

# Semantic Interoperability Levels for Comparing Use Cases

## Describing Value-Add of Semantic Web Design Using a Practical Interoperability Scale

Implementing W3C Semantic Web Standards for Interoperability

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# Problem

Articulating the Interoperability Value Proposition.

Getting Funded.

# Business IT Gap

**Business**



Business Expert's Perspective: Processes

**IT**



Querying the  
Process Space



Process  
Implementation

IT Implementation Perspective

# This Benefits You

## Business



- **For:** Business Decision Makers
- **Who Need:** Tool that Gets the IT Team to Put the Interop Benefits in a Clear, Concise Presentation.

## IT



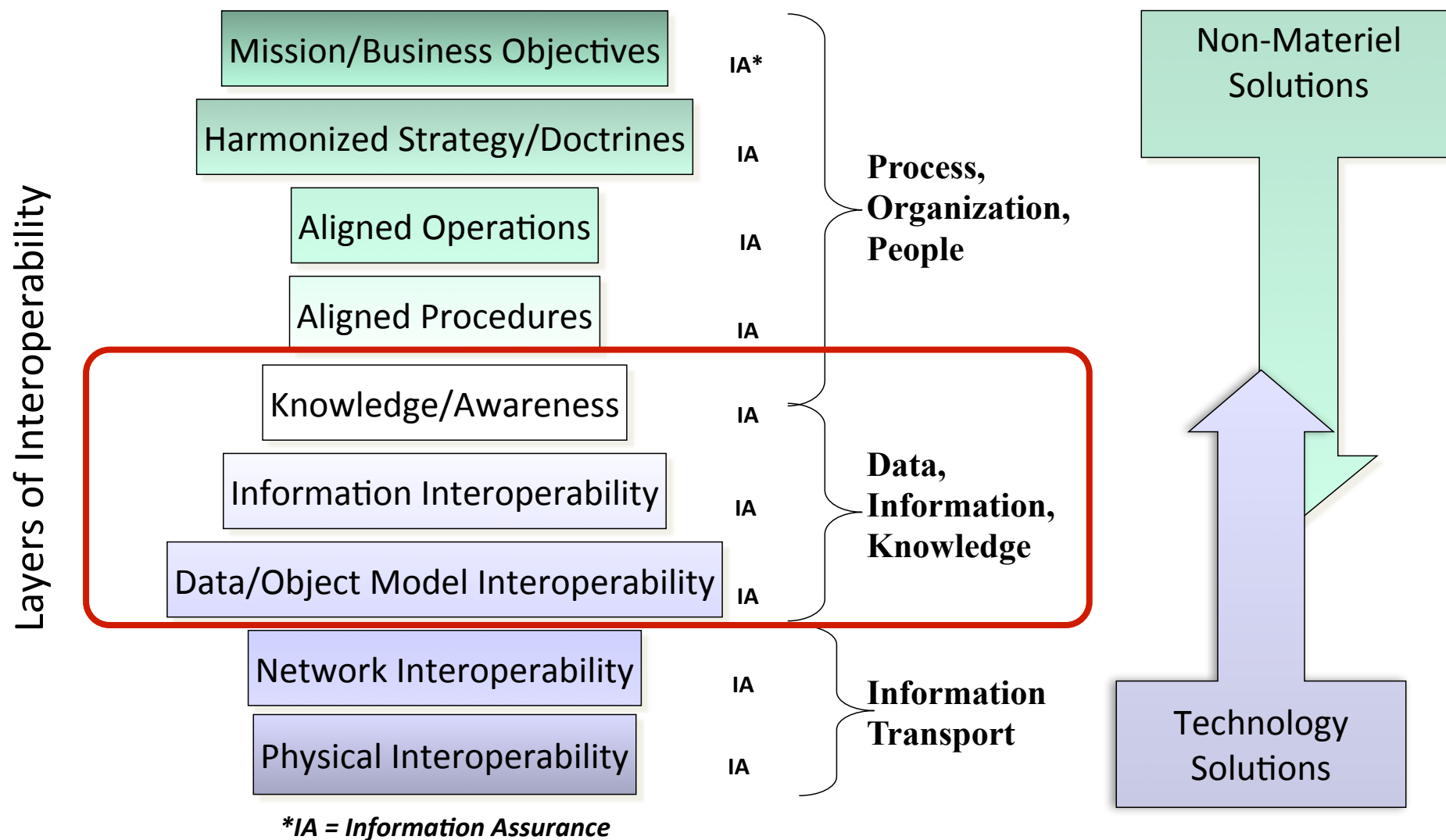
- **For:** CIOs, IT Architects, IT Project Managers
- **Who Have:** Interoperability Project or Technology
- **Who Need:** Means to Communicate Interoperability Value Prop to Business Decision Makers
- **So they can:** Get Funded, Get Paid, Solve Expensive Interoperability Problems.

# A Current Method

"Measure for Merit for Coalition Interoperability"

# Interoperability Model:

## A composite of Materiel & Non-materiel solutions



Adapted from "Beyond Technical Interoperability – Introducing a Reference Model for Measure of Merit for Coalition Interoperability". Dr. Andreas Tolk, VMASC, ODU. 8<sup>th</sup> CCRTS, NDU, June 2003

