# SMART Manufacturing & Cyber Security: Foundational ISA/IEC 62443 Standards Evolving with Learning Machines

U.S.-GERMAN STANDARDS PANEL 2018

April 10, 2018 ($2^2/2^25/2^13^2$)


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ISA

# Bellingham and Consequences

- Broadcast storm shutdown SCADA and Delayed Leak Detection
  - Loss of View, Loss of Control
- All sensors set to average values and safety systems didn't actuate
  - Loss of Safety
- Requires revisiting cyber security and safety standards

# Last Week

- **Attack on Natural Gas Network Shows Rising Cyberthreat (4/6/18)**
- **Pipeline Firms Hit; Gas Still Flowing (4/4/18)**
- “3 of 4 companies operating pipelines admitted they were hit by a cyberattack this week”

# SMART Manufacturing Cyber Security *Standards* Challenges

- Heterogeneous Organizations
  - Manufacturers, Suppliers, Integrators, Governments: *Domain & Size* varies widely
- Heterogeneous Instruments, Automated Control Systems
  - Engineered systems' *Protocols still compete*
- Heterogeneous Languages: *even within same Natural Language*! Interpretation & Communication barriers (*Ambiguity & Redundancy*)
- Adversaries: Actors (state & non-state); Mismatched lifespans & evolutionary time constants
- How to avoid an automated *Tower of Babel*?

# Outline

- Introduction
- Problem Description
- Foundational & Ongoing  IA&CS Cyber Security Standards Development
- Platform for Evolving Threats
- Conclusions & Future Work

# ISA 99 Global Coverage: Role, Membership & Industries

- Scope: IACS compromise could result in:
  - “endangerment of public or employee safety
  - environmental protection
  - loss of public confidence
  - violation of regulatory requirements
  - loss of proprietary or confidential information
  - economic loss
  - impact on entity, local, state, or national security”
- 900 members world-wide
- Sector expertise:
  - Chemical Processing
  - Oil & Gas
  - Food & Beverage
  - Energy
  - Pharmaceuticals
  - Water
  - Manufacturing
  - ICS suppliers
  - → Medical ++
- Product:
  - ISA/IEC 62443 *series* of standards

# The Basics

- General Concepts
- Fundamental Concepts
- Foundational Requirements

# General Concepts

- Security Context
- Security Objectives
- Least Privilege
- Defense in Depth
- Threat-Risk Assessment
- Supply Chain Security


Source: ISA-62443-1-1, 2nd Edition (Under development)

# Fundamental Concepts

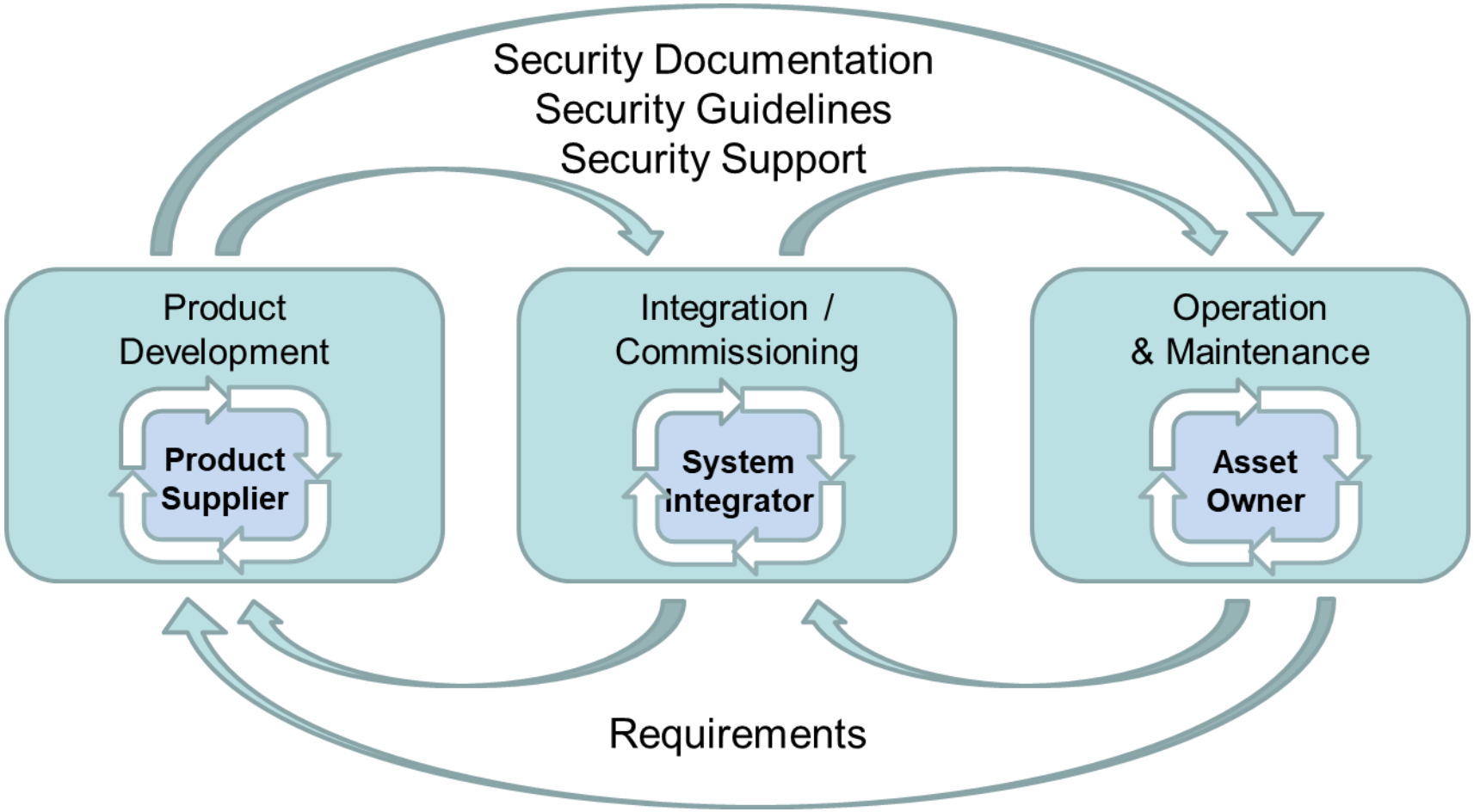
- Principal Roles
- Life Cycles
- Zones and Conduits
- Security Levels
- Maturity Assessment
- Security and Safety

Source: ISA-62443-1-1, 2nd Edition (Under development)

# Principal Roles

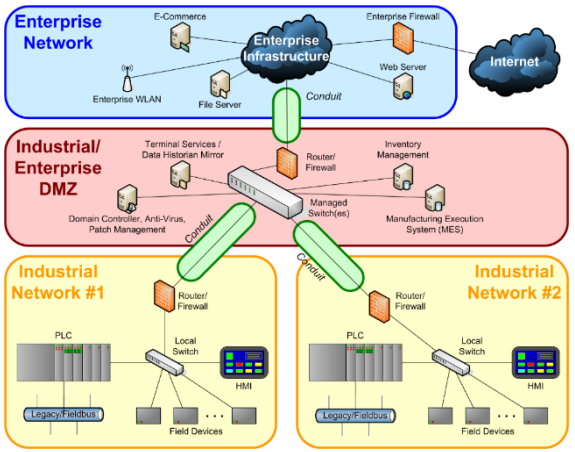
- Product Supplier (PS)
- Integration Provider (IP)
- Asset Owner (AO)
- Maintenance Provider (MP)
- Service Provider (SP)
- System Operator (SO)
- Regulatory Authority (RA)
- Compliance Authority (CA)

# Life Cycles


Security Documentation
Security Guidelines
Security Support
Product Development
Product Supplier
Integration / Commissioning
System integrator
Operation & Maintenance
Asset Owner
Requirements

# Zones & Conduits

- A means for defining…
  - How different systems interact
  - Where information flows between systems
  - What form that information takes
  - What devices communicate
  - How fast/often those devices communicate
  - The security differences between system components
- Technology helps, but architecture is more important



# Security Levels

**Protection against…**

# Maturity Assessment

- A means of assessing capability
- Similar to Capability Maturity Models
  - e.g., SEI-CMM
- An evolving concept in the standards
  - Applicability to IACS-SMS

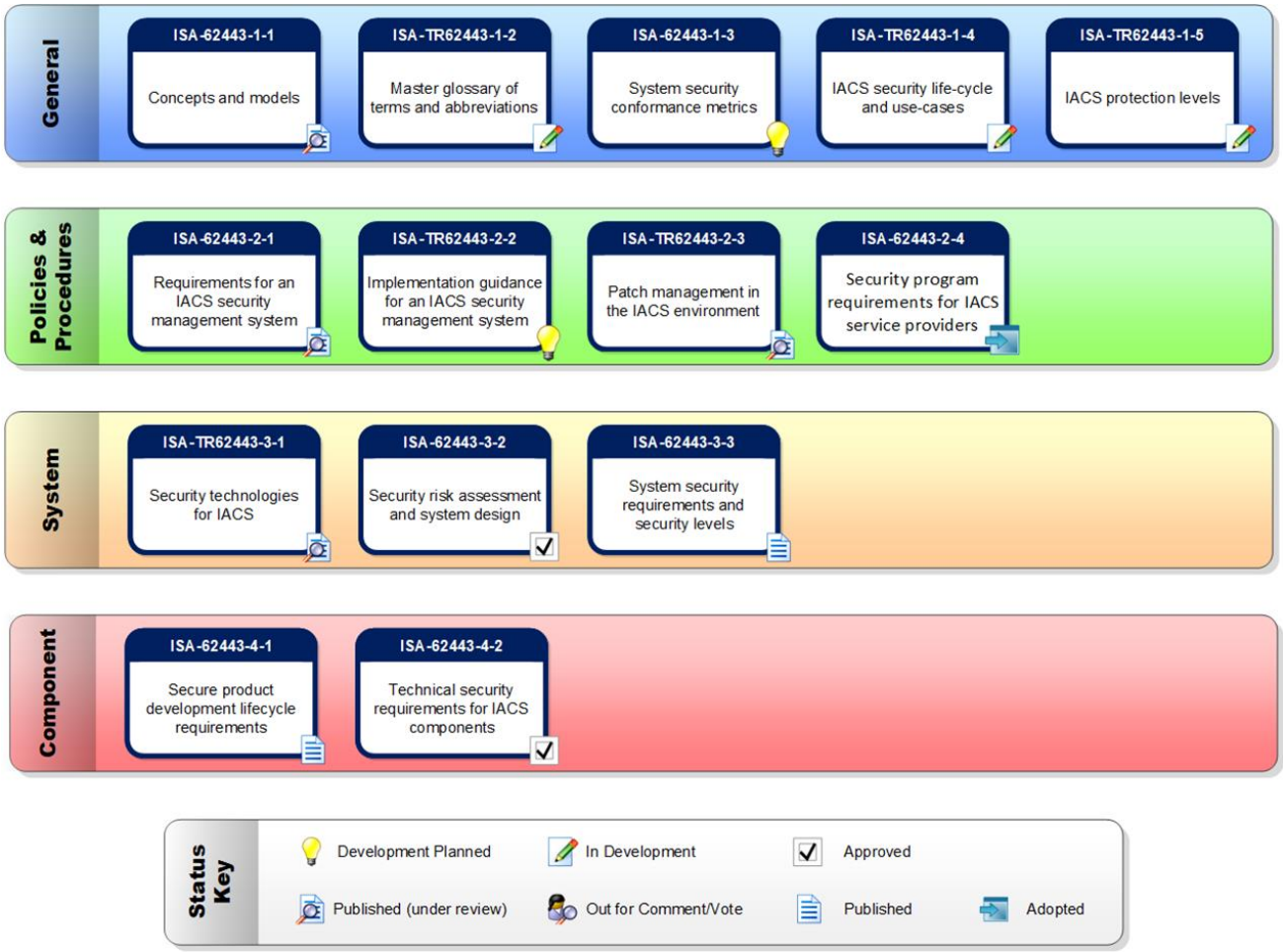
# Security & Safety

- Safety: much of the reason for security
  - Presenting consequences
- Much learned from safety community
- Collaboration
  - ISA99-ISA84 joint effort
  - IEC TC65 work group 20
  - ISA Safety and Security Division

# Foundational Requirements

- FR 1 – Identification & authentication control
- FR 2 – Use control
- FR 3 – System integrity
- FR 4 – Data confidentiality
- FR 5 – Restricted data flow
- FR 6 – Timely response to events
- FR 7 – Resource availability

# Work Products include: ISA-62443 Series

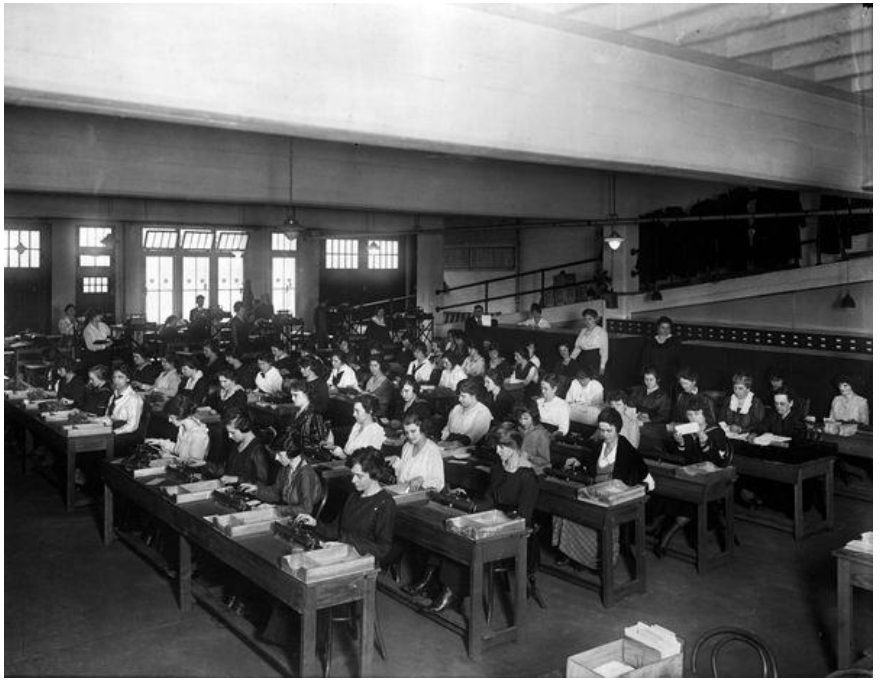


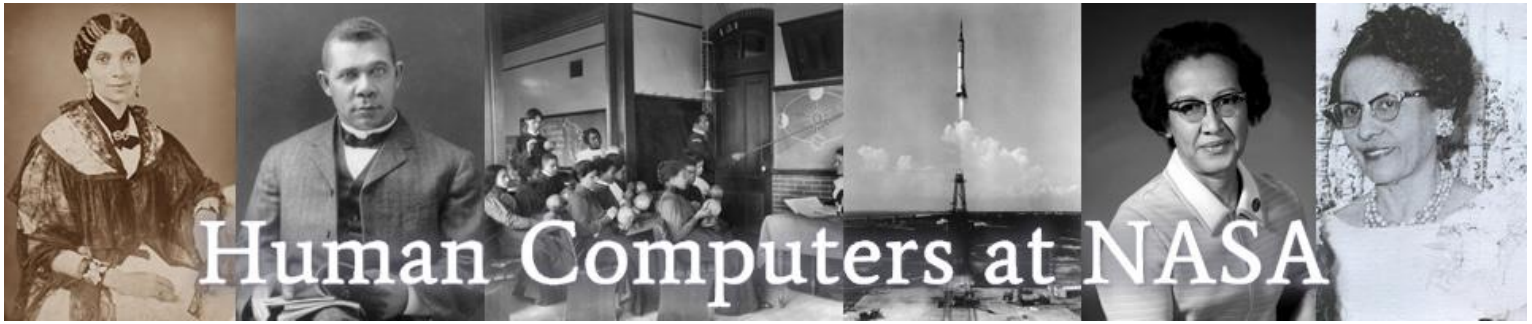
# ISA 99

- 16 years' effort: ISA/IEC 62443 standards series
- Evolution of standard continues:
  - Application to IoT
  - Devices on Level 0,1

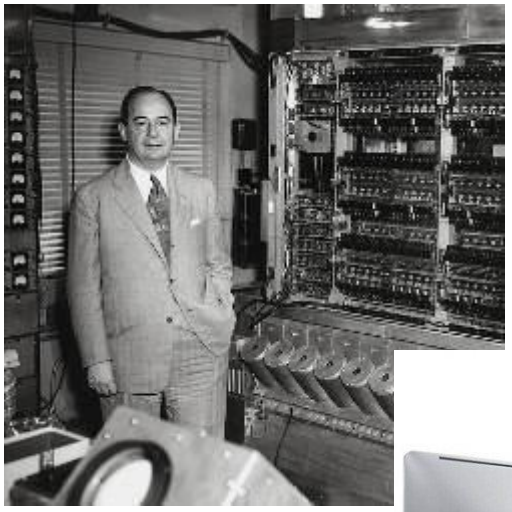
- How do we handle Evolving/Imminent Threats?
- How do we *trust* incoming request?
- How does a human sentry react to a cyber packet sent at speed of light?

