT-OF-CONTEXT) *Sub-Contractor*
FUNCTIONING ENTERPRISE	e.g. DATA	e.g. FUNCTION	e.g. NETWORK	e.g. ORGANIZATION	e.g. SCHEDULE	e.g. STRATEGY	FUNCTIONING ENTERPRISE

Steps for creating the Business Rule Models… and transforming tacit "under-water" knowledge into information that can be seen "above-water"

- **Rule Discovery / Rule Design process**
  - Rule Requirements Workshops
  - Business Rule Workouts
  - Knowledge Acquisition and Rule Definition KARD™ Workshops
  - Ensure rules are correct, complete, atomic, reusable
  - Map rules to data objects
  - Define rule attributes, rule meta-data, and **rule templates**
  - Integrate rules into process, system & data architecture
  - Design ruleflow and integrate rules into ruleflow
  - Design business rules for the business, not for the vendor's technology
- **Rule Modeling process**
  - Define terms, facts, semantic maps, rule hierarchies, rules
  - Define enterprise rules architecture (db architecture)
  - Define rulebase repository hierarchy
  - Define rule packages, rulesets, rule conditions & actions
  - Define Rule normalization, ruleflow model, rule chaining interdependency model
- **Rule Validation Guidelines**
  - No rule overlaps, gaps in coverage, subsumptions, conflicts, etc.

Rule Repository Design

Best Practice:

Spend time up front designing the rule repository before writing the rules

- **Repository design is a crucial task**
- **Design individual application repositories first, then look at designing and building the enterprise repositories**
- **Repository design tasks include:**
  - **Folder and hierarchy design**
    - **Global rules that apply to all applications and processes would be at the top level**
    - **Rules that apply only within an application would be stored at the application level**
    - **Rules that apply to a specific business process would be stored at the business process level**
    - **Local rules that only apply to a specific rule package would be stored at the lowest level, the rule package level**
  - **Folder, ruleset, and rule naming conventions**
  - **Identify global rules that should be shared across enterprise applications**
  - **Identify local rules that are only used by one application**
  - **Design the rule repository before writing the rules**

Rule Templates

- Before creating a new rule, identify what type of rule you need
- Use the appropriate rule template for that category to help you write the rule
- Rule templates are organized into these categories:
  - Term
  - Fact
  - Trigger
  - Constraint
  - Inference (IF/THEN)
  - Calculation
  - Decision Table
  - Decision Tree
  - Lookup Table
  - Pattern Matching
  - Scorecard
  - etc.

Best Practice:

Use Rule Templates to help standardize how you write rules and rule definitions

"There are only 3 ways to document rules

- **Pictures – Decision trees**
- **Charts – Decision tables**
- **Words – Textual rules"**

Best Practice:

Draw a picture of the rules first. Once they are reviewed, then write them down if necessary

Best Practice:

Use trees and tables to design & approve many rules at once (i.e. Rulesets)

"If I can't picture it, I can't understand it."

Albert Einstein

Source:
How to Write the Rules of CRM, eBusiness, and eGov,
By Rolando Hernandez
Business Rules Forum, New Orleans
Nov 2001

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Rule Priorities

- In general, most BRE vendors recommend not prioritizing rules
- If you prioritize all the rules, you negate the rules engine and end up with a procedural application

Best Practice:

In general, do not use rule priorities to override the rule engine

Best Practice:

It is a good idea to use priorities for either the first rule or the last rule

In conclusion… The Knowledge-Based 21st Century Enterprise Knows How to Transform Tacit Knowledge into Visible Knowledge

- **KNOWLEDGE**
  - **INFORMATION**
    - Tangible
    - Visible knowledge
    - Can be accessed by third persons
    - Once shared, it belongs to everybody
    - Can be seen "above the water"
  - **TACIT KNOWLEDGE**
    - Intangible
    - Invisible
    - Hidden "underwater"
    - Can be accessed on the first-person basis only

Source:
Understanding Knowledge Societies
In twenty questions and answers with
the Index of Knowledge Societies,
Department of Economic and Social Affairs
Division for Public Administration and Development
Management, United Nations, New York, 2005

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Thank you!

