Bringing Commitments (and Other Norms) to Practice

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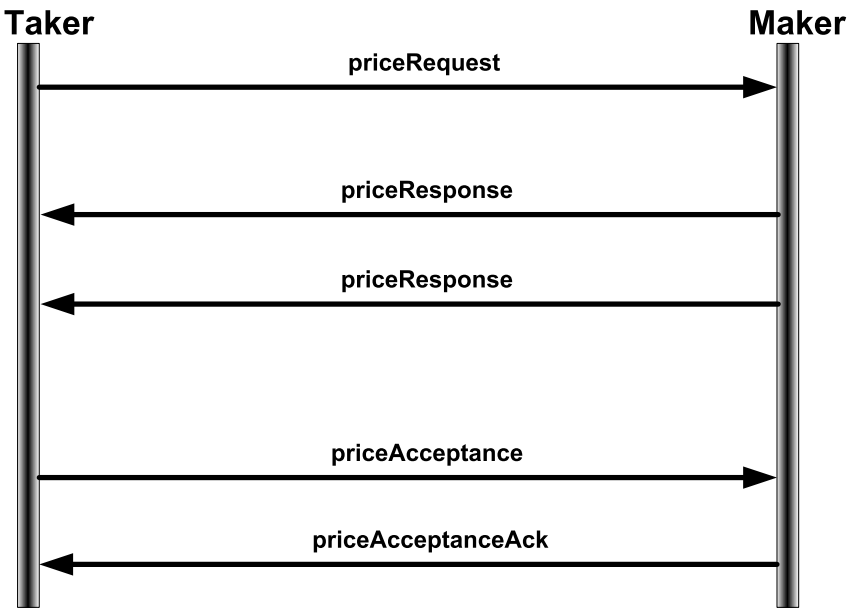
Outline

Example of Social Computing: Scientific Collaboration

Global Hybrid Profile Mooring Being Launched; Credit: Tom Kleindinst, WHOI

Example of Social Computing: Finance

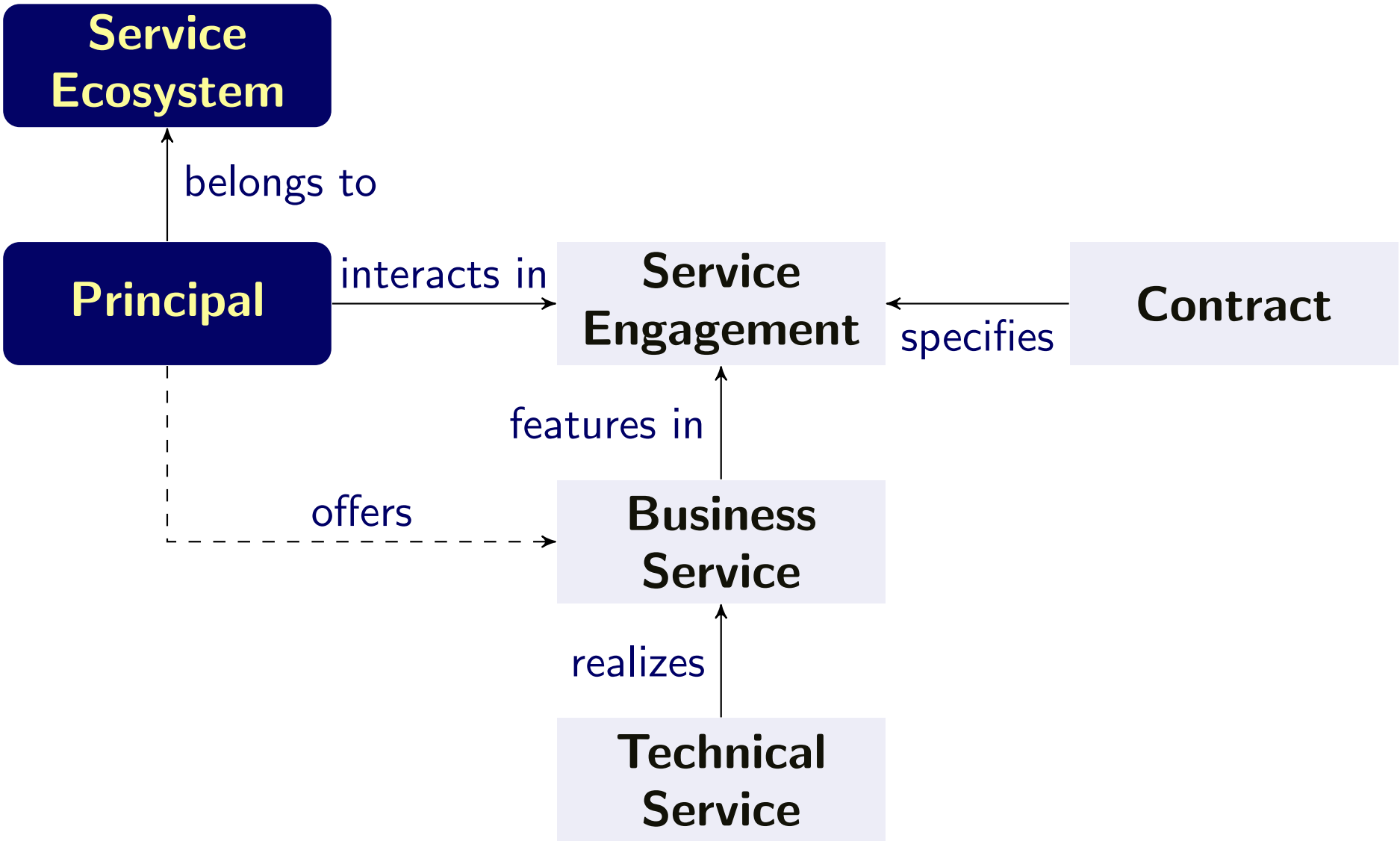
Bilateral Price Discovery (*BPD*)