# Comparing Use Cases

Situation: Legal Contract Management System

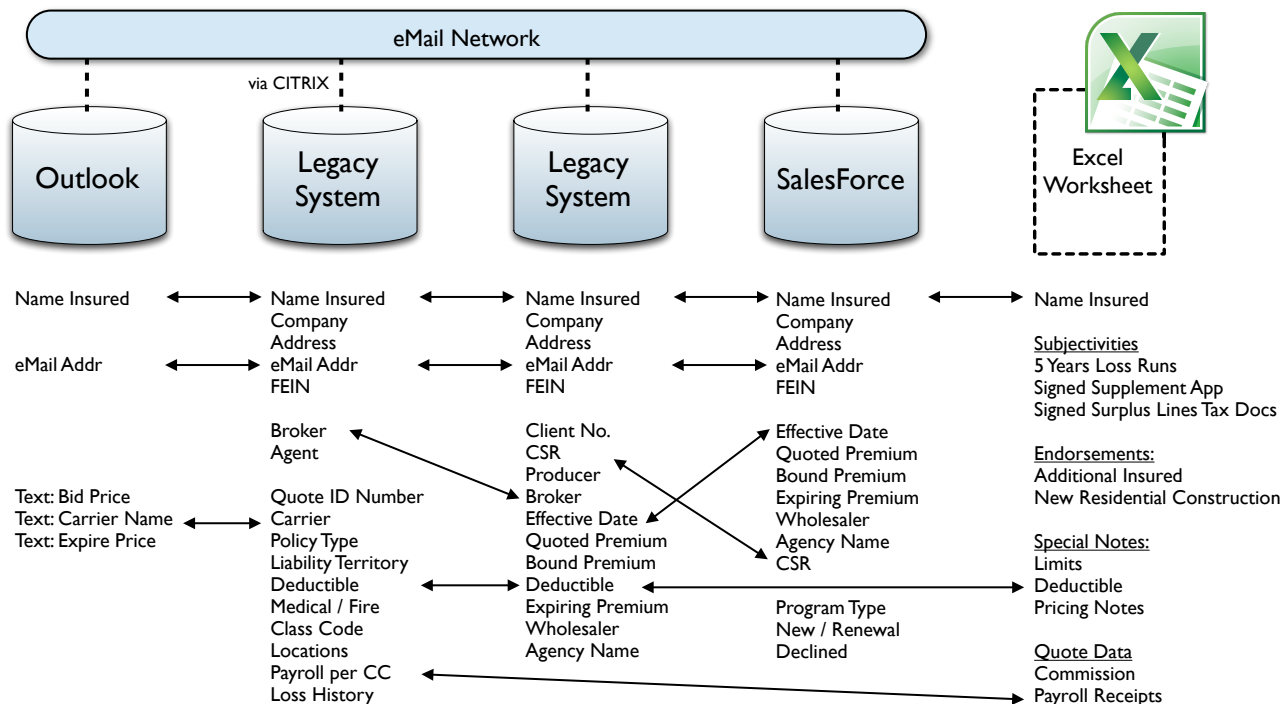
# Client Situation

Managing Data & Rule Complexity



# Client Data Alignment Problem

Goal: Understand Situation & Context

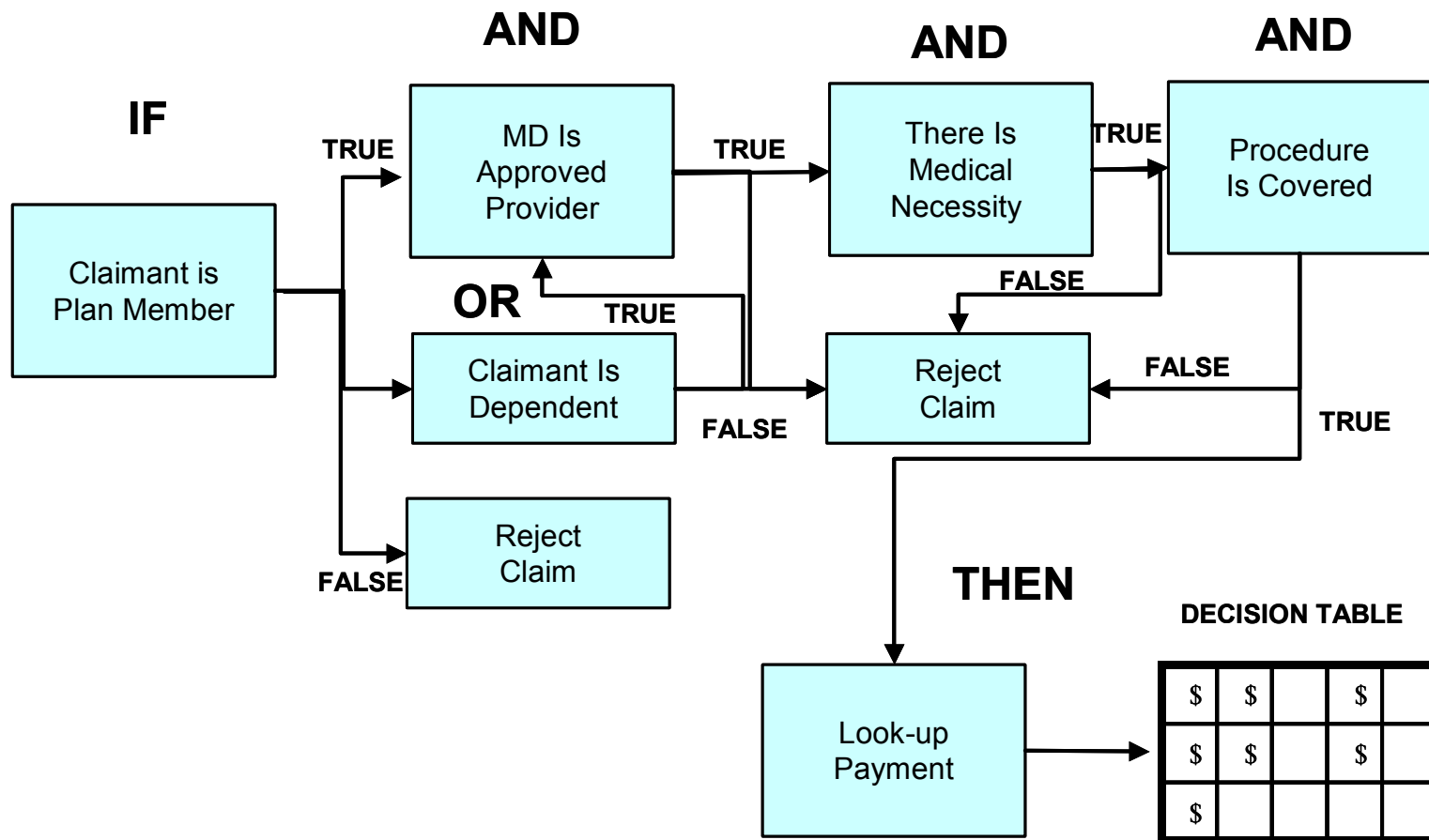


# Rules Drive the Business

The Ability to Manage Rule Complexity Determines Success or Failure.  
Risk vs. Loss.