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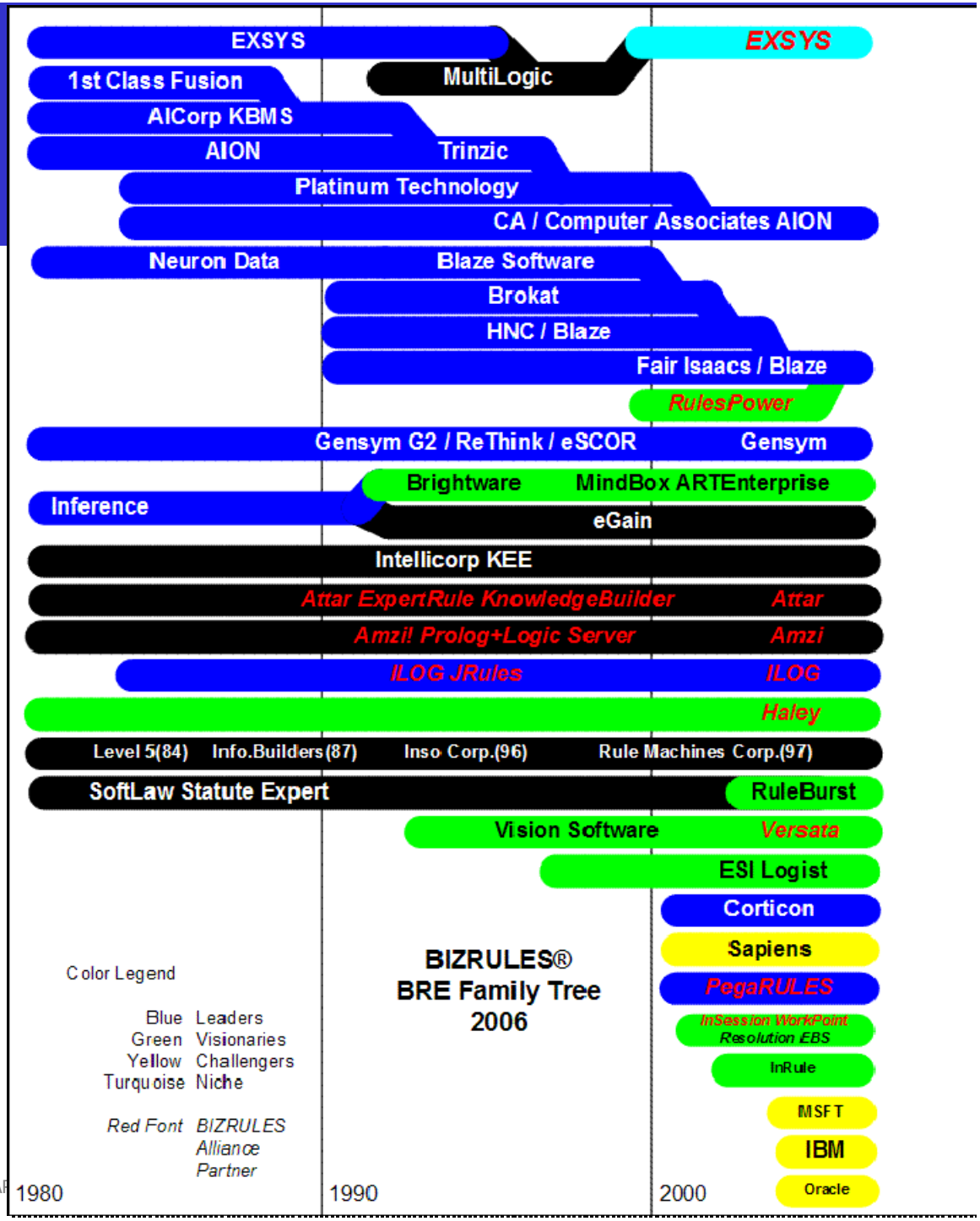

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