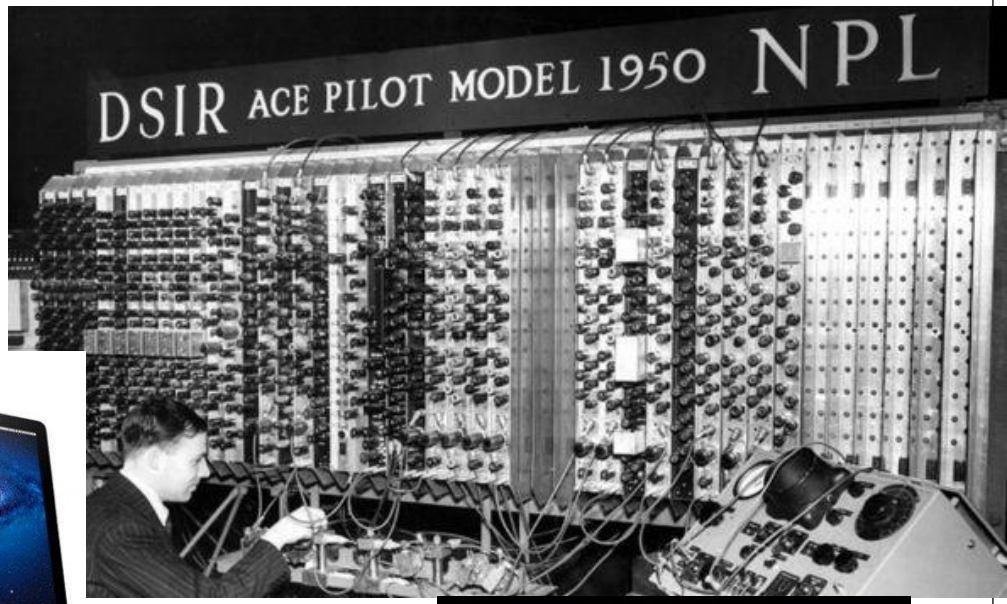
# Computers



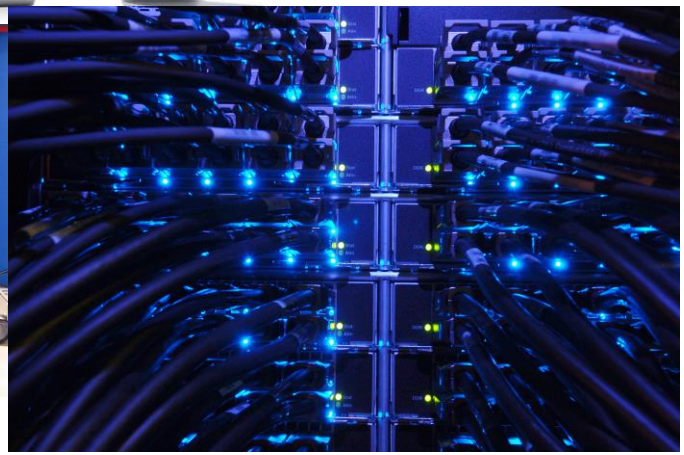


# Automated Computing Machines

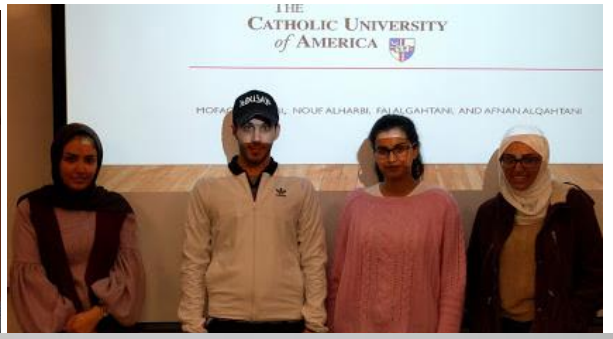




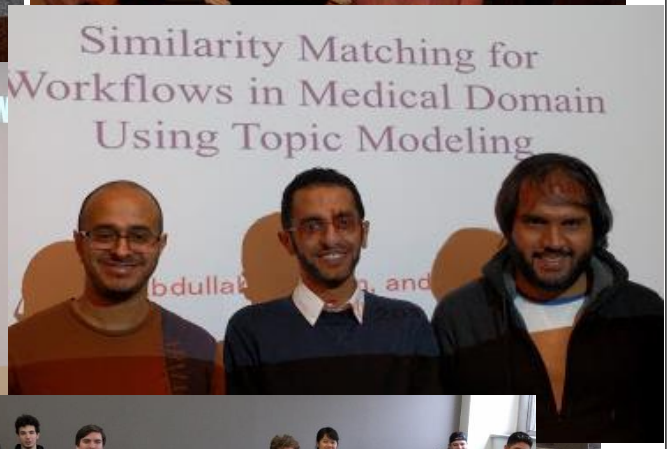


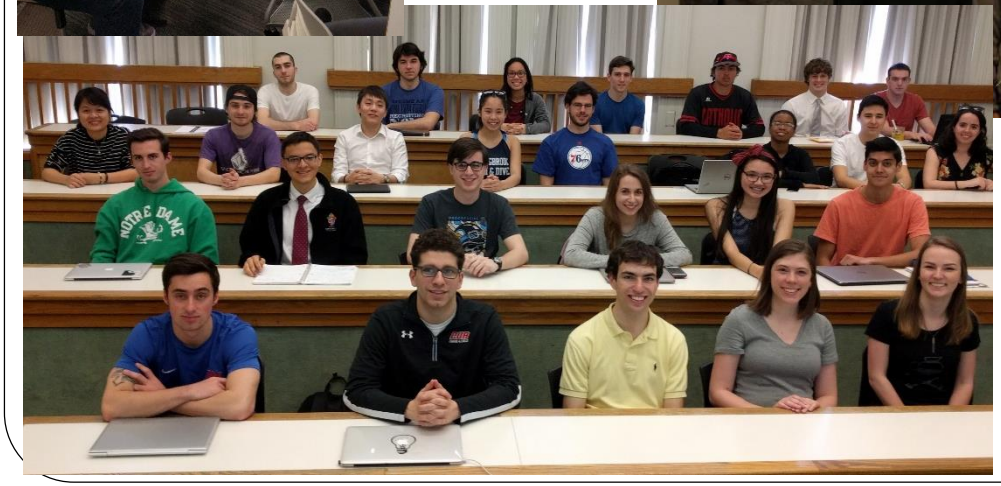


# Learning Machines





# Automated Learning Machines

# Shoulders of Giants





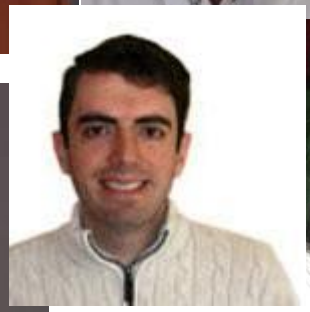






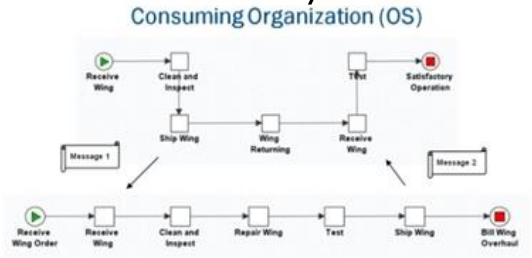


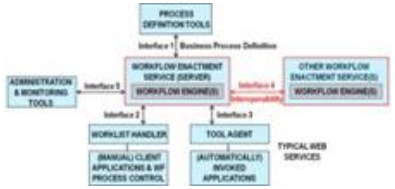




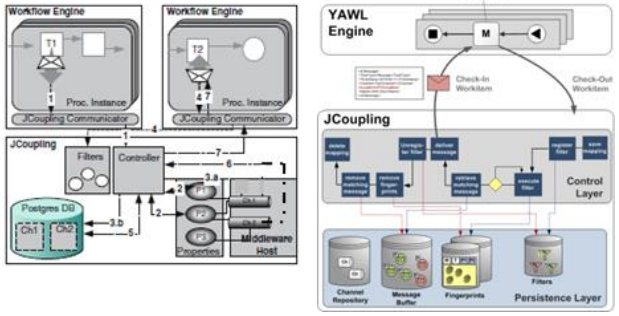

# Automated Learning Machines: Helping *Securely* Share Remote Work

## Workflow/YAWL



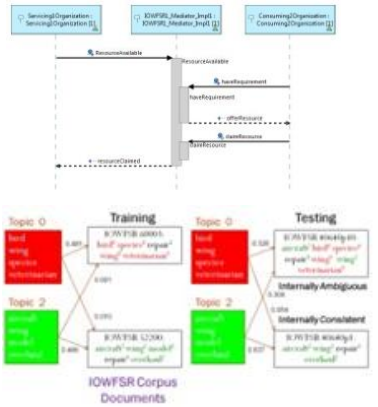




## IOWF/JCoupling

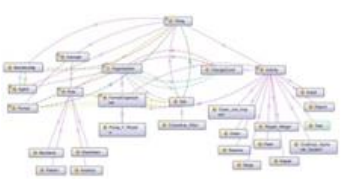


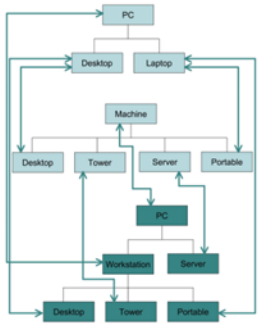

## Servicing Organization


## IOWFSR Mediator

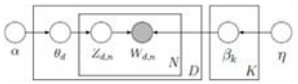


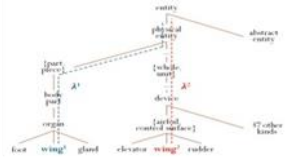

## Ontology/Protégé

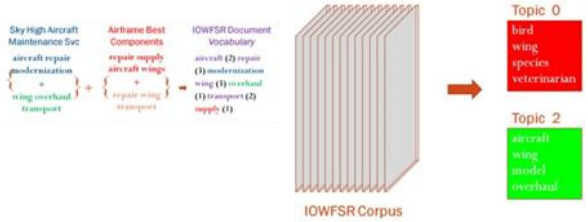





## Topic Modeling/LDA/LDAWN

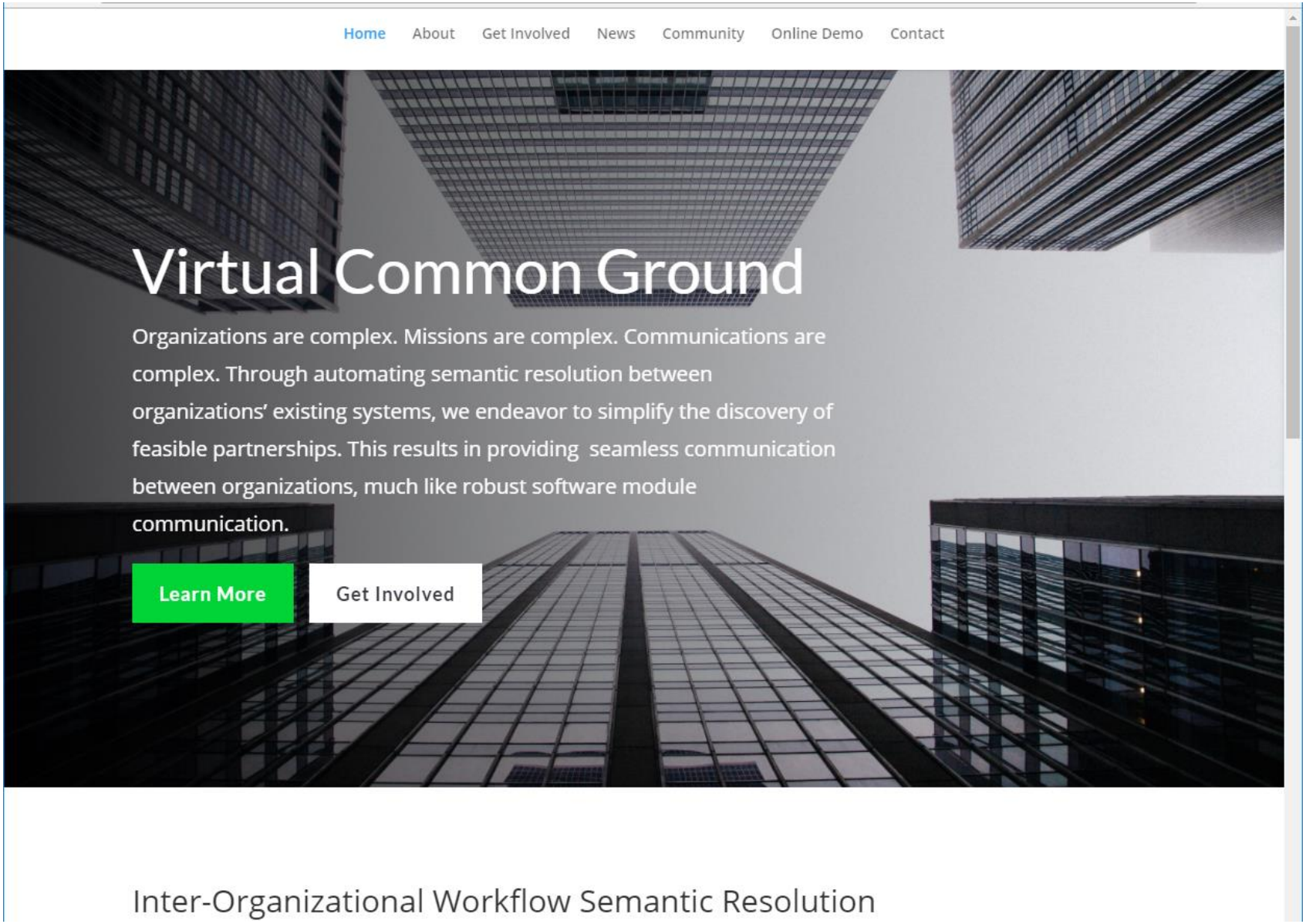







## Trust; but Verify!

# www.VirtualCommonGround.org



# Conclusions & Future Work

- (Automated) Learning Machines need:
  - Structure
  - Good teachers (data)!
- SMART Manufacturing needs:
  - Trustworthy partners
  - Translation assistance
  - OT rather than IT-based Cyber Standards
- We need:
  - Lunch!
  - Questions?
- *Can these principles help solve your engineering, management, medical, civil, biological issues?*