Business Rules Drive Integration Costs

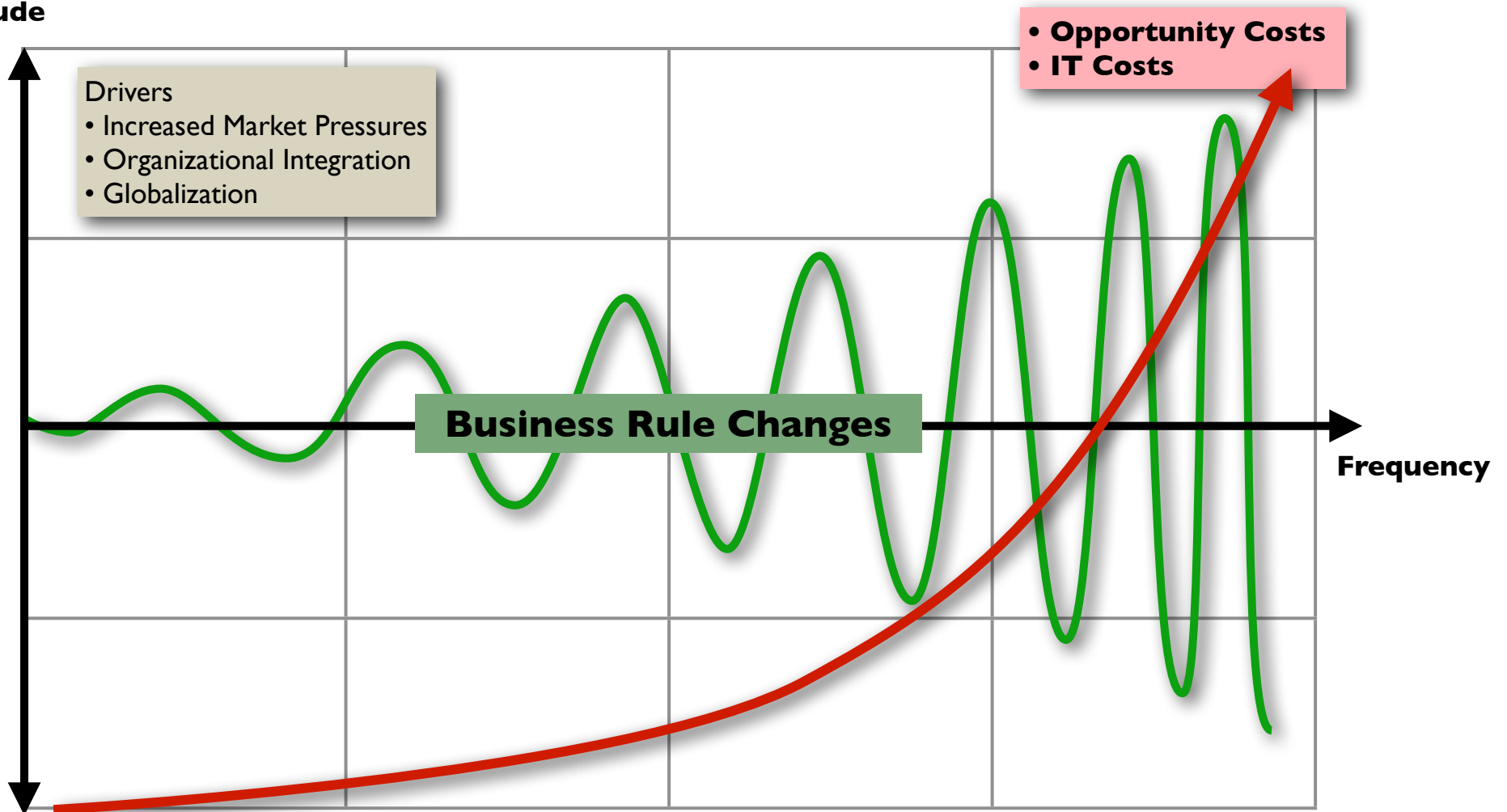
**Figure 1: A Medical Claim Rule Set**



# Rule Change is the Norm

Rules Become more Complex and Change More Frequently

Magnitude



Source: Gartner, Pega

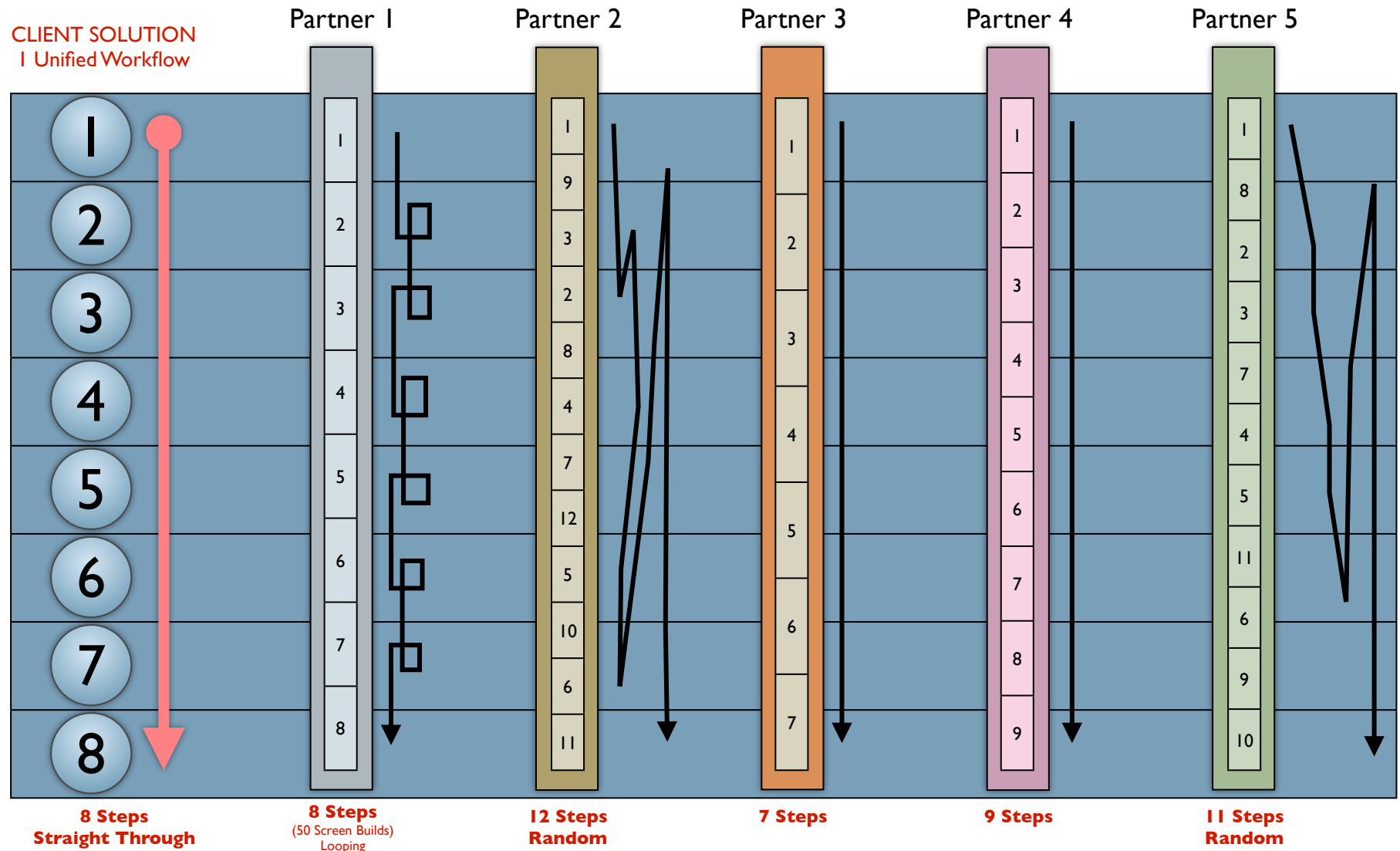
# Rules Enable Unified Workflows

**Answers these Questions:**

What needs to be done?

Who is supposed to be doing it?

Who is approved to share work in what step?



# Solution

Interoperability for: Rules, Workflows, Data

based on **W3C** Semantic Web Standards





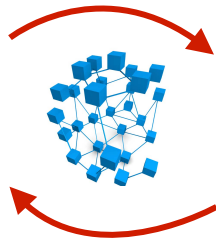
# Interoperability Drives Value

Connect Industries & Governments

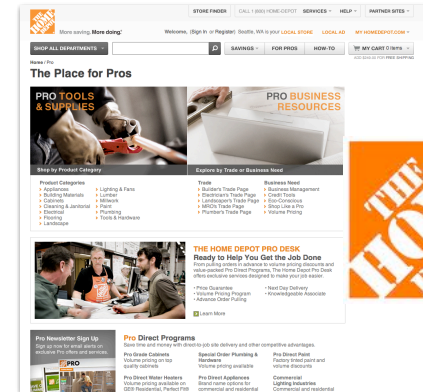
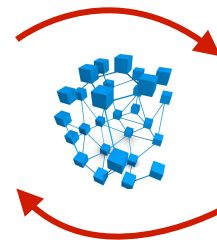
HealthCare