What do these messages mean?

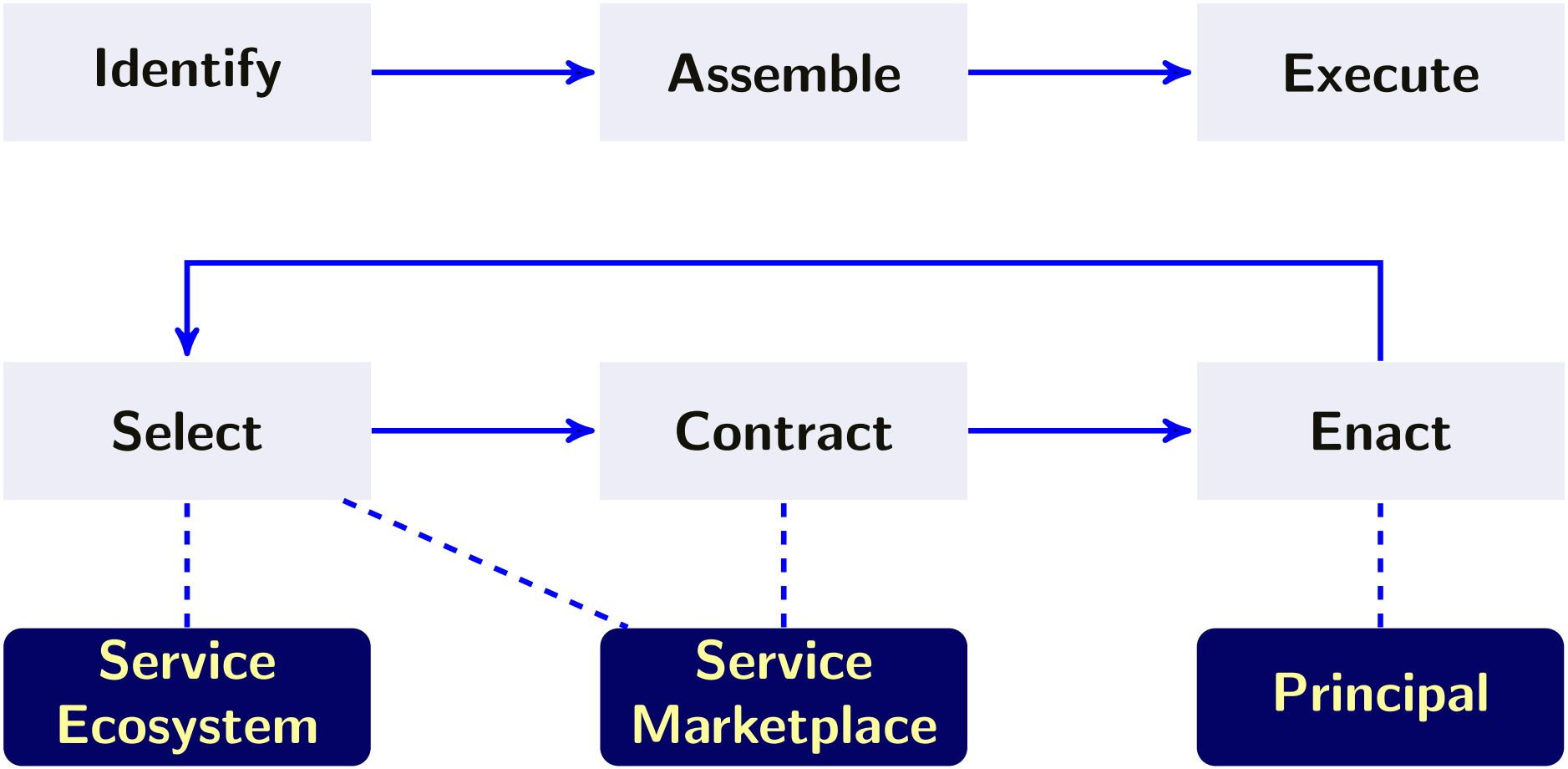
- Must the *Maker* trade at the quoted price if the *Taker* accepts the price?
- Must the *Taker* trade at an accepted price even without confirmation?
- Why is it that multiple RFQs are OK but multiple accepts are not?