# Acknowledgments


- ISA 99: Eric Cosman & Jim Gilsinn (Co-Chairs); Joe Weiss (Managing Director); Charley Robinson & Eliana Brazda (ISA Staff); committee & slides.
- Research advisor: Professor Shmuel Rotenstreich (b: Germany)
- Numerous global colleagues active development: Pictured
- The Catholic University of America: faculty, facilties &
- Continuing Research: Mr. Khalid Khawaji, Ms. Anh Thai, Mr. Khoi Nguyen, Ms. Cynthia Fioriti, Mr. Ibrahim Al Mubark, Mr. Abdullah Almalki, Mr. Mofaq Alotaibi, Mr. Luke Lepak, Mr. Dominic Abela, Mr. Abdulaziz Alhuthali and Mr. Andrew DeNooyer (CUA EECS Graduate & Undergraduate Students)
- Images: Numerous students, museums & libraries

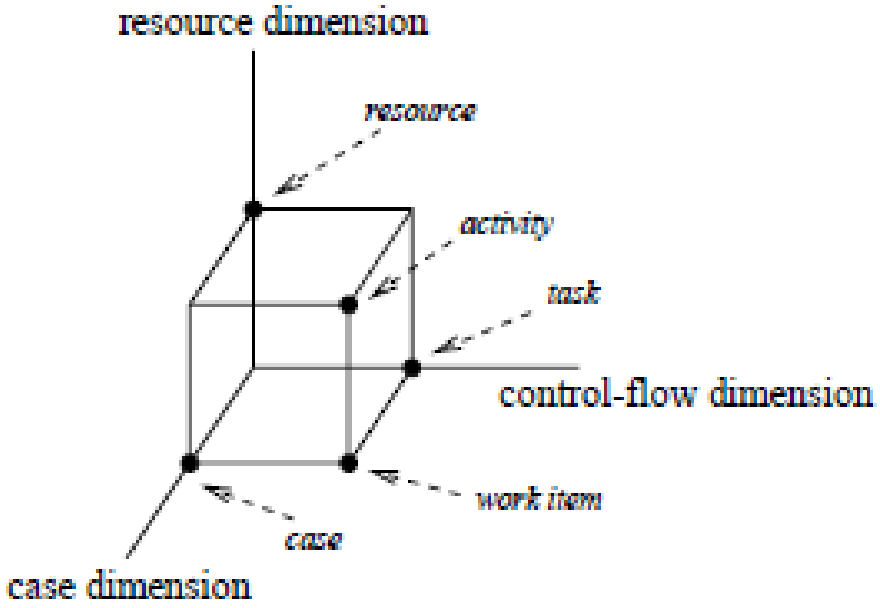
# Backups

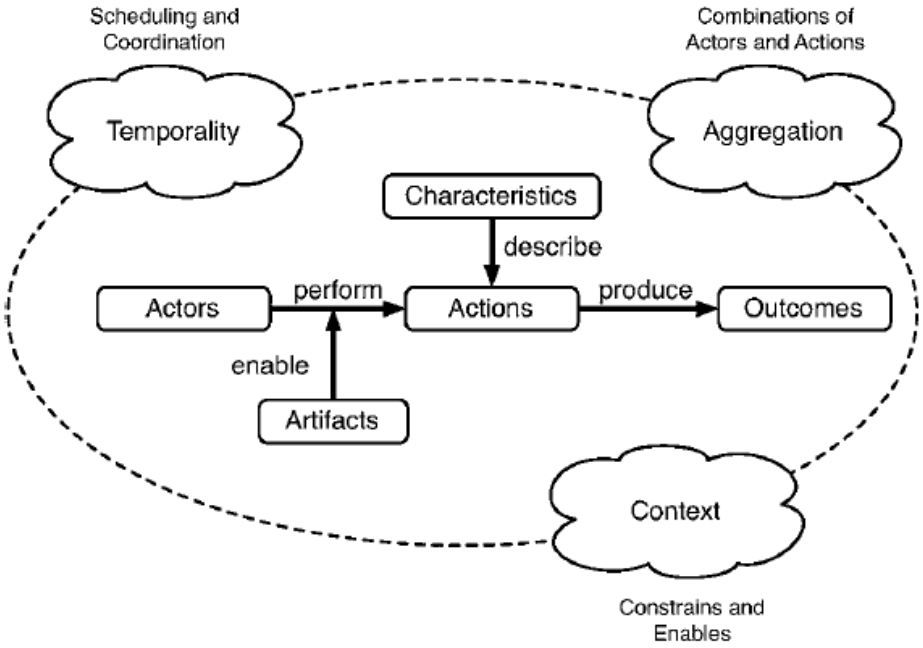
# Foundational Work: Prior Work, Limitations & Applications

- Task Organization & Automation: Workflow
- Local Knowledge: Organizations & Ontologies
- Process Sharing: Inter-Organizational Workflow
- Remote Computational Comprehension

# Foundational Work: Workflow

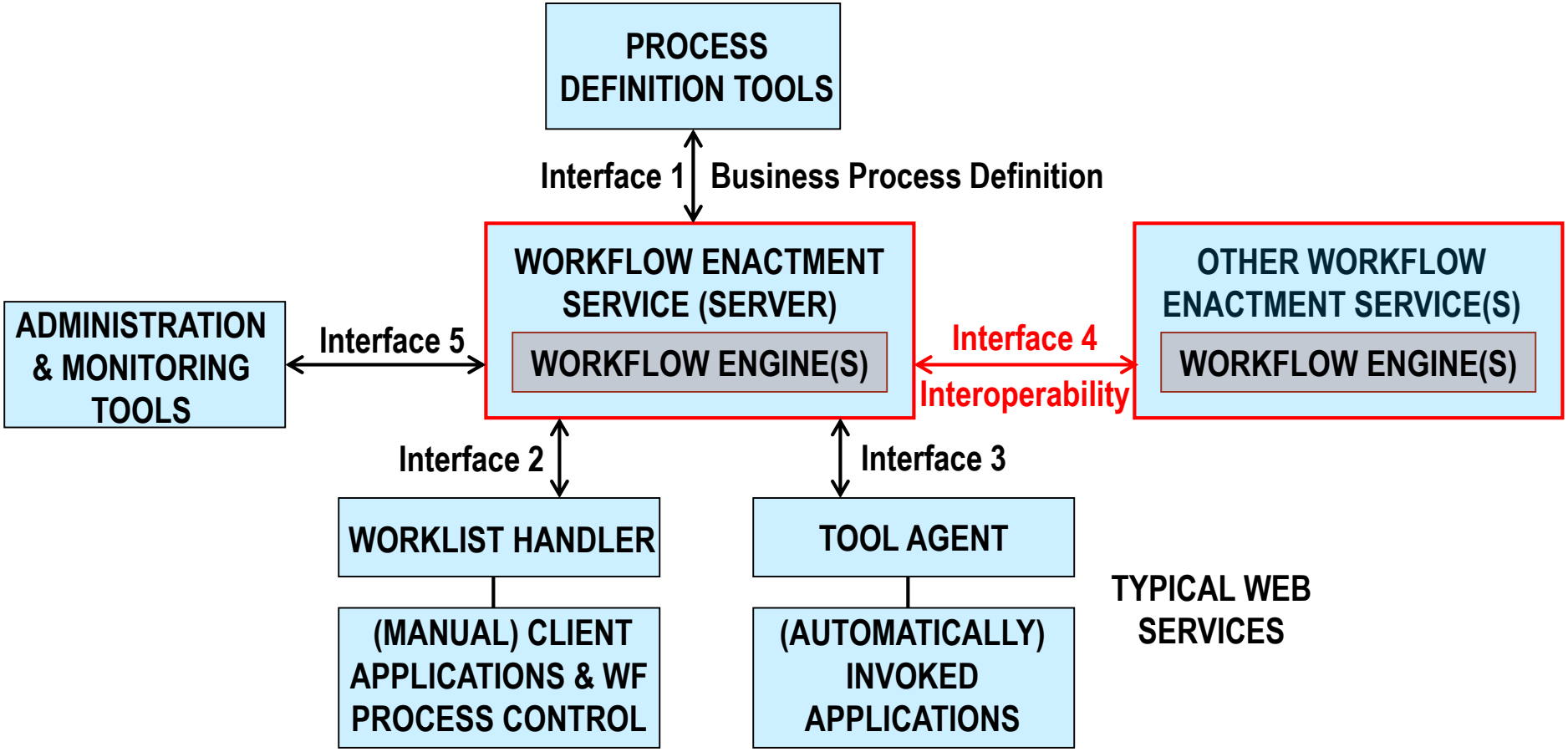
- Major work: Office Automation 1960s & 1970s
- Key principle: decouple business process function & flow logic
- Dimensions (Aalst, 2004);  Mining (Wang et al. & Aalst, 2013)
- Development niches (*many*, 200X+)
- Distilled Workflow Elements Model (Unertl et al., 2010)



# Foundational Work: Workflow

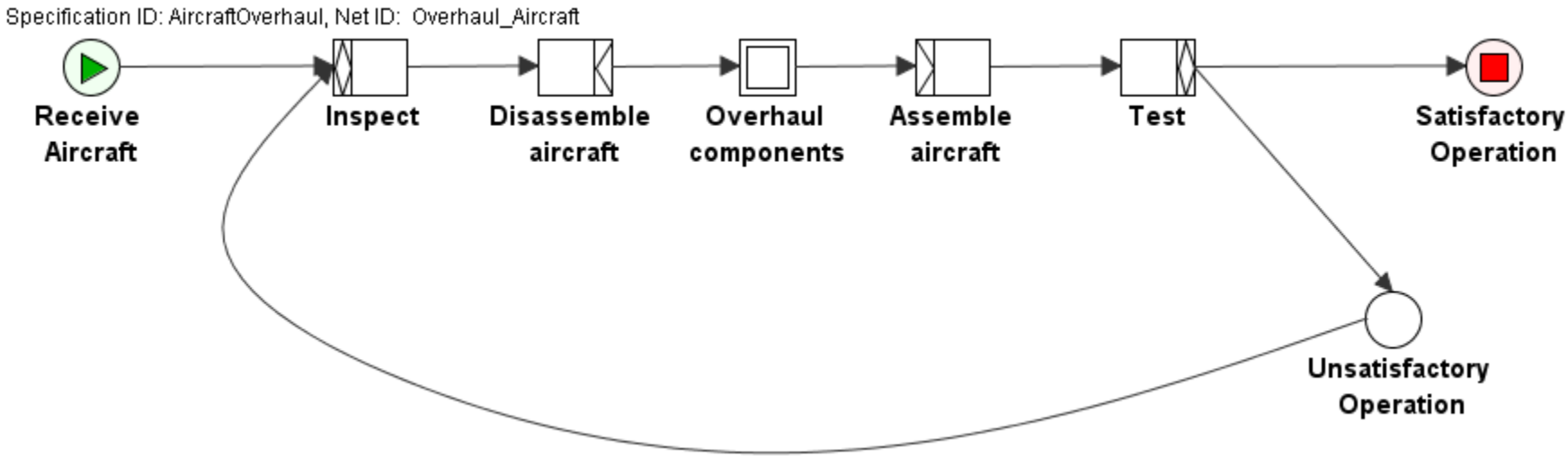
Primary interfaces (Workflow Management Coalition, 1995):



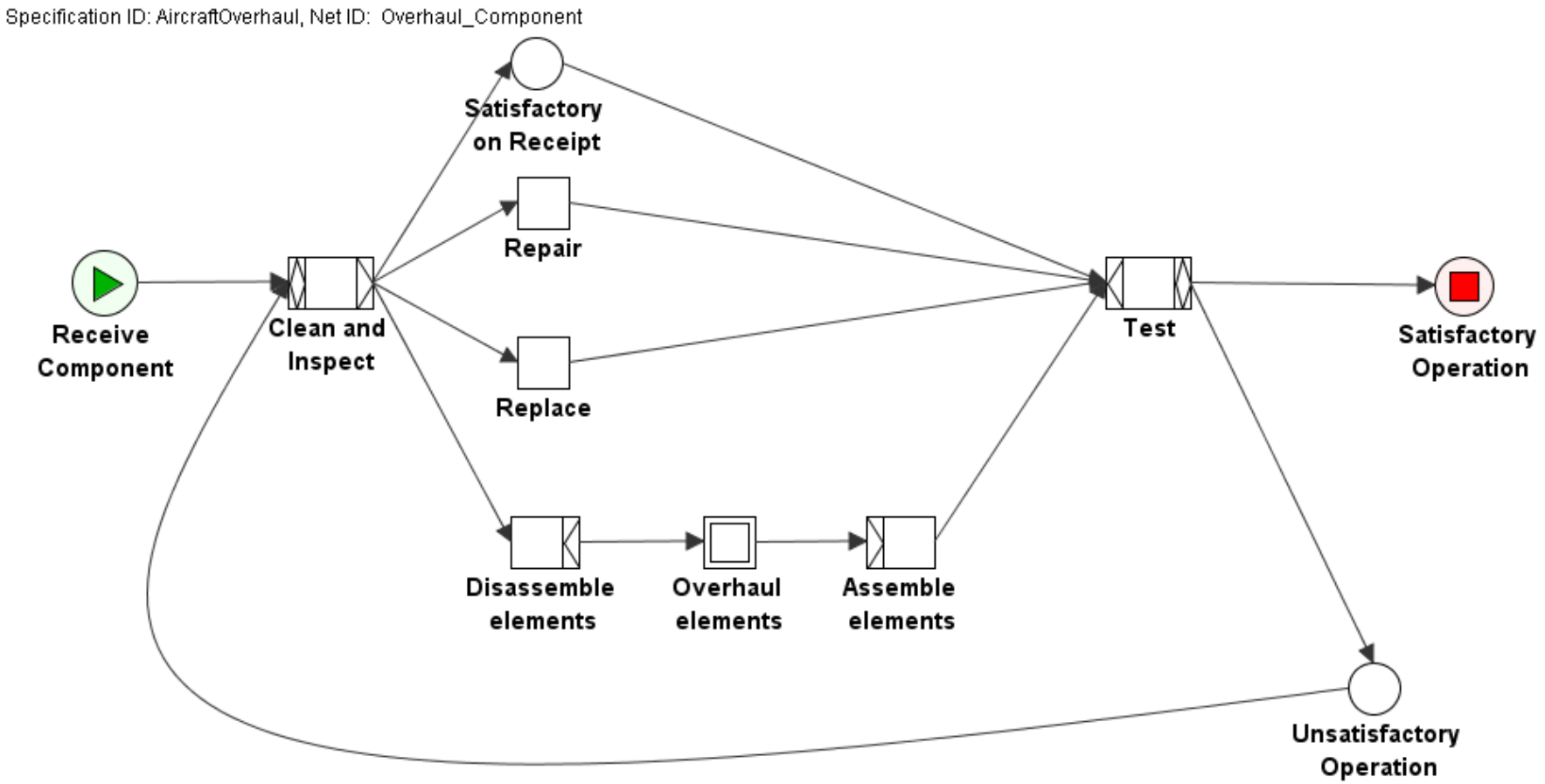
# Workflow Example (Aircraft Overhaul)