Insurance

eCommerce



Drywall Contractor



Contractor Materials

# Solution Strategy

## **Step 1: Specify the UI Specs & Data**

Mockup Screens

Identify Workflows, Business Rules, Data Model

Import & Verify Data Preserving Original Semantics

## **Step 2: Build a Common Knowledge Model**

Connect Classes, Infer Data Structure

Import Instance Data, Browse

Build Screens Adding Rules & Workflows to complete the App

## **Step 3: Access Your Connected Knowledge**

Facet Browse Data with Speed

Navigate Workflows

Access Remote Data, Enter New Data

## **Step 4: Extend with Confidence**

Accounting, Billing, Business Dev., IT, Brokers, Policies, Salesforce

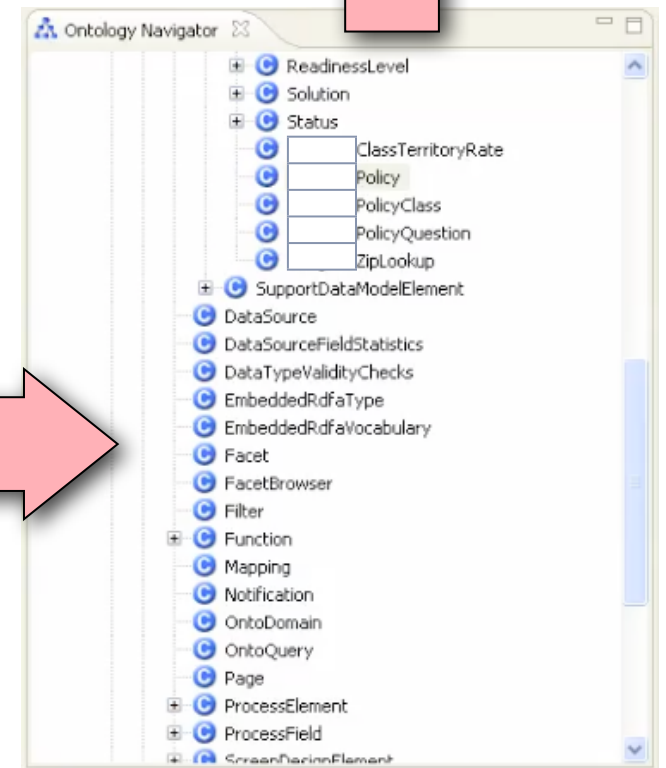
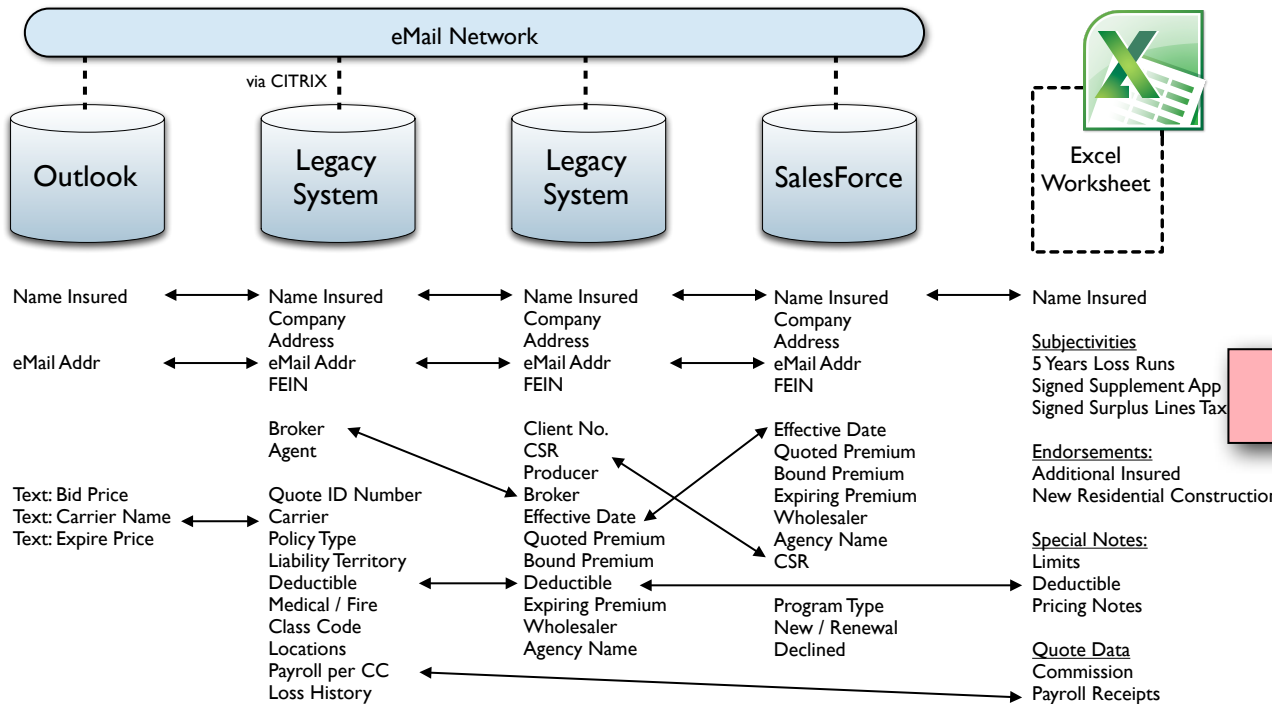
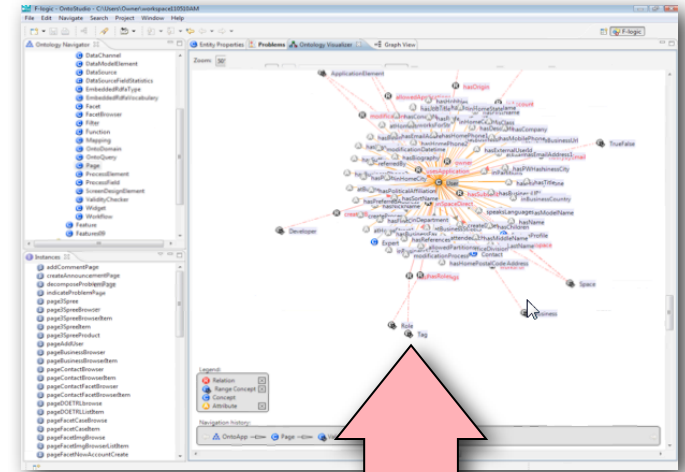
Knowledge Model Grows to be Richer, More Connected

Access Data From Everywhere

# Step 2

# Get a Common Knowledge Model

- Connect Classes
- Add Rules
- Import Instance Data





# Common Knowledge Model

The image displays a software interface for managing an ontology. On the left, the 'Ontology Navigator' shows a hierarchical tree of classes, including 'ControlEnumeration', 'DataChannel', 'DataModelElement', 'ApplicationDataModelElement', and 'ReadinessLevel'. Below this, the 'Instances' panel lists 100 instances of 'DOERL' (DOERL1 to DOERL110).

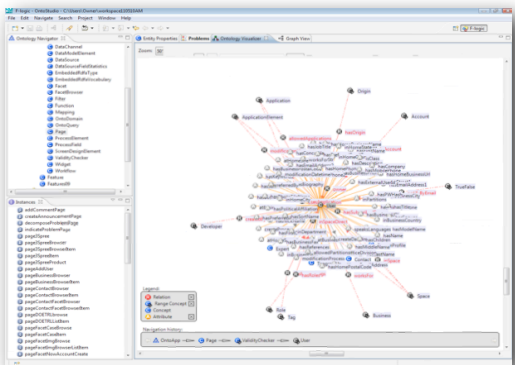
The main area, 'Ontology Visualizer', shows a network diagram of the 'Semantic TRL Ontology - Aligns Readiness Levels'. The central node is 'ReadinessLevel'. It is connected to several other classes via relationships:

- ApplicationElement** (Class) is connected to **ReadinessLevel** (Class) via the relationship **hasId** (Property).
- Origin** (Class) is connected to **ReadinessLevel** (Class) via the relationship **hasOrigin** (Property).
- Tag** (Class) is connected to **ReadinessLevel** (Class) via the relationship **hasRelatedTags** (Property).
- Space** (Class) is connected to **ReadinessLevel** (Class) via the relationship **inSpaceDirect** (Property).
- Space** (Class) is connected to **ReadinessLevel** (Class) via the relationship **inSpace** (Property).
- ReadinessLevelCriteria** (Class) is connected to **ReadinessLevel** (Class) via the relationship **createUser** (Property).
- User** (Class) is connected to **ReadinessLevel** (Class) via the relationship **creationUser** (Property).
- ApplicationDataModelElement** (Class) is connected to **ReadinessLevel** (Class) via the relationship **createdBy** (Property).
- Developer** (Class) is connected to **ReadinessLevel** (Class) via the relationship **createdBy** (Property).
- User** (Class) is connected to **ReadinessLevel** (Class) via the relationship **owner** (Property).
- User** (Class) is connected to **ReadinessLevel** (Class) via the relationship **modificationUser** (Property).

A legend at the bottom left indicates that a blue square with a 'P' represents a 'Relation' and a blue square with a 'C' represents a 'Range Class'.