- YAWL (Aalst & Hofstede, 2002; Hofstede, et al., 2010 ; Adams, et al., 2012): Language & WFMS

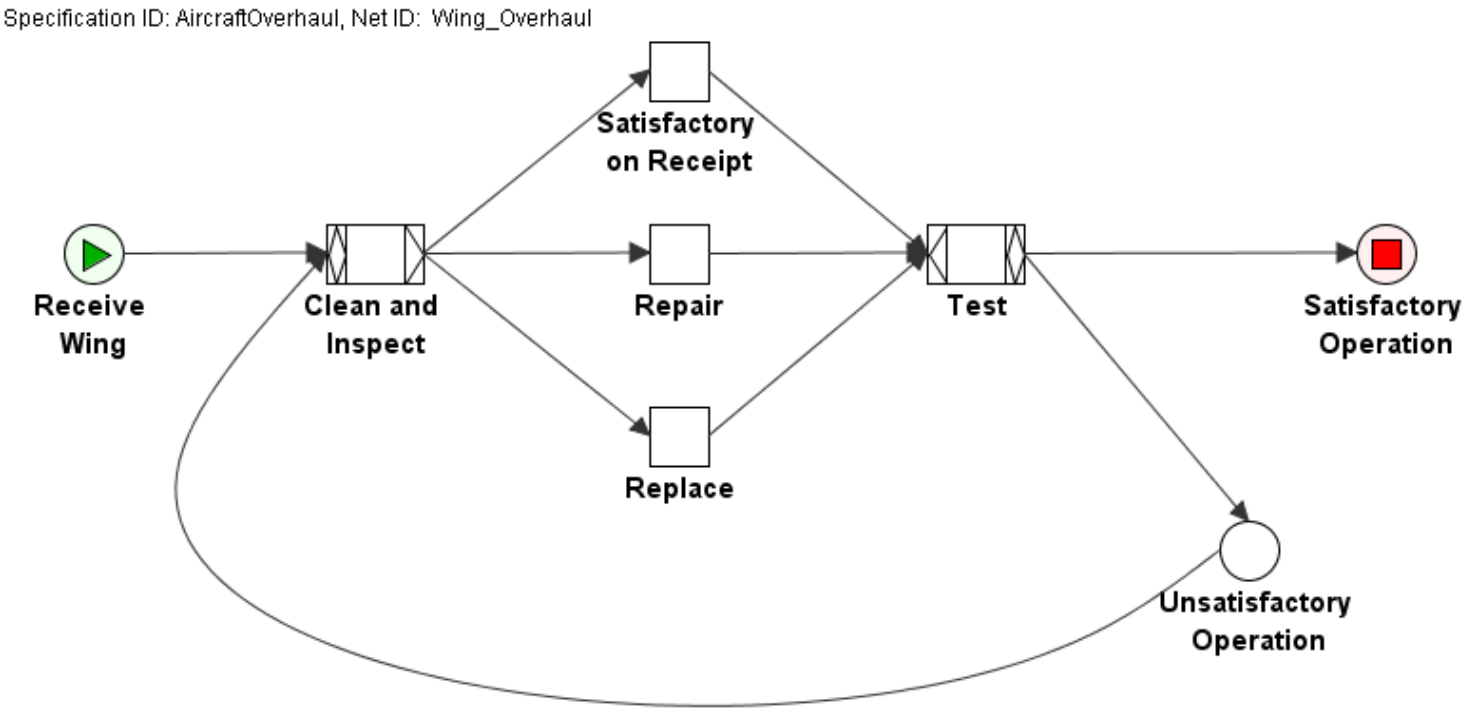
Demonstrates workflow pattern, mathematical & Petri Net bases compliance feasible (previously under contention)



# Workflow Example (Component Overhaul)



# Workflow Example (Wing Repair)



# Foundational Work: Organizational Behavior

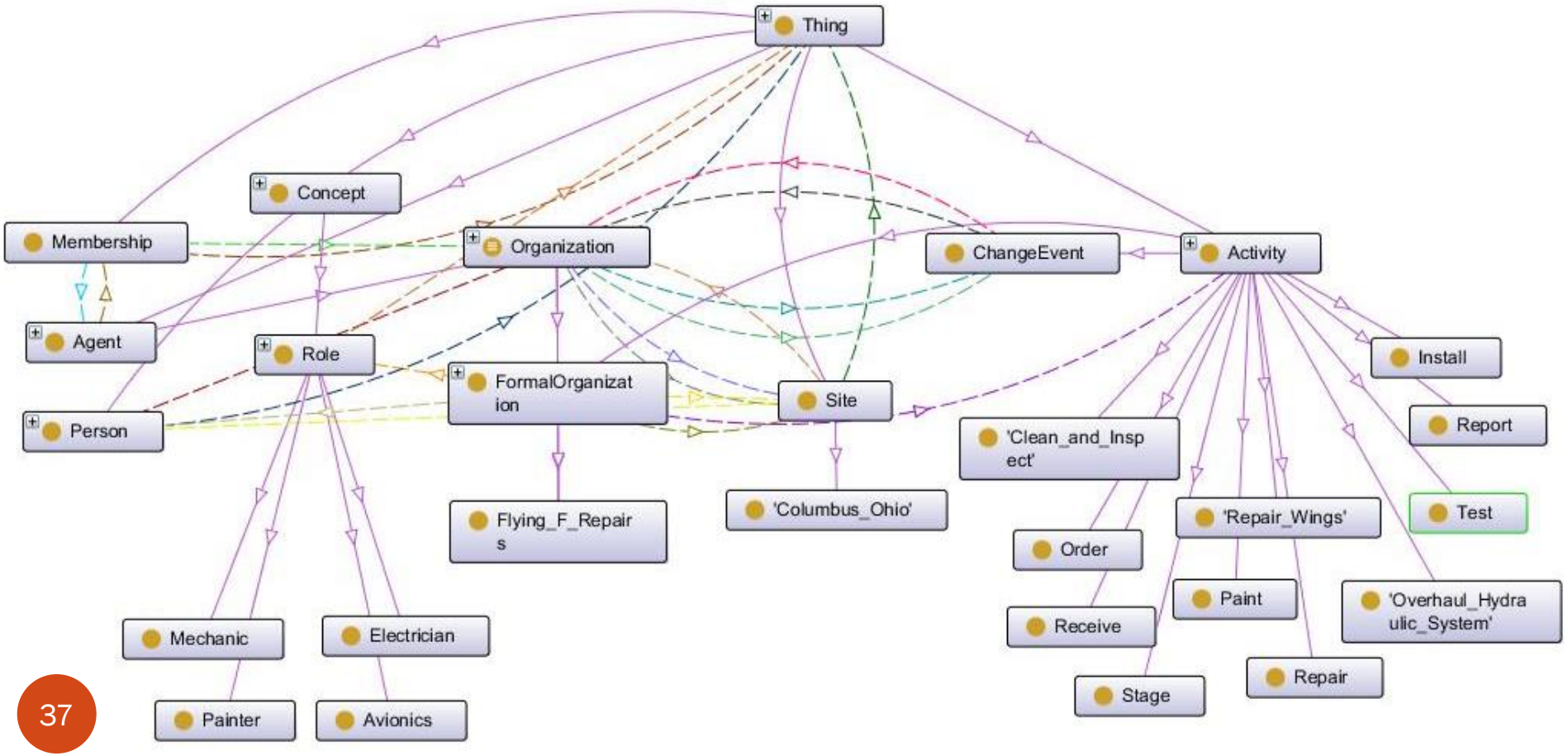
- Seminal organization process behavior research (McGrath, 1963)
- Organizational culture shapes & symbols signal deeper *meaning*
  - Gordon, 1999; Rafaeli & Worline, 2000; Horling & Lesser, 2005; Alvesson, 2011
- Common ground clarifies meaning; internal diversity helps ally new collaborators
  - Weber, 2000; Engeström, 2001; Carroll et al., 2008
- Team communication & cognition: social processes where contextual clarity matters
  - Perin, 1995; Bednar et al., 2007; Fiore et al., 2008; Narayanan et al., 2011
- Known by neighbors kept (Competitors, Customers, Suppliers)
  - Porac et al., 1989; Hodgkinson & Healey, 2011

# Foundational Work: Knowledge & Ontologies

- Ontological Computer Science applications: Roles; ECA; DOLCE
  - Gruber, 1993; Smith, 1998; Wagner, 2003; Smith & Grenon, 2004; Bottazzi & Ferrario, 2005 & 2008
- Organizational Ontology: natural knowledge representation bridges internal workflow meaning gap
  - Hodgkinson & Johnson, 1994; Hepp & Roman, 2007
- Knowledge Capture: tacit/explicit; *chunking & feature matching* strategies
  - McManus et al., 2003; Haynes & Smith, 2008
- Semantic application: encoding methods
  - Miller, 1995; Desouza & Hensgen, 2002; Hirst, 2009

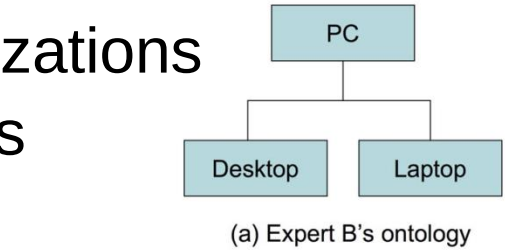
# Simple Organizational Ontology Example

- Protégé Ontology design tool (Noy et.al, 2000+)

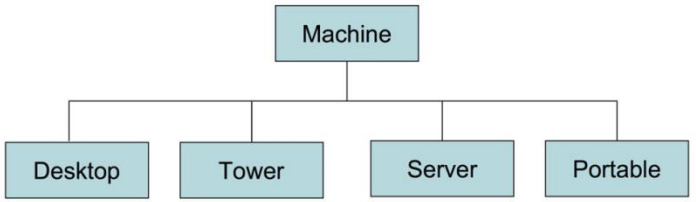


# “Simple” Ontology Alignment Example

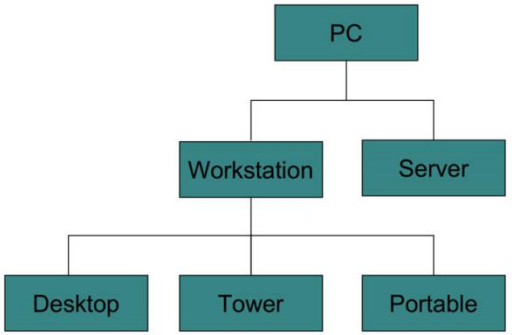
- Challenge:
  - Variation between organizations
  - Merging *actual* ontologies
- Ontology 1
- Ontology 2
- Aligned Ontology
  - Negotiated



(a) Expert B’s ontology



(b) Expert C’s ontology

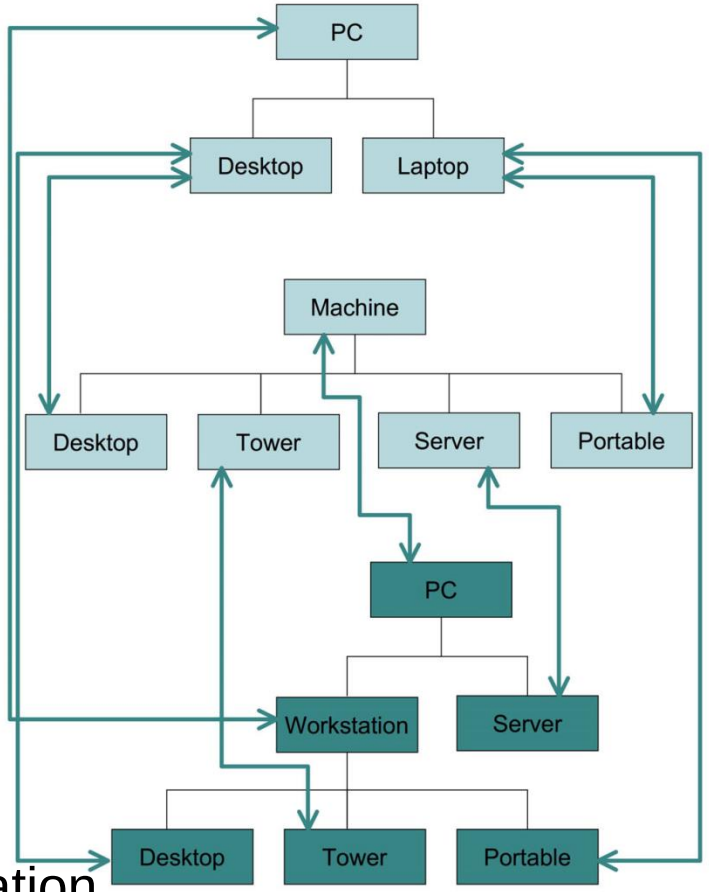


(c) Common ontology

Hameed et.al, Ontology Reconciliation in *Handbook on Ontologies*, 2004

# “Simple” Ontology Alignment Example

- Ontology 1
- Ontology 2
- Aligned Ontology and mappings (SUMO, Paliwal et.al, 2012)