# Connect Knowledge.

W3C Semantic Standards Enable Very High Interoperability



# Interoperability Comparison Tool

Client System: Before vs. After

# Interoperability vs. Approach/Effort



Time  
Seconds / Minutes

		Ad Hoc Custom Programming	XML, Import/Export Batch Processing	XML, SOA Live Web Services	Semantic Web RDF-based
<b>Automated</b>	8. Live Interoperability with 2-way Update	Custom code enables interop. No rules or semantics. Expensive to maintain. (2)	Mapping Live XML is hard. No rules or semantics. Expensive to maintain. (2)	Mapping WS is very hard. No rules or semantics. Expensive to maintain. (3)	Easy with shared ontology. No configuration required. Easy to maintain with rules. (5)
	7. Live Interoperability with 1-way Update	Custom code enables interop. No rules or semantics. Expensive to maintain. (2)	Mapping Live XML is OK. No rules or semantics. Expensive to maintain. (2)	Mapping WS is very hard. No rules or semantics. Expensive to maintain. (3)	Easy with shared ontology. No configuration required. Easy to maintain with rules. (5)
	6. Live Interoperability - read only	Custom code enables interop. No rules or semantics. Expensive to maintain. (2)	Mapping Live XML is OK. No rules or semantics. Expensive to maintain. (2)	Mapping WS is very hard. No rules or semantics. Expensive to maintain. (3)	Easy with shared ontology. No configuration required. Easy to maintain with rules. (5)
<b>Manual</b>	5. Direct Import Export	Direct API scripting makes it slightly easier to interface. Hard to maintain. (3)	Relatively easy to interface to Direct APIs for batch processing. Hard to maintain. (3)	Relatively easy to interface to direct APIs for web services. Harder to maintain. (2)	Easy to interface to apps with direct import / export. Easy to maintain. (5)
	4. Export Import through intermediate product	Relatively easy to interface intermediary products with custom code. Hard to maintain. (3)	Relatively easy to interface to intermediates for batch processing. Hard to maintain. (3)	Relatively easy to interface to intermediates for web services. Harder to maintain. (2)	Easy to interface to intermediate products. Easy to maintain. (5)
	3. Third Party Translation	Relatively easy to interface to Translators into custom code. Hard to maintain. (3)	Relatively easy to interface to Translators for batch processing. Hard to maintain. (3)	Relatively easy to interface to translators for web services. Harder to maintain. (2)	Easy to interface to third party apps. Easy to maintain. (5)
	2. Custom Import/Export Approach	Relatively easy to write Custom code. Hard to maintain. (3)	Relatively easy to write Custom code for batch processing. Hard to maintain. (3)	Relatively easy to write custom code for web services. Harder to maintain. (2)	Easy to interface to custom apps. Easy to maintain. (5)
	1. Low: None. No interoperability enabled. Import/Export to Excel, Word, Email	Easy to import/export data to non-interoperable forms Word, Excel, eMail (5)	Easy to import/export data to non-interoperable forms Word, Excel, eMail (5)	Easy to import/export data to non-interoperable forms Word, Excel, eMail (5)	Easy to import/export data to non-interoperable forms Word, Excel, eMail (5)

## App. Examples:

- NetRate via CITRIX
- CA CSLB Site
- ACORD Form (Fax)
- Worksheet WORD
- Unstructured eMail

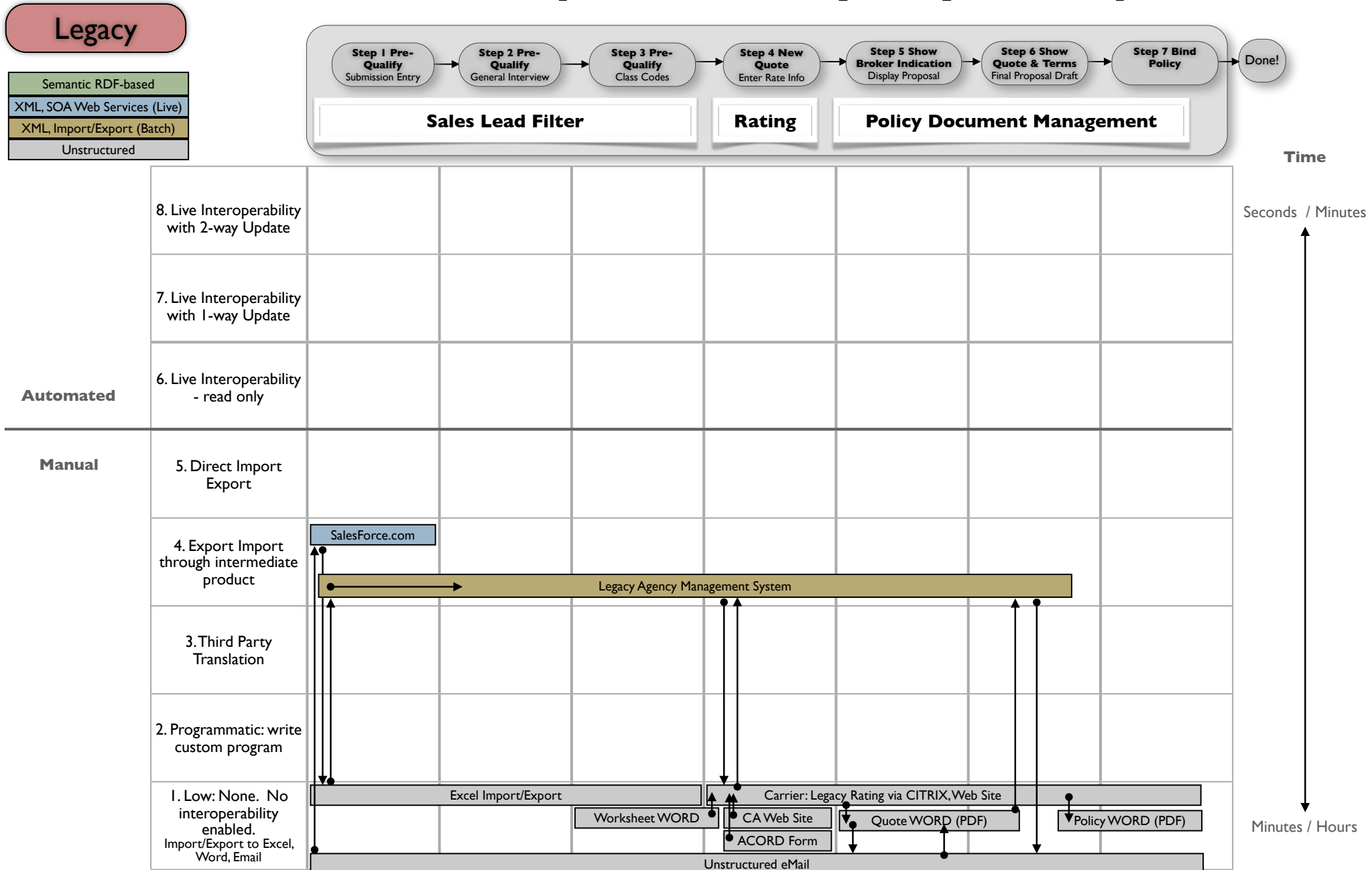
- Great Plains Accounting
- Oracle DocuMaker
- Vertafore Policy Issuance (VPI)
- Vertafore ImageRight (PDF)
- USF: CGI INSideOut
- SAP Data Integrator
- Appulate Server
- ACORD Form (XML)
- Vertafore AMS 360
- Applied Sys TAM/EPIC