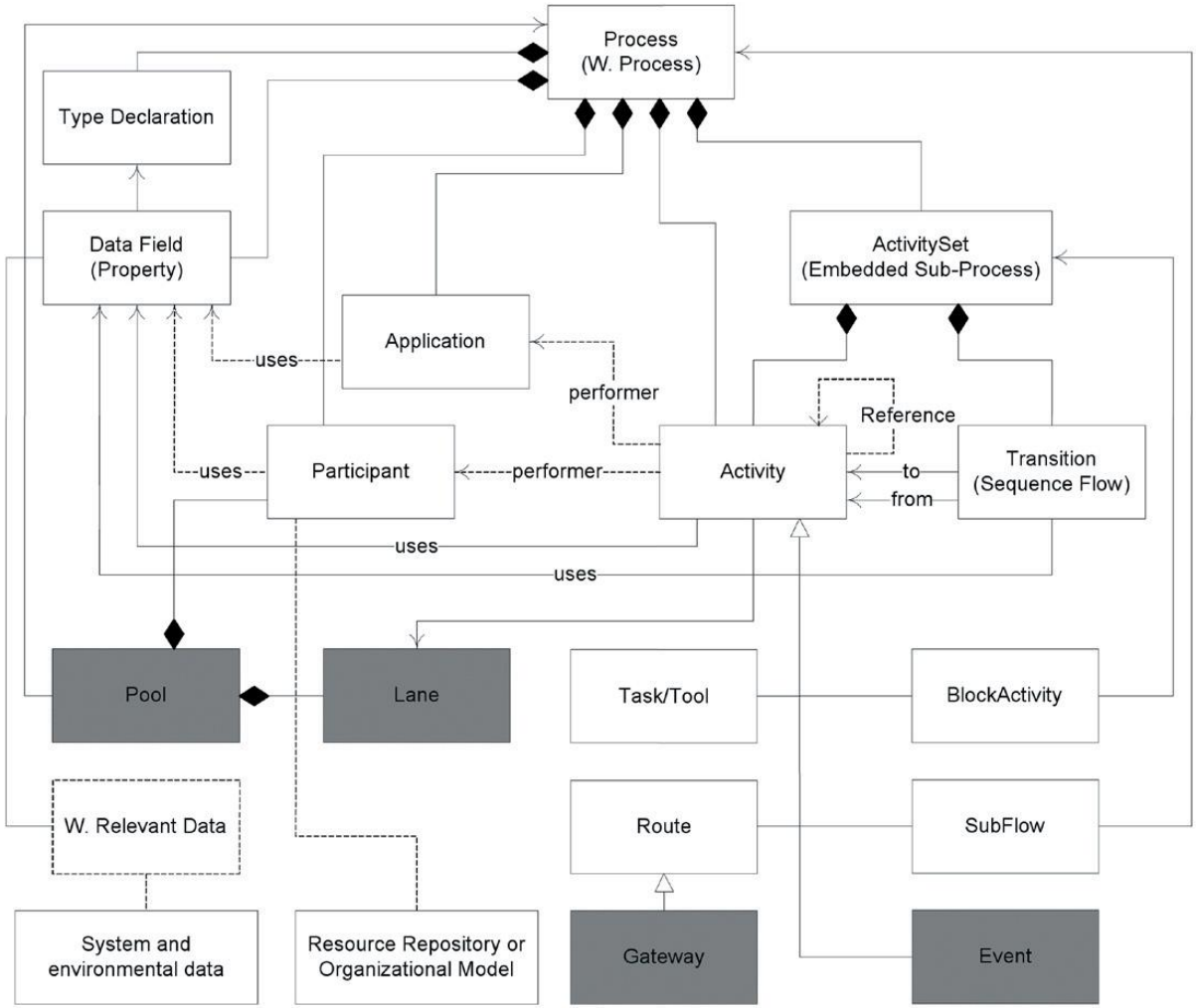

Hameed et.al, Ontology Reconciliation in *Handbook on Ontologies*, 2004

# Foundational Work: Inter-Organizational Cooperation

- Teaming Behavior: Cooperation, Social economic interaction, Defined *tools* & *signs,* Distributed communication *leaky* by nature
  - Axelrod, 1984; Schelling, 1978; Carroll et al., 2008; Engeström, 2001; Rentsch et al., 2008
- Protocols: Sequential messaging fits Inter-organizational negotiations
  - Kraus, 2001; Bertino et al., 2004; Hirst, 2002; Aalst et al., 2000 & 2002; Bruno, 2005; Aldred et al., 2005-9; Kuhr et al., 2008
- IOWF:
  - Networked virtual enterprise interoperability *unfilled* promise
  - Emergent complex systems require robust communication between heterogeneous partners using natural strategies observed
  - Ebers, 1997; Bradley & Nolan, 1998; Johnson, 2001; Papazoglou et al., 2000; Sheth et al., 1997; Stegwee & Rukanova, 2003; Visser et al., 2003; Hofstede et al., 2010

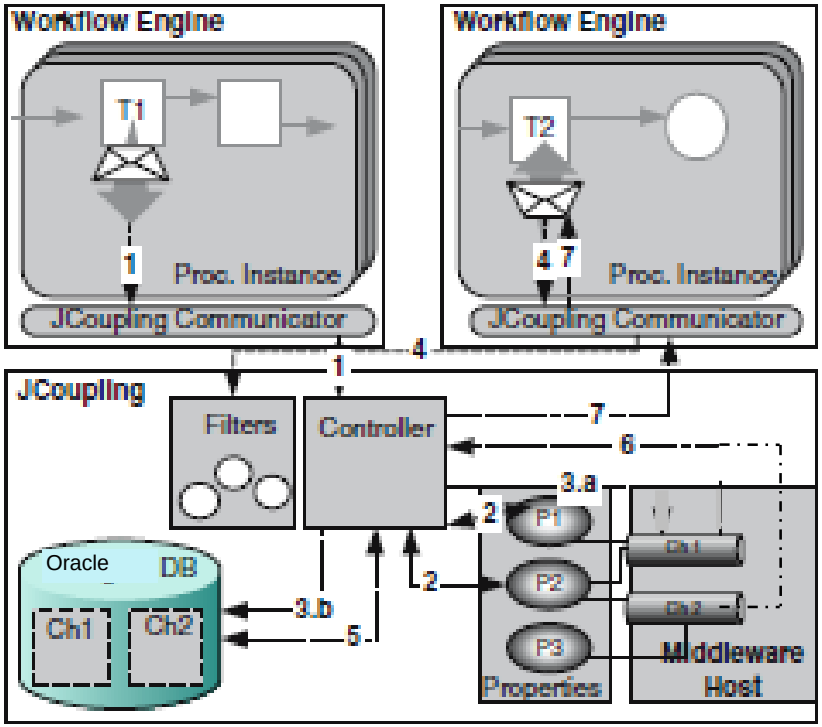
# Inter-Organizational Workflow Primitives

## XPDL Business Process Meta Model (2005 & 2008)

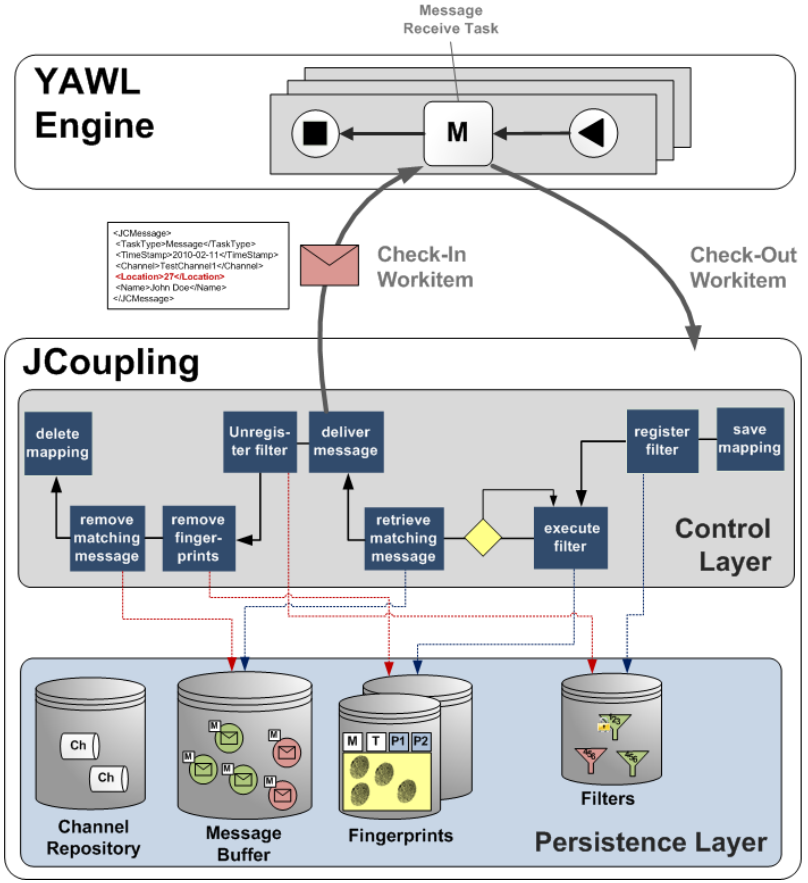


# Intra-Organizational Workflow Middleware

- Decoupling middleware 3 *communication* dims (Aldred, 2005-9)
- JCoupling tool for workflow messaging (Kuhr, 2008 & 2012)




JCoupling Bridge Architecture



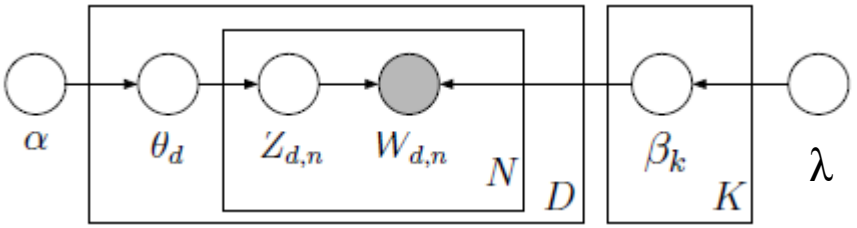

YAWL Message Handling

# Foundational Work: Computational Comprehension

- Natural Language: Hard problem, long automated translation history repairing *language shortcuts* reduces parties' conception gap
  - Weaver, 1949; Bar-Hillel, 1960; Wilks et.al, 1975, 89, 90; Dailey, 1986; Hirst, 2002; Dodig-Crnkovic, 2005
- Word Sense Disambiguation (WSD)
  - Approaches vary; facets: sense distinction *granularity*; external knowledge source; context representation; classification method
  - WordNet
    - Tool: manually cataloged words (synonyms, other relations: ontologies)
    - Verbs' polysemy significantly greater than nouns (verbs, actions, tasks)
    - Semantic similarity distance measurements
  - Metrics
    - Coverage, Precision & Recall
    - Senseval/Semeval international competitions (tri-annual starting 1998)
  - Topic Model-based (next slide) avoids *knowledge acquisition bottleneck*
  - Navigli, 2009; Miller et.al, 1993; Resnik, 1999

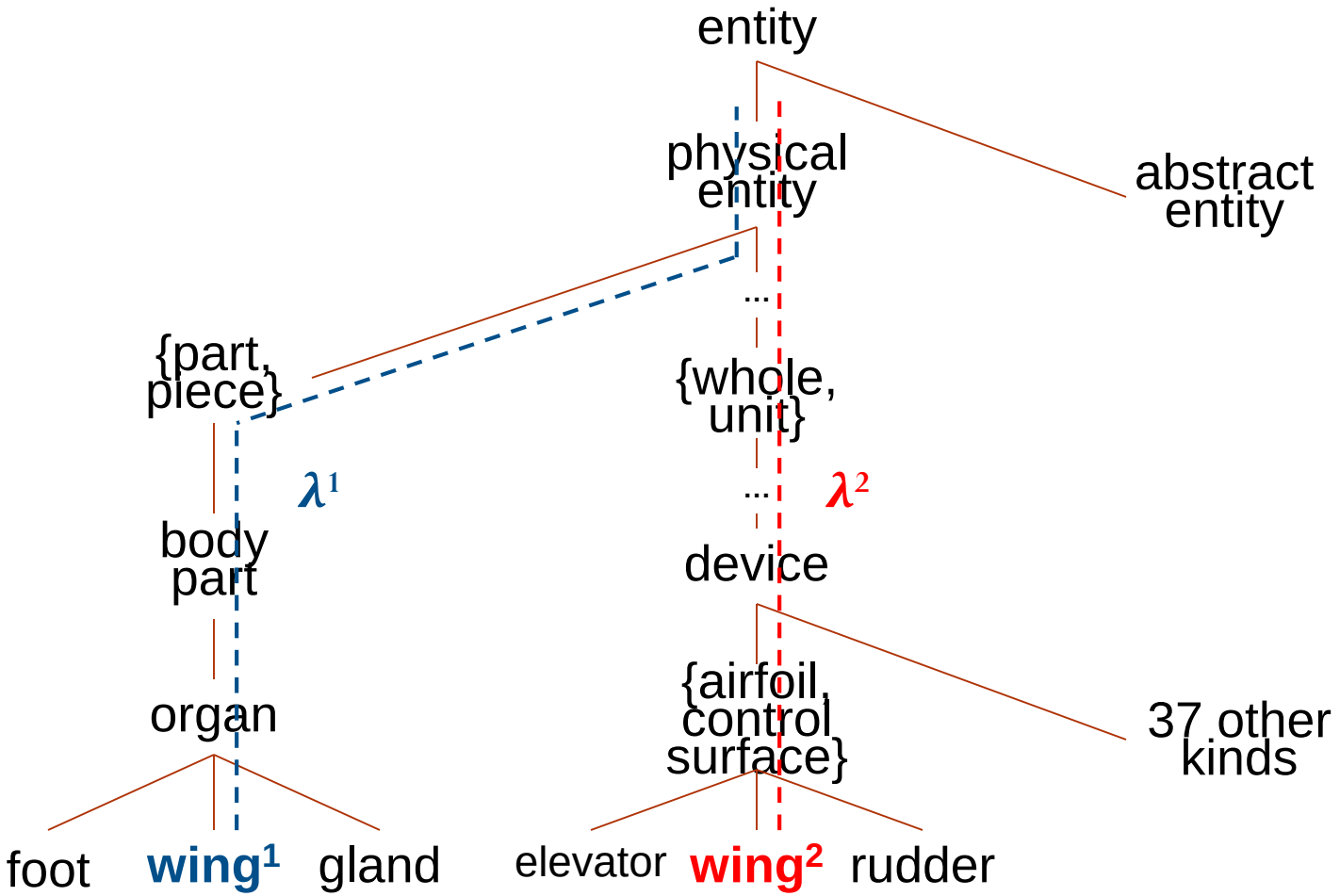
# Foundational Work: LDA Application to WSD

- Latent Dirichlet Allocation (LDA: Blei, Ng, Jordan, 2003)
- Finding Scientific Topics (Griffiths & Steyvers, 2004)
- Topic Model applied to WSD (LDA with WordNet: Boyd-Graber, Blei, Zhu, 2007)
- Incorporating *generalized* domain knowledge (Andrzejewski, 2009; Hu, Boyd-Graber, 2011)




- LDA Generative Model:
  - For each topic *k* of *K*: draw multinomial distribution $\beta_k$ from Dirichlet distribution with parameter $\lambda$
  - For each document *d* of *D*: draw multinomial distribution $\theta_d$ from Dirichlet distribution with parameter $\alpha$
  - For each word position *n* of *N (*in *d* of *D)*: select hidden topic $Z_{d,n}$ from multinomial distribution with parameter $\theta_d$
  - Choose observed word $W_{d,n}$ from distribution $\beta_{Z_{d,n}}$ for that topic
  - Used to mine business contracts for topics (Gao & Singh, 2014)
- LDAWN compares associated found topics words' senses, mapping traversed WordNet *synsets* hypernym paths $\lambda$ speeding convergence

# Incorporating Structured Domain Knowledge: Simplified WordNet *Wing* Hypernym Example

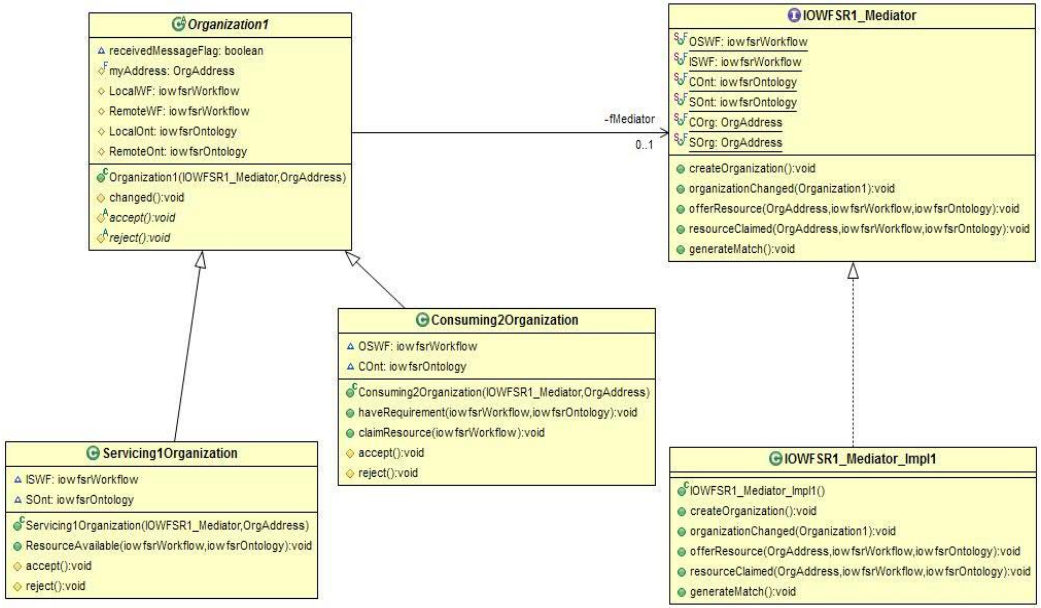


# IOWF Semantic Mediator

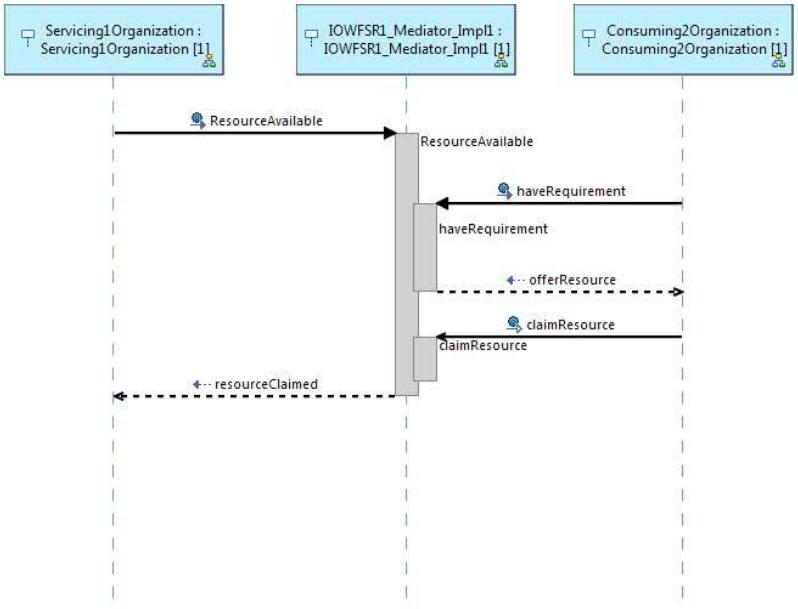
- Concept:
  - Automated workflow systems (like humans) to make *sense* of received information must understand terminology in *context*
  - *Not* of listener, but of speaker
  - Polysemous language overloads individual words' meaning
  - Implied unique meaning(s) within organization *confound* outsiders
    - *Port*: Computer Science Department vs. Nautical usage
- Mediator design pattern solution employs:
  - High level bridge encapsulating myriad workflow systems' requisites for choreography
  - Low level unstructured computational semantic resolution mechanism providing context

# IOWF Semantic Mediator to Bridge Organizations' Workflows

## Architectural Perspective

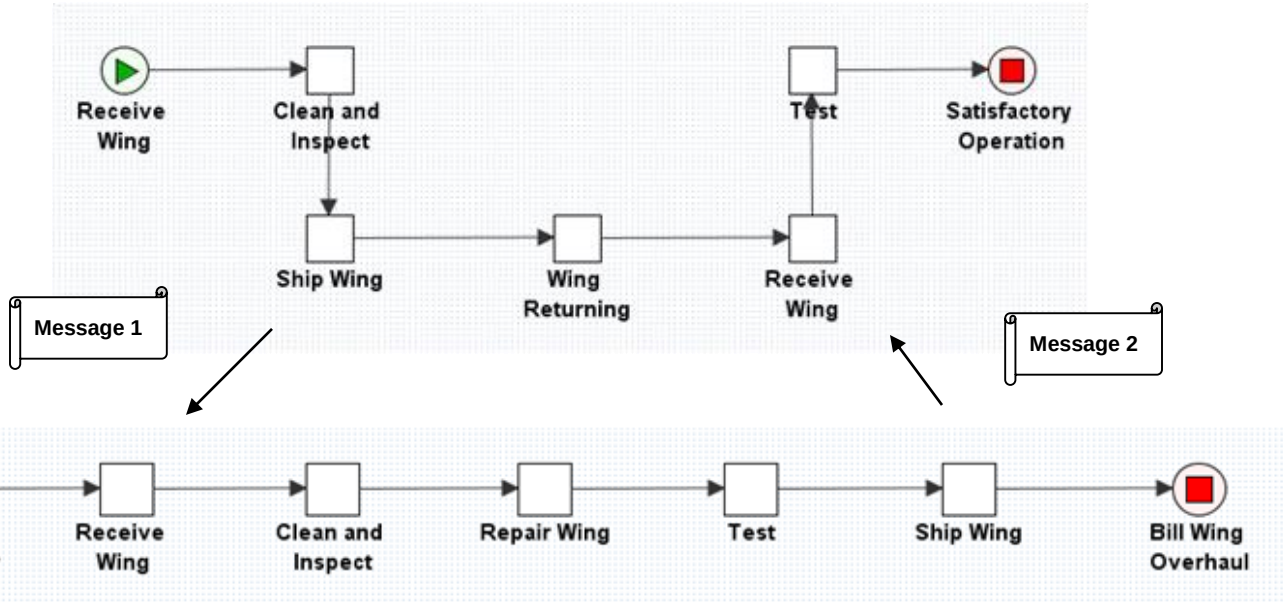



## Interaction Perspective



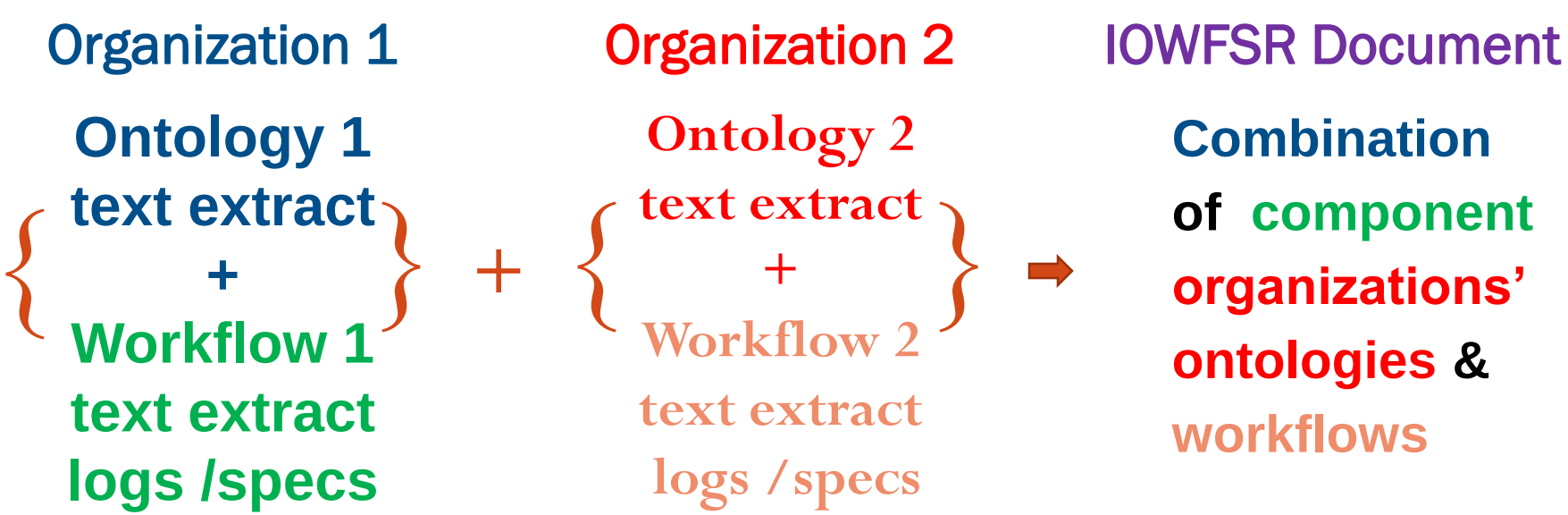
# Simplified IOWF Example: Outsource & Insource Wing Repair

## Consuming Organization (OS)




## Servicing Organization (IS)

# Creation of IOWF Semantic Resolution 'Documents'




Interlocking coordination of Work across varying internal vocabularies of meanings

IOWFSR correlations validated by experience

# IOWF Semantic Resolution Document Creation Example

Sky High Aircraft Maintenance Svc

Sky High Aircraft Ontology

+

Wing overhaul OS Workflow

+

Airframe Best Components

ABC Ontology

+

Wing repair IS Workflow

➡

IOWFSR *Document*

Sequential combination of component organizations' ontologies & workflows

Interlocking coordination of Work across varying internal vocabularies of meanings

IOWFSR correlations validated by experience

# IOWF Semantic Resolution Document Creation Example

**Sky High Aircraft Maintenance Svc**

aircraft repair
modernization
+
wing overhaul
transport

+

**Airframe Best Components**

repair supply
aircraft wings
+
repair wing
transport

→

**IOWFSR Document *Vocabulary***

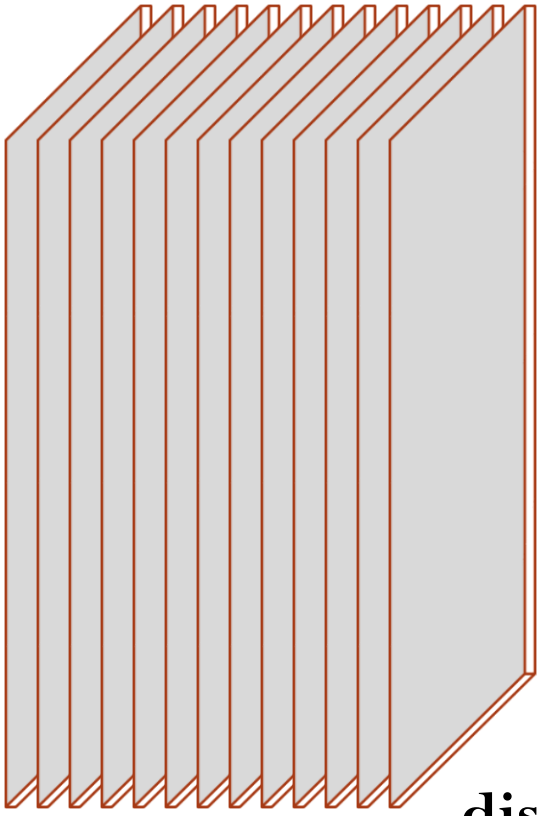
aircraft (2) repair
(3) modernization
wing (3) overhaul
(1) transport (2)
supply (1)

Interlocking coordination of Work across varying internal vocabularies of meanings