SalesForce.com

Semantic Platform

Minutes / Hours

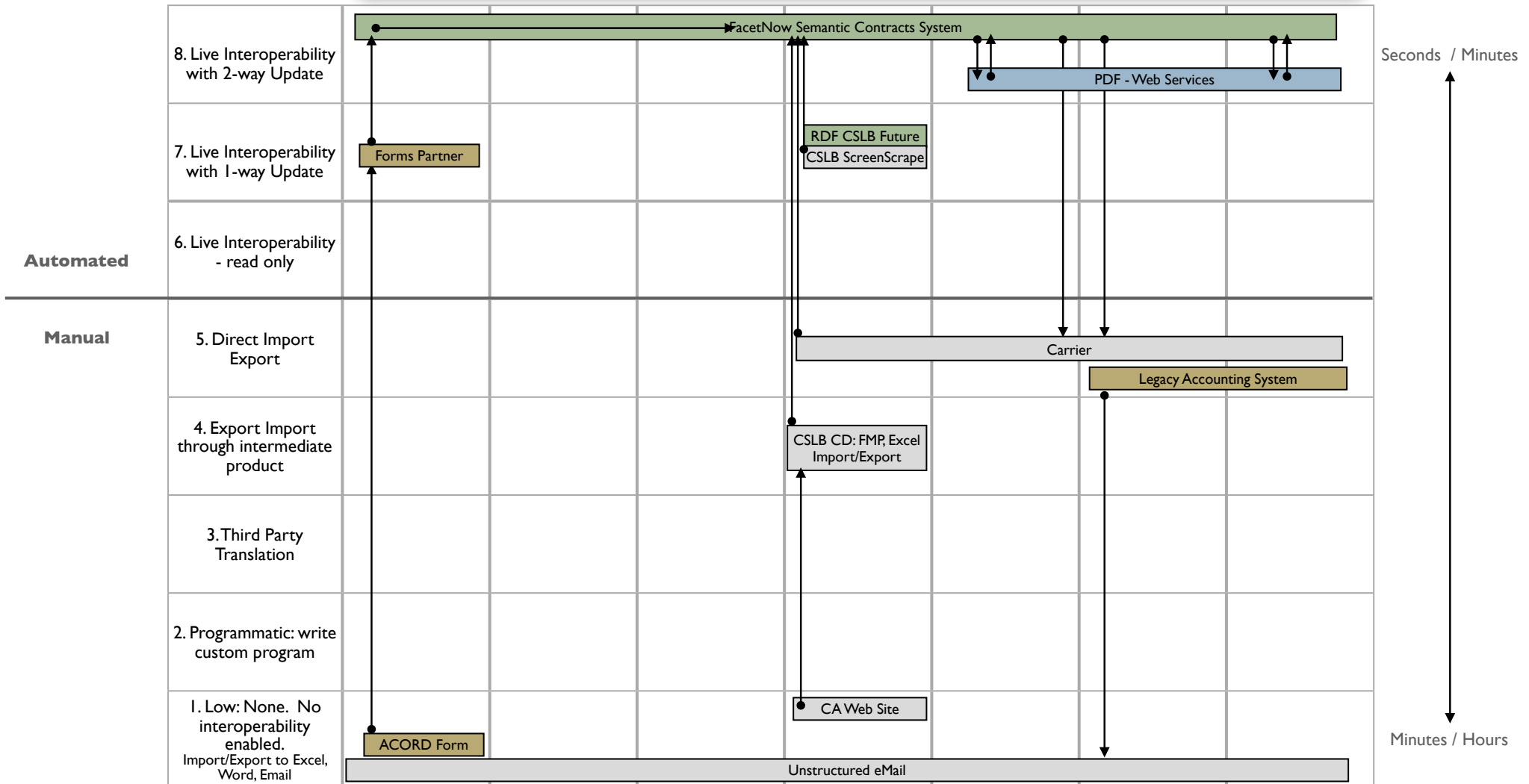
# #1: Interoperability by Step



# #1: Interoperability by Step



Semantic RDF-based
XML, SOA Web Services (Live)
XML, Import/Export (Batch)
Unstructured



# Interoperability Solutions

NCOIC™

Join: [NCOIC.org](http://NCOIC.org)



# Interoperability Rules.

## Federal Data & Apps

DoD, DoE, DHS

The screenshot shows the DATA.GOV website interface. At the top, it says "An Official Web Site of the United States Government" and "Sign Up Sign In". The main header includes "DATA.GOV" and a navigation menu with items like HOME, INTERACTIVE DATASETS, RAW DATA, APPS, GEO DATA, COMMUNITY, METRICS, OPEN DATA SITES, GALLERY, and WHAT'S NEW. The "Government Apps" section is highlighted, with a sub-header "Government Apps" and a description: "Use the catalog below to access apps provided by the U.S. Federal Executive Branch. Types of apps available include widgets, gadgets, tools, and RSS feeds. Click on the name of an app to view additional metadata about it. By accessing these apps, you agree to the Data Policy. The Government Apps catalog provides hyperlinks which may lead to agency tools or agency web pages that allow you to mine datasets." Below this is a "Browse Government Apps" table with columns for Name, Popularity, and Type. The table lists 11 apps, including "US GAAP RSS Feed of XBRL Financials", "Food and Drug Administration-Recalls", and "Latest Volumes of Foreign Relations of the United States".

Name	Popularity	Type
1. US GAAP RSS Feed of XBRL Financials	18,871 views	CS
2. Food and Drug Administration-Recalls	15,642 views	CS
3. Latest Volumes of Foreign Relations of the United States	11,271 views	CS
4. Airline On-Time Performance and Causes of Flight Delays	5,843 views	CS
5. Child-Related Product Recalls	5,602 views	CS
6. AVAILABLE TECHNOLOGIES	5,338 views	CS
7. Travel Warnings	5,220 views	CS
8. Travel Alerts	5,004 views	CS
9. Weekly Fatality Reports	4,609 views	CS
10. Cooperative Research and Development Agreement (CRADA) Opportunities from NIH	4,297 views	CS
11. RadNet Map Interface for Near-Real-Time Radiation Monitoring Data	3,476 views	CS



NetCentric (Semantic) Interoperability Industry Meets Govt

The screenshot shows the NCOIC website interface. At the top, it says "NCOIC Network Centric Operations Industry Consortium" and "Home About NCOIC NCOIC Role in Technology Calendar & Events Press Room Join NCOIC Sign-in Contact Us". The "ABOUT NCOIC" section is highlighted, with a sub-header "Member Organizations" and a description: "NCOIC Membership is organized in a tiered structure, each with a unique privileges and responsibilities." Below this is a grid of member organization logos, categorized into Tier 1, Tier 2, and Tier 3. Tier 1 includes BOEING, CISCO, Deloitte, and EADS. Tier 2 includes HARRIS. Tier 3 includes ADIESA, AFEI, American Red Cross, aselsan, CACI, EVER VIGILANT, Citi Business Networks, NCPS, ciena, DCNS, EIC, FacetApp, LLC, FINMECCANICA, Fraunhofer Institute for Open Communication Systems, GBL Systems Corporation, HAVELSAN, IDA, and Intelligent Adaptive Systems.



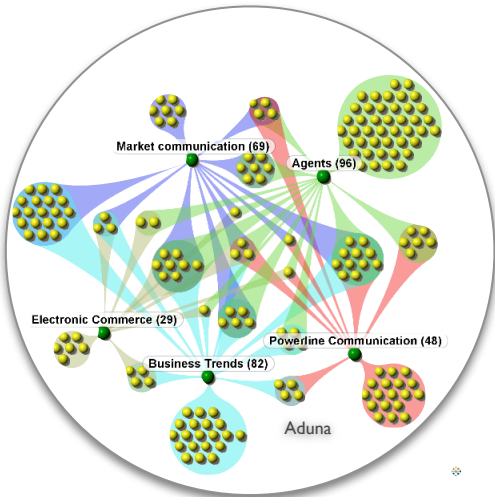
# Build Your Knowledge Ecosystem

## Government Communities

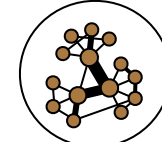
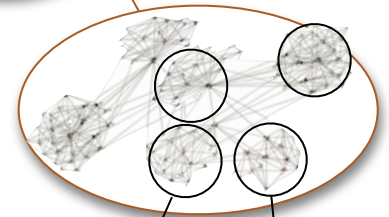
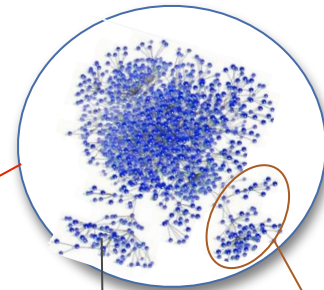
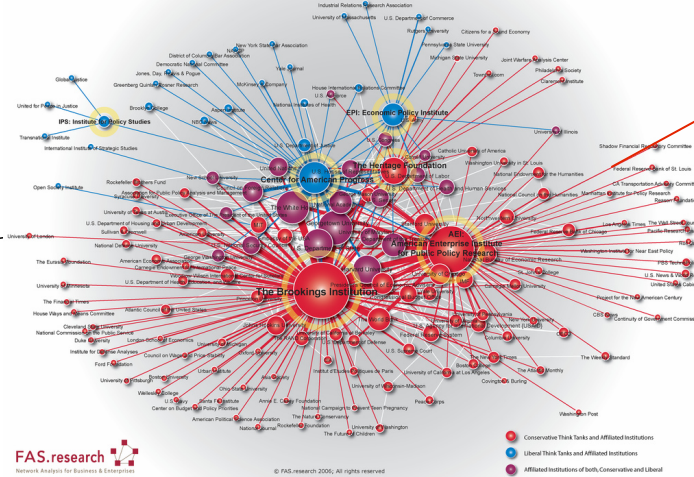
## Your Communities



### Semantic Web 3 Universe



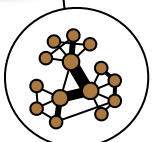
THINK TANKS - NETWORK ANALYSIS



Non-Profits



Industry



UN

# Learn More

**JOIN:**  NCOIC™

Visit: [NCOIC.org](http://NCOIC.org)

SCOPE Working Group

# Backups

What are W3C Semantic Web standards?