IOWFSR correlations validated by experience

# IOWF Semantic Resolution Corpus Collection and Topic Discovery

IOWFSR Documents



IOWFSR Corpus

LDAWN analysis: discover document topic mixture correlations

Topic 0

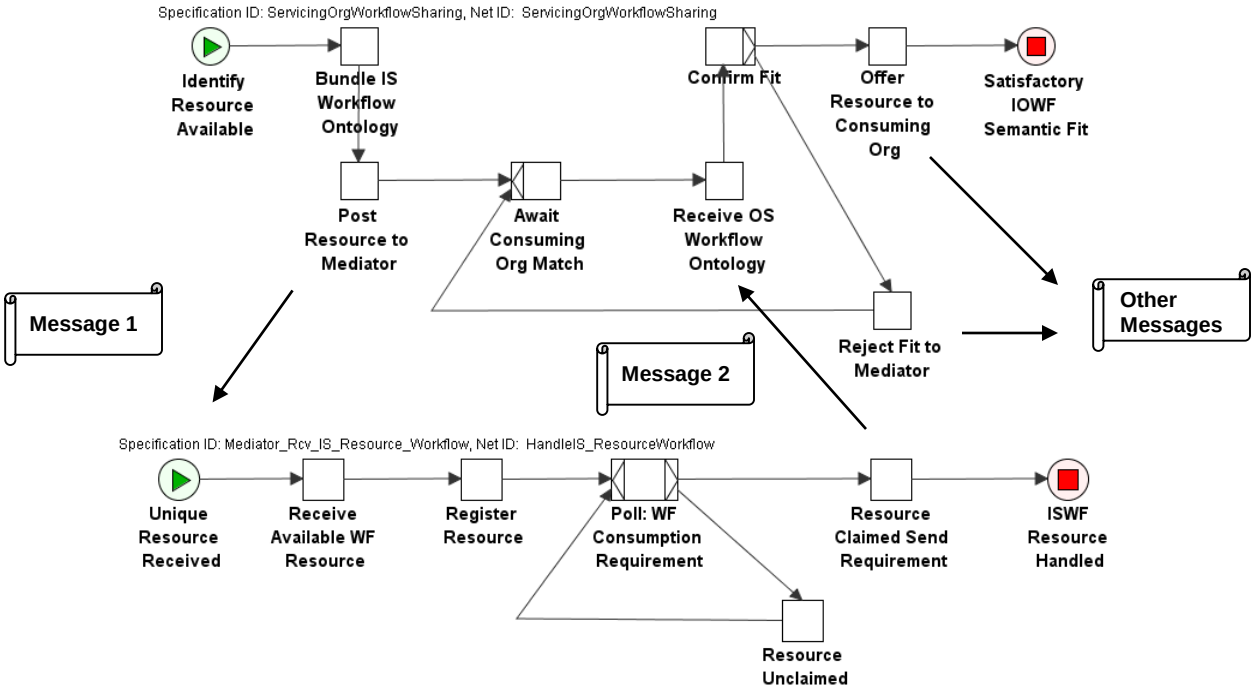
bird
wing
species
veterinarian

Topic 2

aircraft
wing
model
overhaul

# Resource Advertisement & Matching: Servicing Organization & Mediator Interaction

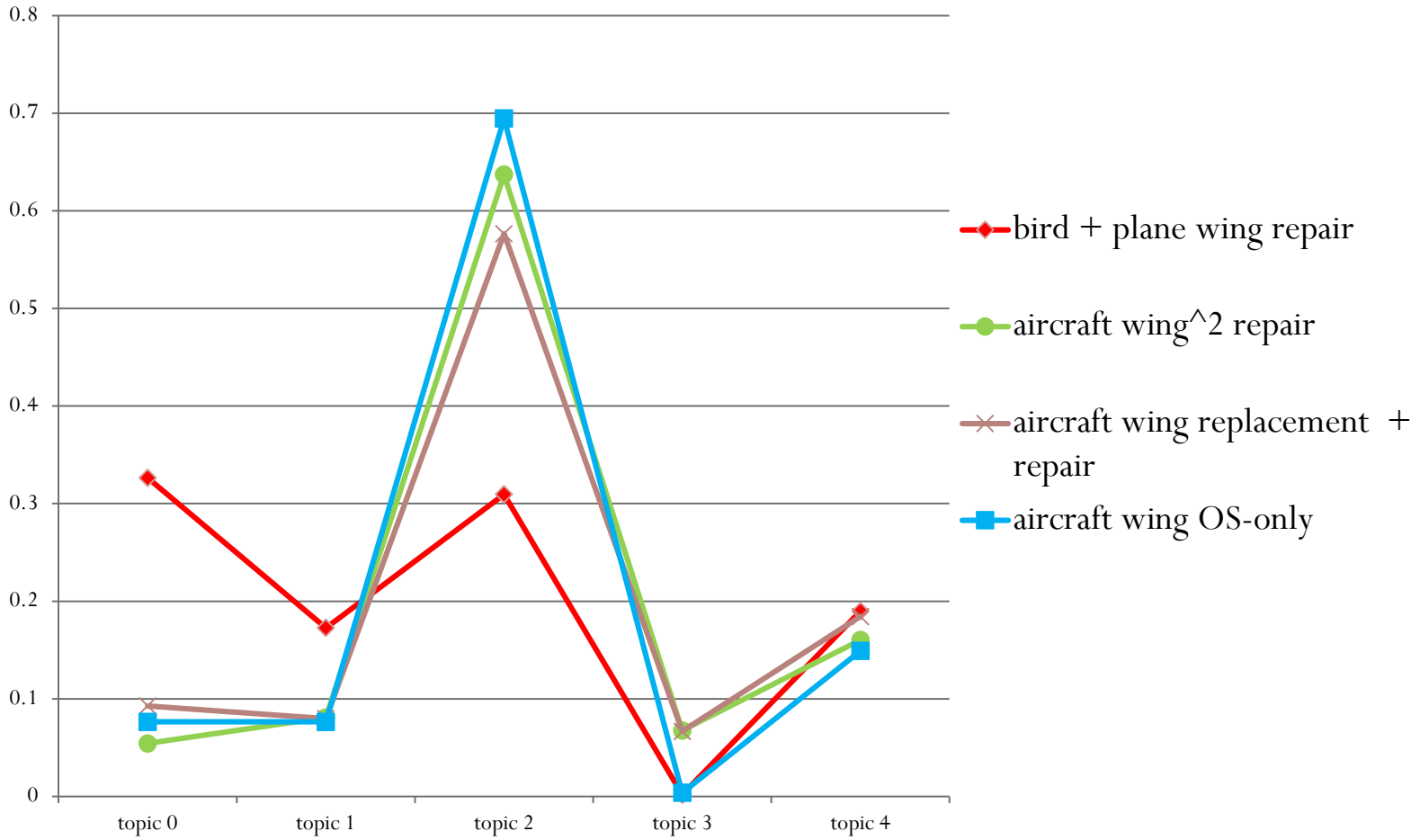
## Servicing Organization



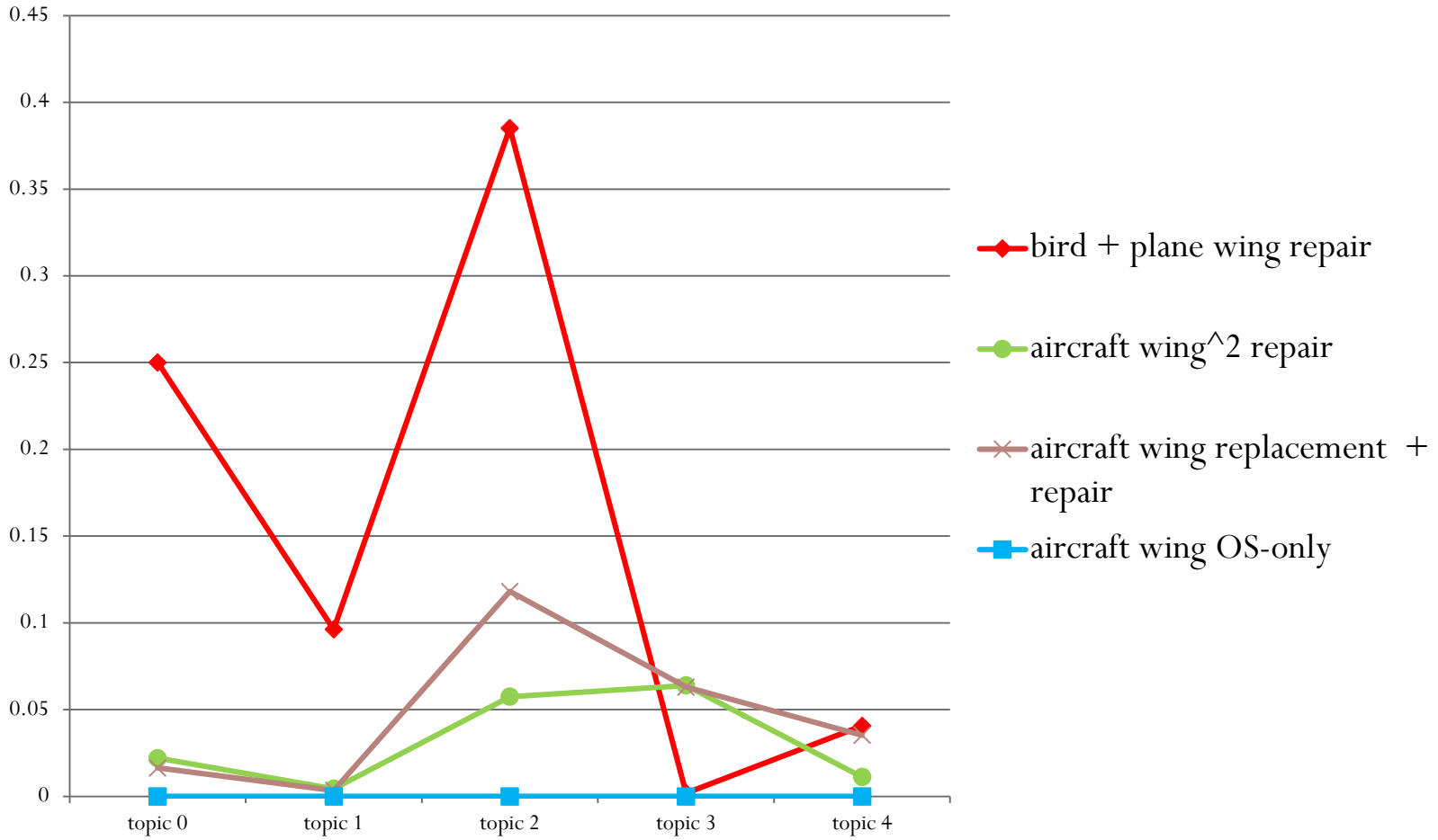

## IOWFSR Mediator

- Requirement handling similar (Consuming Organization)
- Collection & processing of executed IOWFs similar

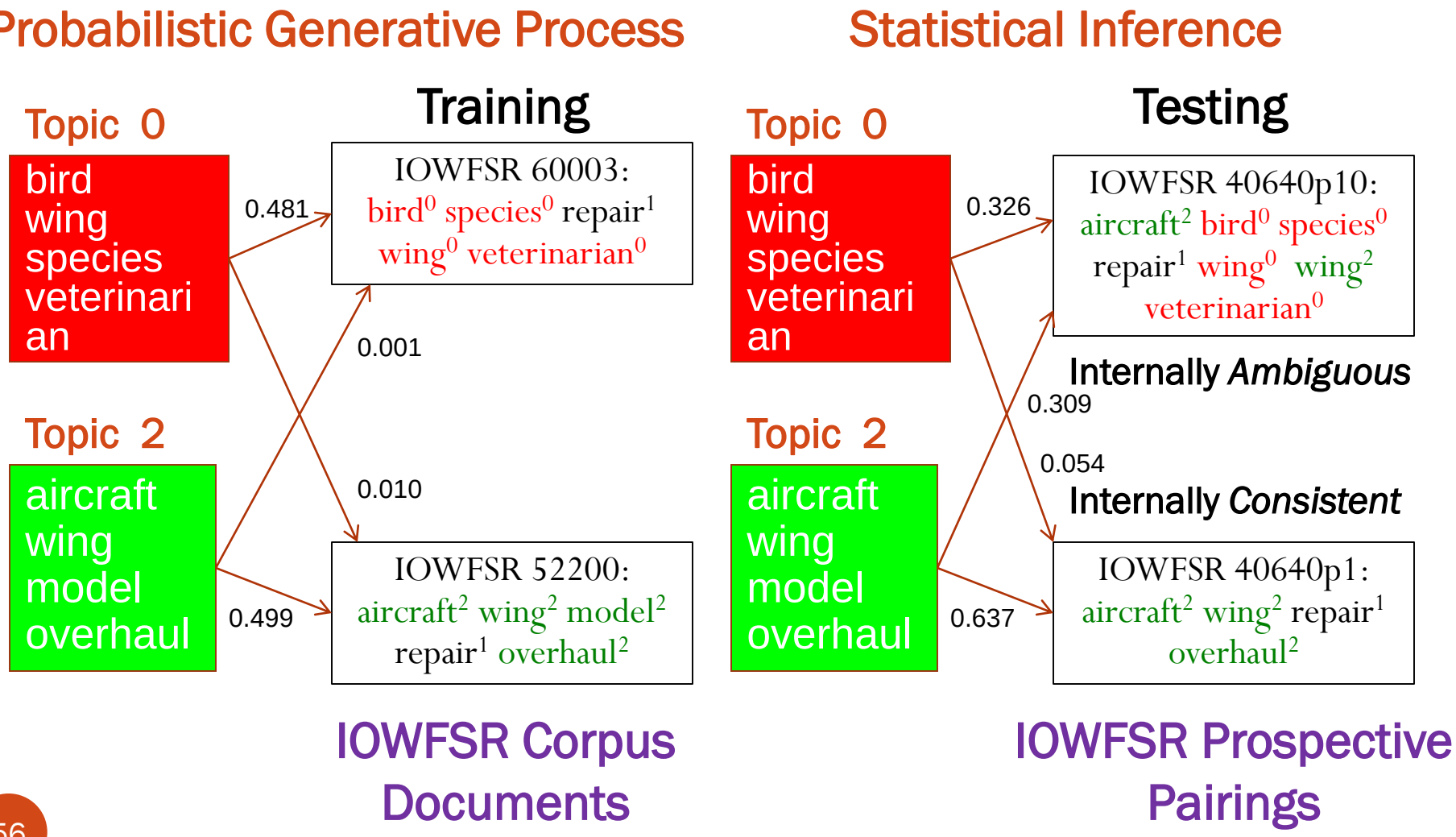
# Prospective IOWF Topic Distribution



# Magnitude of IOWF Topic Distribution Difference: Prospective — Requesting



# IOWF Semantic Resolution Generative Model & Inference



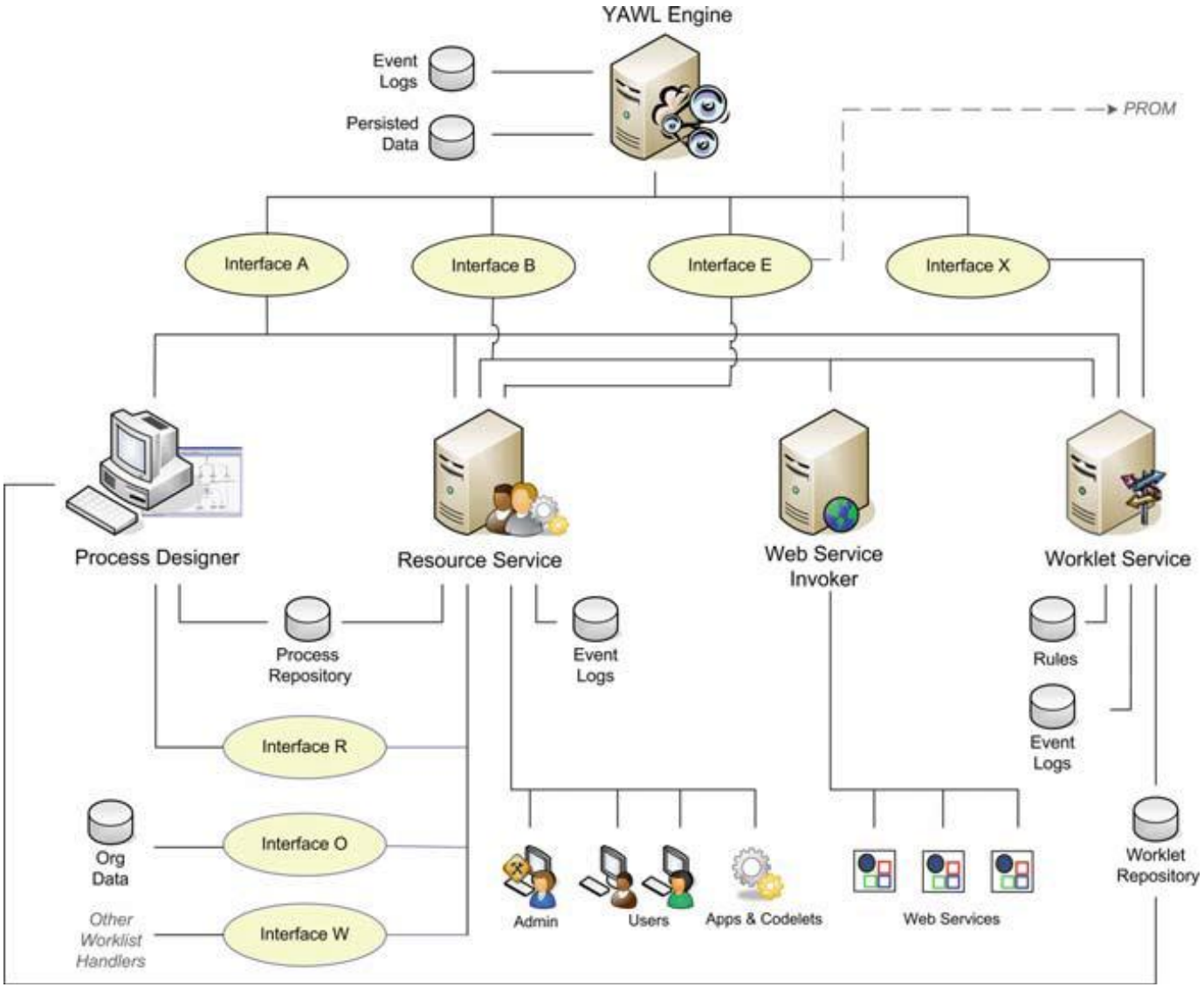
# Conclusions

- Novel framework; exemplary model demonstrates process to automatically resolve semantic ambiguity between organizations' WFMS without *a priori* knowledge
  - Key to decoupling organizations & resources
  - Easing interoperability means sharing more work to accomplish tasks
  - Flexibility & compatibility of approach supports adaption/adoption
- Enhancing semantic clarity exposes more potential inter-organizational workflow resource & consuming alternatives
  - Publishing alternatives publicly *lowers* service costs & *increases* markets
  - R&D partnering assistance
  - Prototype, One-off matching minimizes costs & maximizes markets
- Transfers semantic resolution
  - *From* time of execution
  - *To* planning stage (evaluation of alternatives)

# Future Work

- Generalize, automate, test & apply framework to increasingly complex cases
- Formalize IOWFSR Model
- Apply to unlabeled message source identification
- Apply to outstanding Complex System communications issues (How can we apply to solve your engineering / management / medical / biological issue?)
- Dynamic IOWFSR Mechanism to allow modeling interaction of heterogeneous complex system components independently
- Extension of IOWFSR methods beyond natural language to new heterogeneous domains of encoded structural & dynamic knowledge
- How do nano-bot swarms communicate to accomplish a mission?
- Questions?  Thanks!

# Workflow Management System Example (YAWL)



# Organizational Language Barriers to Communication

- Ontology (Workflow components)
  - Language of (given) Organization
  - Subset of Domain, Natural Language
- Languages evolve from particular community seeds
  - Terminals start from instances (proper names: *Tailor*)

Obs: Task *names* may vary, even though *predicates* match

  - Generalization rules vary by environment, create unique grammars
  - True for clans, societies, organizations
  - Grammar commonalities, differences *emerge* as distinct groups interact
- Industrial orders: “regional ontologies which attempt to define what life, labor, and language are in their own beings” (Foucault, *The Order of Things*, 1973)
- “Languages are the measure of mankind’s ideas” (Turgot, 1750) in *Language as the Key to the Epistemological Labyrinth* (Lifschitz, 2004)
- Generated bottom-up; interpreted top-down
  - Direct mappings between ontologies of organizations: *intractable computing jungle*!

# Why Natural Language Workflows?

- Reasonability
  - WFMS primarily model organizations of humans automating their work processes
  - Workflow tasks primarily defined using NL
- Importance
  - Machine readable dictionaries (MRD) help resolve WF corpus elements (semantic primitives) meaning
  - Linguistic Theory and NL development *slightly* predate advent of Computer Science
- Extensibility
  - Handle multiple domains, built from given NL
  - Concept extensible to variety of languages, providing dictionary available (or may be generated)

# WSD (Topic Model & MRD) vs. Meta-Ontology Mapping

- Simpler – Façade!
  - "Bag of Terms" analysis internally models latent structure vs.
  - Tagging POS & generating structured syntax meta-trees
- "Automatic" maintenance
  - As terms added, LDA topics migrate slowly over time, maturation
  - Meta-Ontology restructuring might result in incremental versions not resembling each other: revolutionary vs. evolutionary
- Research areas relative success in resolving problem
- Inclusiveness & predictability of semantic resolution
- WordNet empirically defined syn-sets enhance Topic Model's demonstrated natural clustering affinity

# Distinguished from other IO work

- On-going organizational cooperation
  - *Shared language evolution may already exist*
- Web Services
  - *Stateless; complete interface description available*
- While many WS applications, limited IOWF investigation; except
  - *Meta-model ontology IOWF interoperability approach outlined (Haller, et al. 2005)*
  - *Semantic ambiguity resolution expanded; actual solution alternatives left to future work (Höfferer, 2007)*
- Community-shared standard ontologies IOWF exist
  - *Not many; but nice (ex: Medical, ICD 9&10)*
- Natural Language vs. Scientific or Grid Workflow
  - *NL introduces more ambiguity; broadens application*
- Agent-based WFMS
  - *Principles don't require agents*
- Custom-developed mapping
  - *Hard-coded translations (look-up tables) presume prior knowledge of parties' languages involved; extensibility intractable*

# Organizational Diversity

- Maturity
  - *Business Process* definition degree of detail
  - *Continuous Improvement*
- Breadth (specialization) of entity/component
- Domain (community) participation
  - Number & degree of standardization
- Internal topology (hierarchical, P2P, matrix)
- Size matters (flexibility/rigidity of roles & tasks)
- Unique internal knowledge: own Ontology

# Profuse Workflow Design Expression

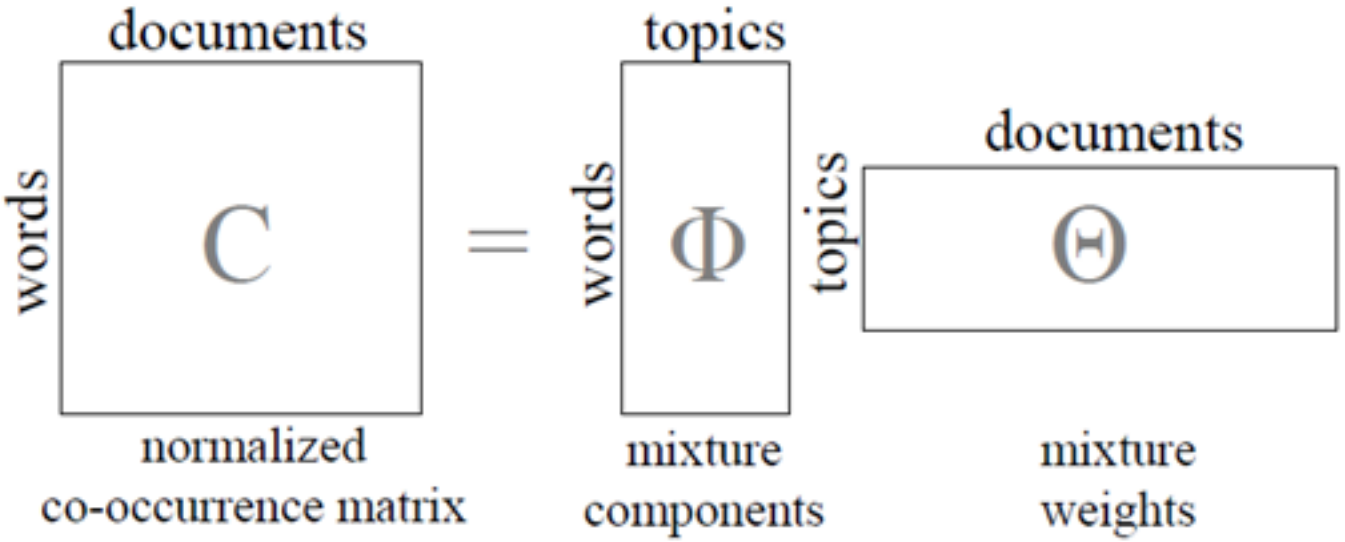
Standards & implementations vary for WFMS:

- Features, information requirements & outputs (heterogeneity excludes Adaptors)
- Detail (generality): derived from organization
- Environment (hardware/software: supported & required)
- Degree of Automation
- Workflow Interface Support (WFMC, later)
- Representation/extent of organization knowledge, structure

# Lexical Relations

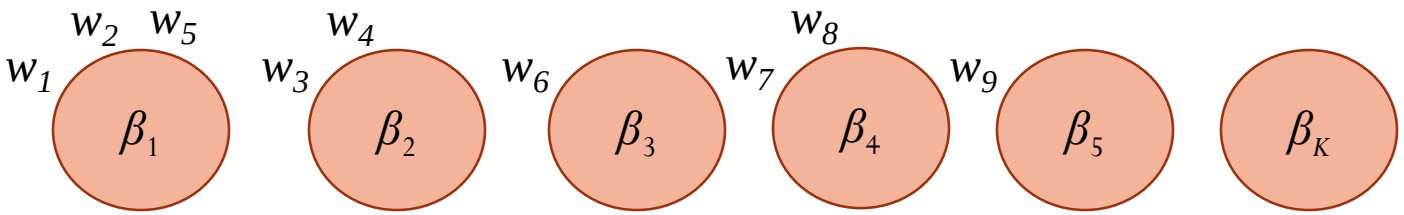
| | |
|---|---|
| synset | word senses expressing (approximately) same meaning |
| gloss | textual definition possibly with examples |
| antonymy | expresses opposite concept |
| pertainymy | adjective of or pertaining to noun (or another adjective) |
| nominalization | noun nominalizes verb (flight, fly) |
| hypernymy | kind-of or is-a (superclass: wing, airfoil) |
| hyponymy | is-a-kind-of (subclass: airplane, jet) |
| troponymy | is-a-kind-of, verb (fly, soar) |
| meronymy | part-of (airplane, wing) |
| holonymy | is-a-part-of (wing, bird) |
| entailment | verb is entailed by verb (overhaul, repair) |
| similarity | adjective is similar to adjective (satisfactory, acceptable) |
| attribute | noun an attribute that adjective expresses value (color, purple) |

# Co-occurrence Matrix, Topics, Documents & Words



# Dirichlet Allocation Example

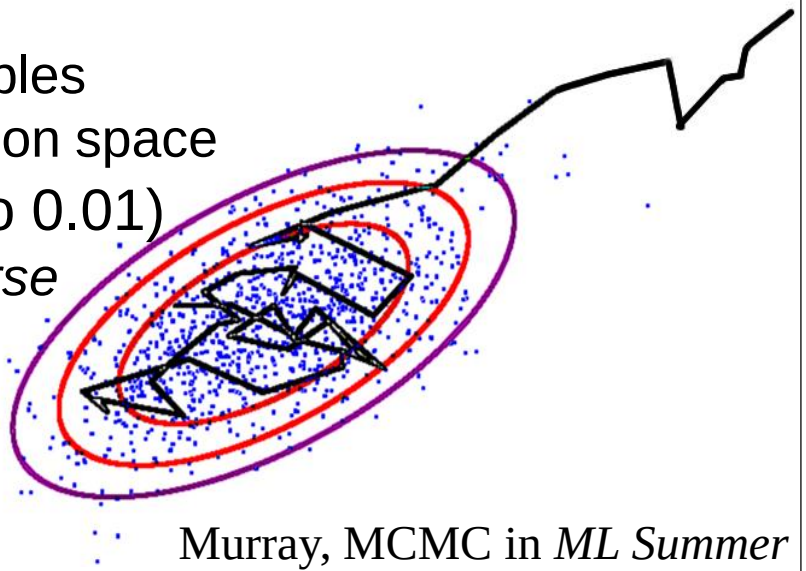
- Dirichlet: Joint distribution random variables over partitions
- Chinese Restaurant Process (CRP) provides example of clustering
  - *N* customers
  - *K* tables
  - Initial *Generation* Step: Customer $w_1$ sits at Table $\beta_1$
  - Successive steps (*n* = 2..*N*), Customer $w_n$ sits at Table $\beta_k$ :
    - Occupied Table $\beta_k$: probability of $\frac{|\beta_k|}{\alpha + W_n - 1}$
    - Unoccupied Table $\beta_{k\text{-}max+1}$: probability of $\frac{\alpha}{\alpha + W_n - 1}$



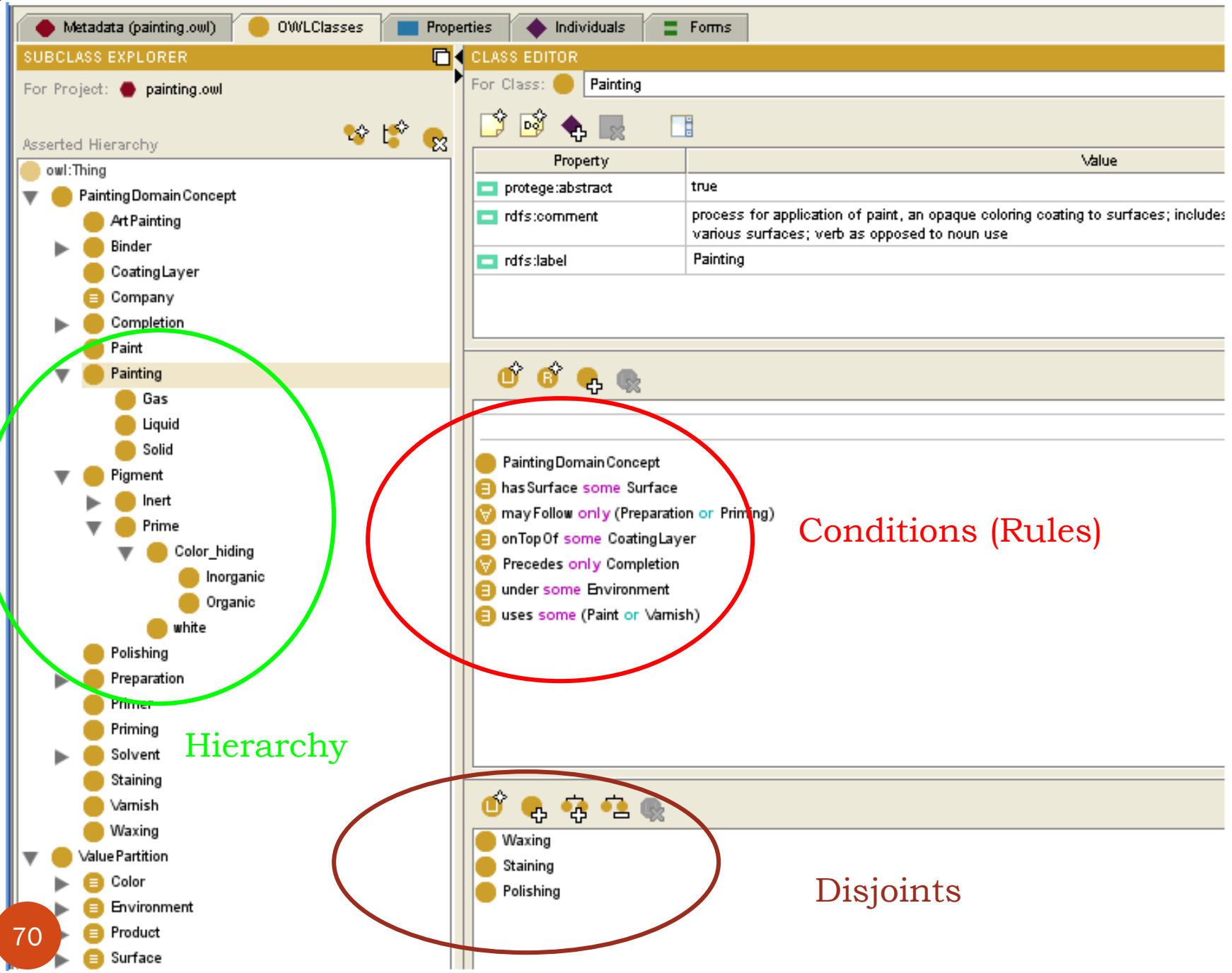

- Representations:
  - Tables are topics
  - Customers are words
  - Restaurants are documents
- Effect of varying *concentration*, $\alpha$: 10^2…unity...10^(-2)

# Gibbs sampling: Markov chain Monte Carlo posterior inference approximation

- Even fixing *K* topics, computation of actual posterior *intractable*
- MCMC biased random walk for 2-dimension r.v. *below*
- Gibbs sampling (one type of MCMC) explores *K*-dimension distribution space of hidden variables
  - Iterates between
    - Each hidden variables' conditional distribution (given observations)
    - Current state of other hidden variables
  - *K* limits topic choice, solution dimension space
- $\alpha$ iteration size; when small (0.001 to 0.01)
  - Restricts # topics per document: *sparse*
  - Increases convergence time
  - Conversely, large $\alpha$ over-generalizes
- Key insight: use *exchangeability*
  - CRP: Where does customer $w_n$ sit?



Murray, MCMC in *ML Summer School* , Cambridge, 2009.


Metadata (painting.owl)
OWLClasses
Properties
Individuals
Forms
SUBCLASS EXPLORER
For Project: painting.owl
Asserted Hierarchy
owl:Thing
Painting Domain Concept
Art Painting
Binder
Coating Layer
Company
Completion
Paint
Painting
Gas
Liquid
Solid
Pigment
Inert
Prime
Color_hiding
Inorganic
Organic
white
Polishing
Preparation
Priming
Solvent
Staining
Varnish
Waxing
Value Partition
Color
Environment
Product
Surface
Hierarchy
CLASS EDITOR
For Class: Painting
Property
Value
protege:abstract
true
rdfs:comment
process for application of paint, an opaque coloring coating to surfaces; includes various surfaces; verb as opposed to noun use
rdfs:label
Painting
Painting Domain Concept
has Surface some Surface
may Follow only (Preparation or Priming)
on Top Of some Coating Layer
Precedes only Completion
under some Environment
uses some (Paint or Varnish)
Conditions (Rules)
Waxing
Staining
Polishing
Disjoints