# What Are Semantic Web Standards?





<http://www.w3.org/standards/semanticweb/>

A “Web of Connected Data”  
where computers are able to automate  
more intelligent decisions for you.



WIKIPEDIA

The **Semantic Web** is an evolving development of the World Wide Web in which the meaning (semantics) of information and services on the web is defined, making it possible for the web to "understand" and satisfy the requests of people and machines to use the web content.<sup>[1][2]</sup> It derives from World Wide Web Consortium director Sir Tim Berners-Lee's vision of the Web as a universal medium for data, information, and knowledge exchange.<sup>[3]</sup>

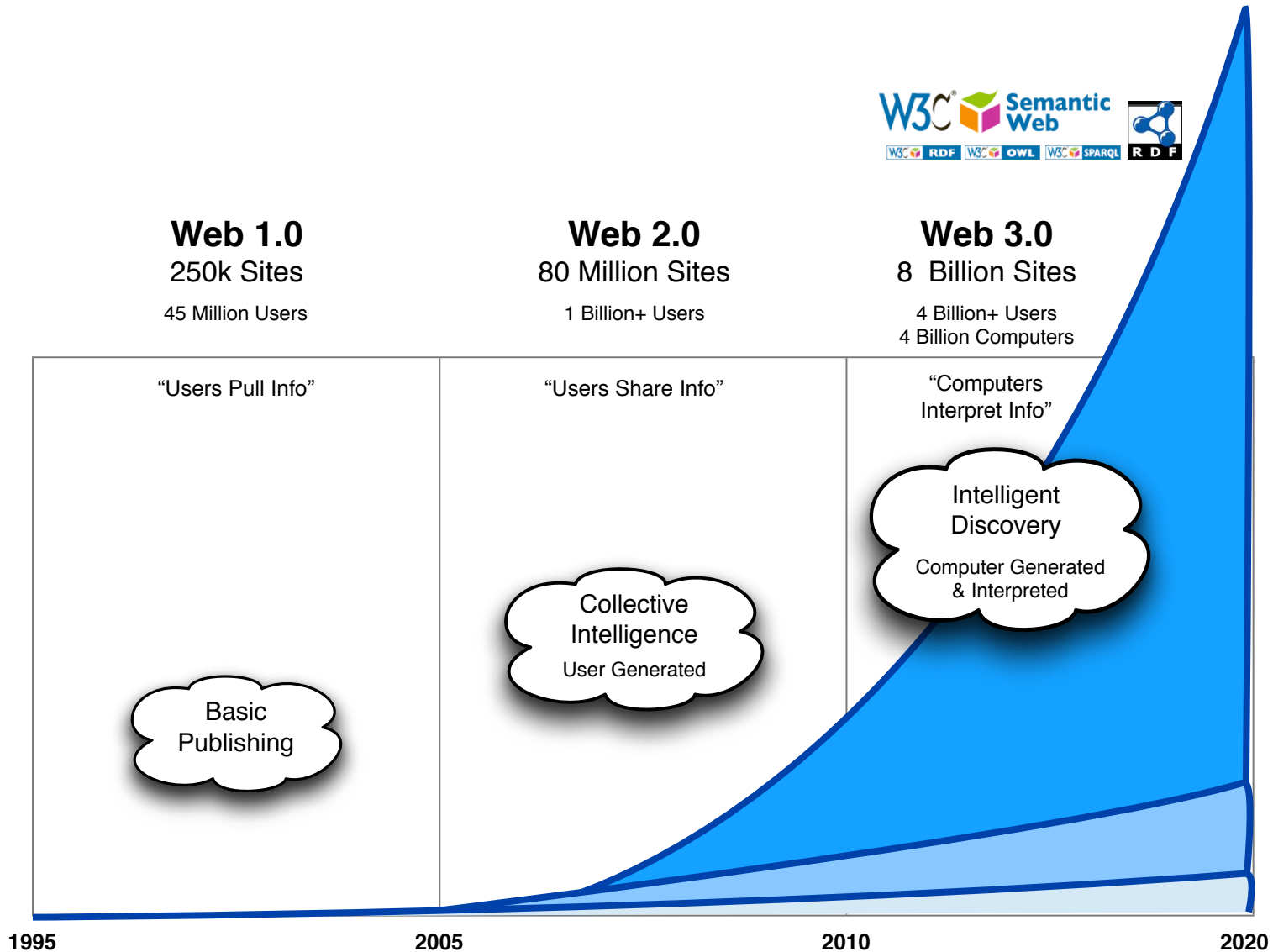


# Web 2.0 vs. Semantic Web

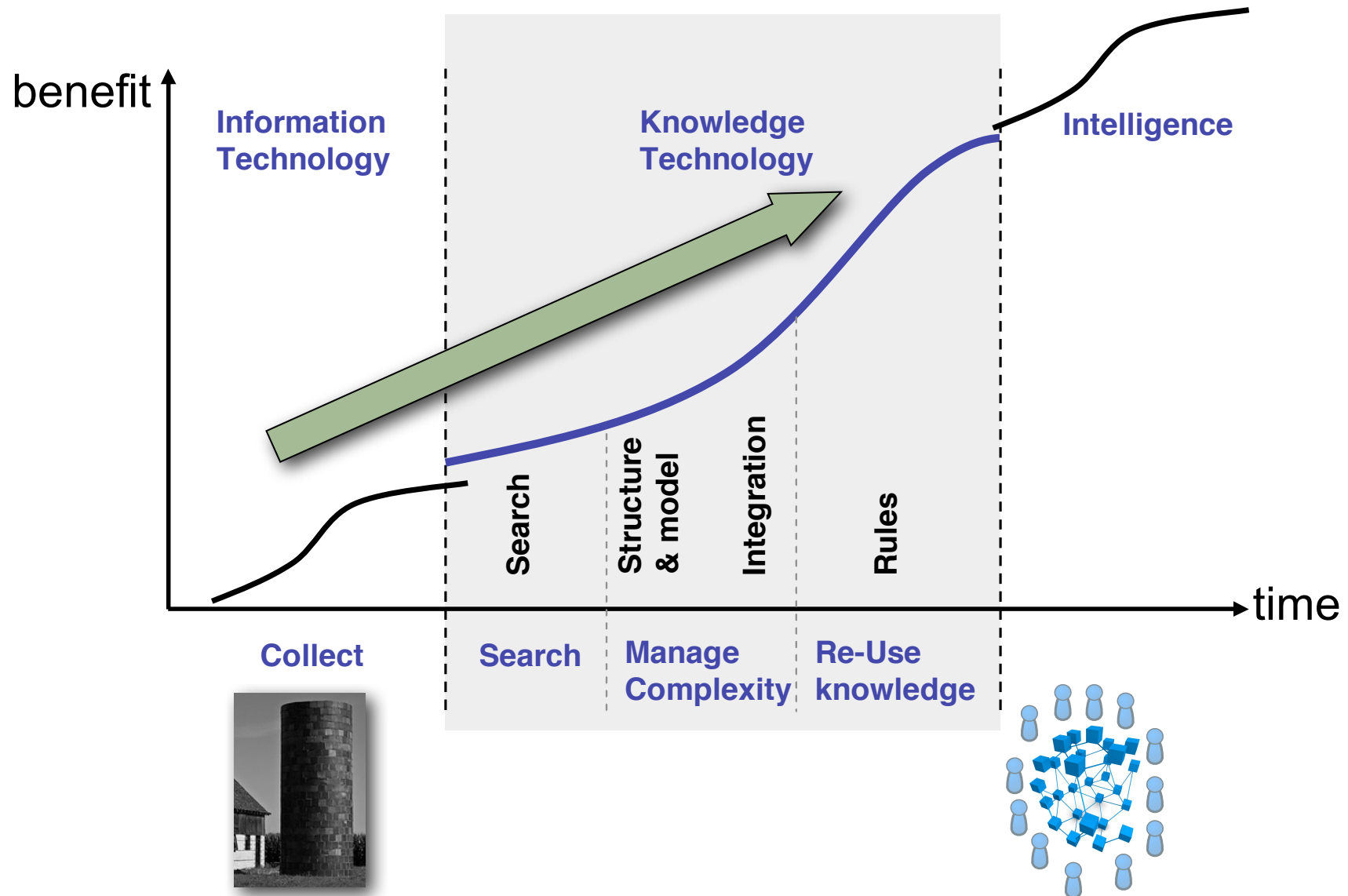
<http://www.w3.org/standards/semanticweb/>

	Web 2.0 technology	Semantic Web technology	Web 2.0 disadvantages	Semantic Web benefits
1	Linked Documents	Linked Data (RDF)	No Interoperability Data Silos (in a logical sense, it lacks metadata)	Real-time Mashups & data updates
2	URL	URI (RDF)	Semantically empty links	Computers Interpret Info
3	Taxonomies & Tag Clouds	Shared Vocabularies - Ontologies	Semantic confusion, Duplicate terms.	Intelligent Discovery
4	Config. Files, Macros	Rules-based Inferencing	Document dead ends	Automated Data Interpretation & presentation
5	Database Query Lang. (SQL)	Logical Query Language (SPARQL)	Text line searches give irrelevant results. Constantly dig for info	Deep Reasoning automates Info Retrieval

# It's the Next Big Leap



# Shift to Knowledge Models



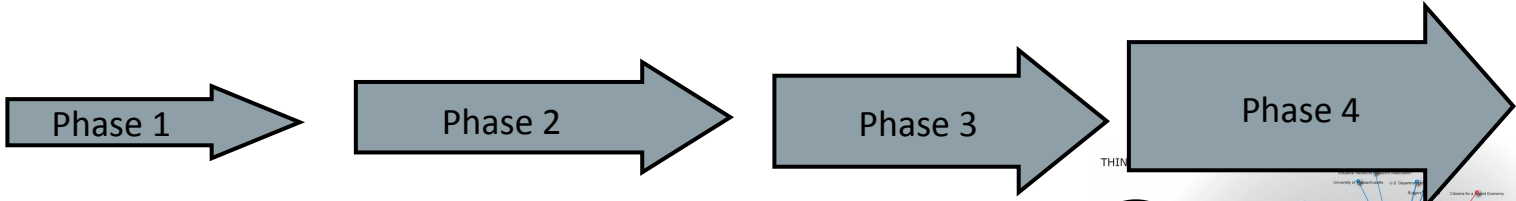


# Data is Smart

Smart Data is Cool.



# High Resolution, Global Interoperability

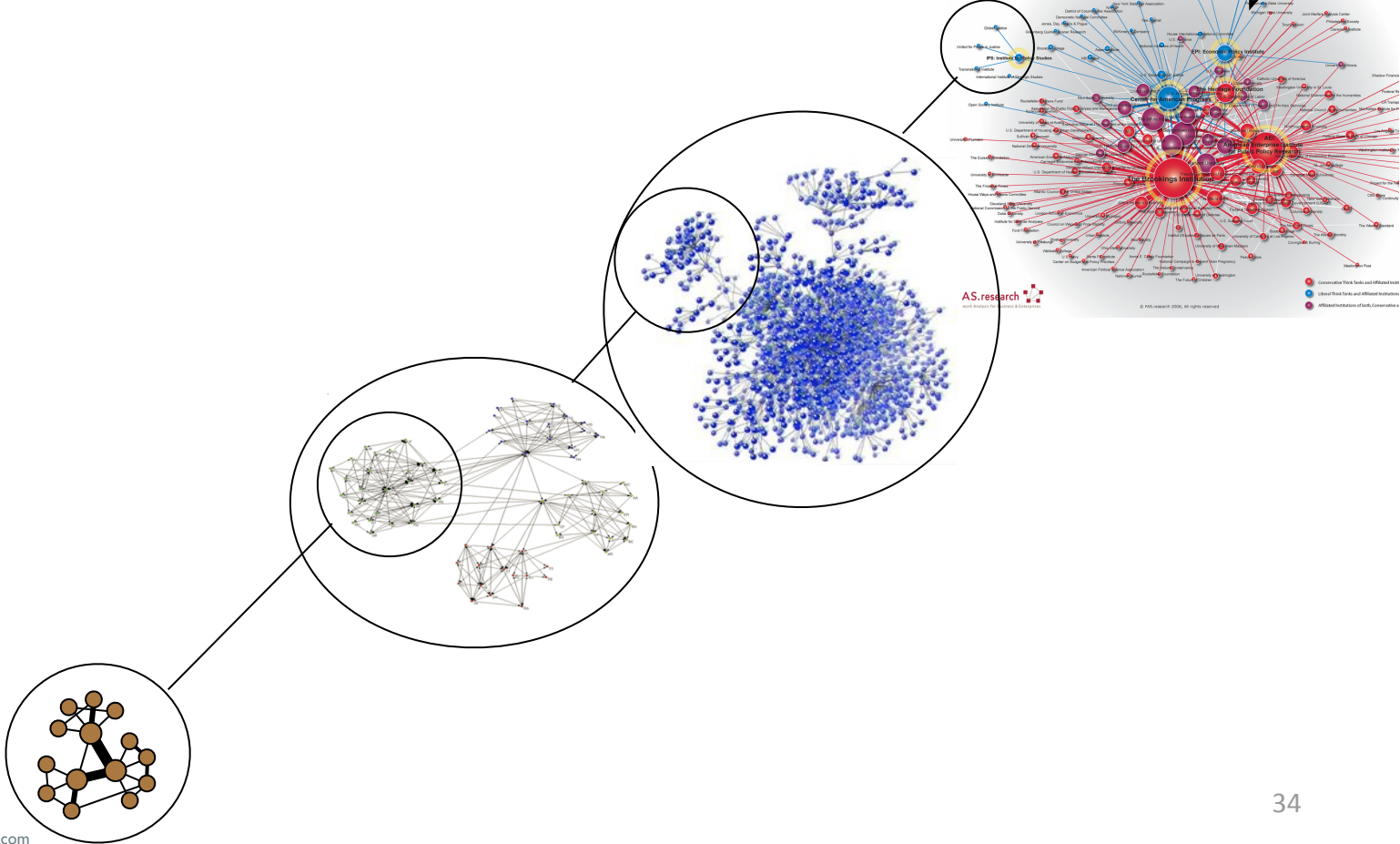


**Global**  
 GNEP  
 DOE - DOD - DHS +  
 UN, NATO

**National**  
 DOE - DOD  
 President  
 Congress

**Intra-Agency**  
 DOE <=> DOD  
 Top Management

**DOD**  
 Team Leaders





Experience Interoperability  
Semantic Composite Enterprise Applications

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Abstract ID: 13616  
**Semantic Interoperability Levels for Comparing Use Cases**

**Describing Value-Add of Semantic Web Design Using a Practical Interoperability Scale**

Interoperability levels are an effective means of expressing the maturity of an IT system for ease of comparing before and after implementations of a semantic web system in a legacy environment.

Prior art describes Interoperability levels in a manner that is not always practical in a setting with non-technical business users, which can quickly lose focus and impact of the intent of the tool (e.g. LISI Model). Prior art also fails to capture the relative impact of different technologies as they move data across an operational workflow.

This presentation will reveal a simple, practical method for describing the interoperability value-added when moving from a legacy environment to a semantic environment with a common workflow. The case study describes an intensive rule-based system for processing legal contracts in the insurance industry. The application could easily be applied to a wide range of eGovernment situations seeking relief from data alignment problems of legacy IT Systems: SoS, C3I, Healthcare, Technology Transition, Energy, Nuclear Waste Remediation, and more.