Example of Social Computing: Service Ecosystems



Elements of an IT Episode: Traditional and for Services

Traditionally, no support for autonomy

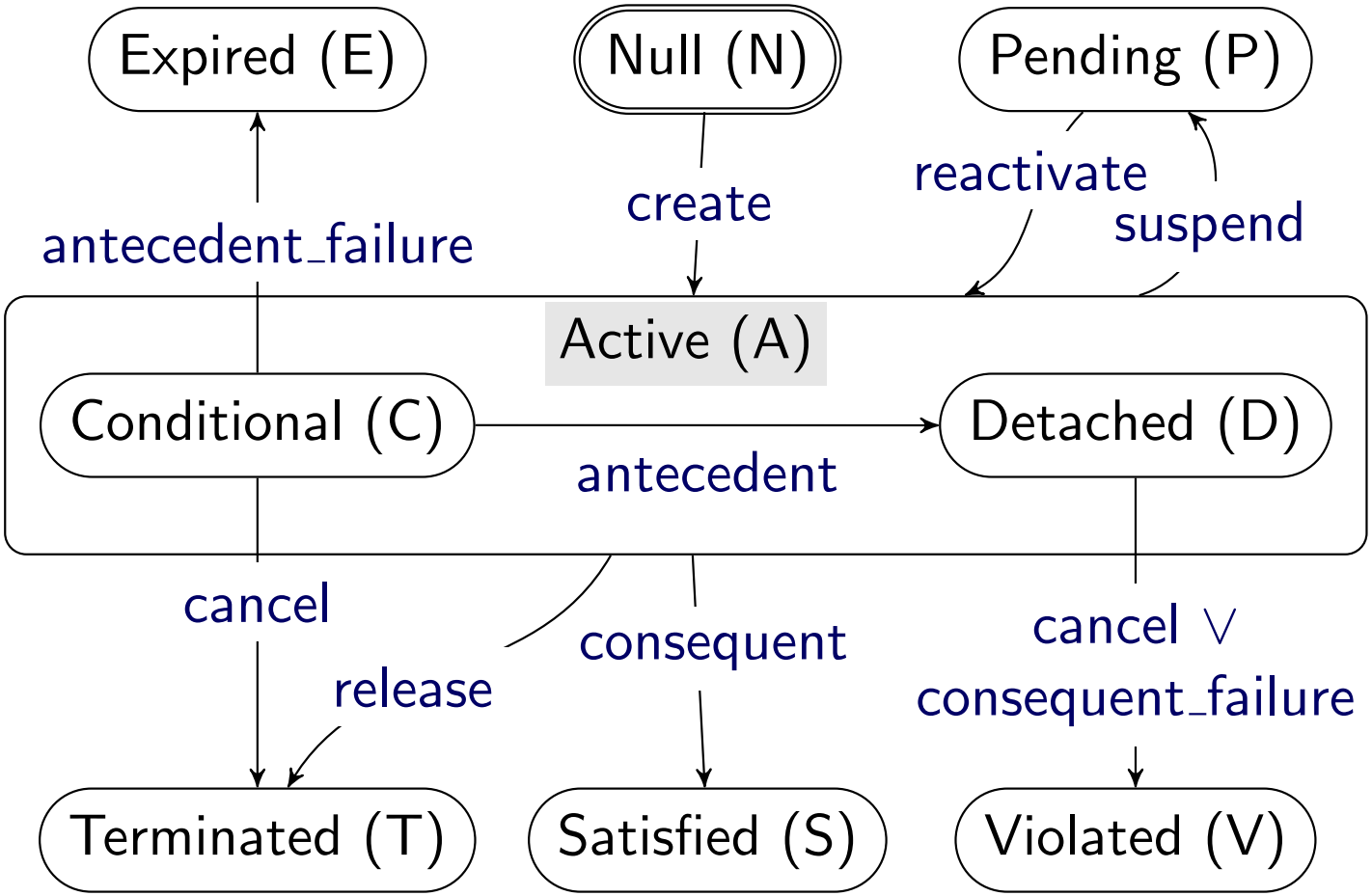


Directions for Research

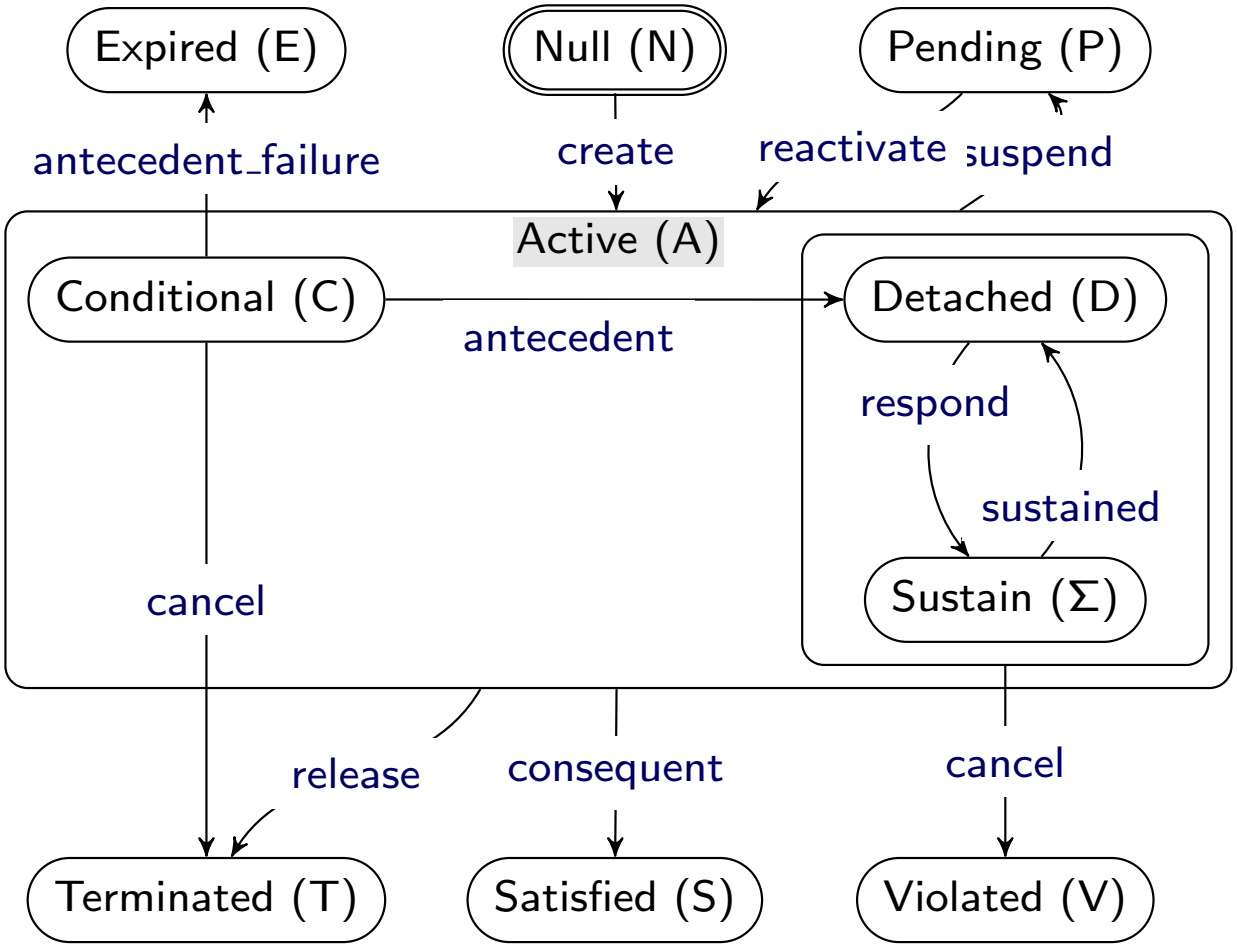
- Selection: Multiple perspectives on creating engagements
  - Social networks for reputation and referral
  - Selecting service coalitions and services for coalitions
  - Estimating trust
- Contracting: Specifying the rules of encounter
  - Specifying models of quality and utility
  - Pricing and economic incentives
  - Modeling exceptions and opportunities
  - Engendering trust
- Enacting: Technical infrastructure to facilitate new business models
  - Cloud computing as a foundation for service clouds
  - Ad hoc processes
  - Accommodating unexpected exceptions and opportunities
  - Decentralized enactment: doing without a process orchestrator

Outline

Achievement Commitments Life Cycle

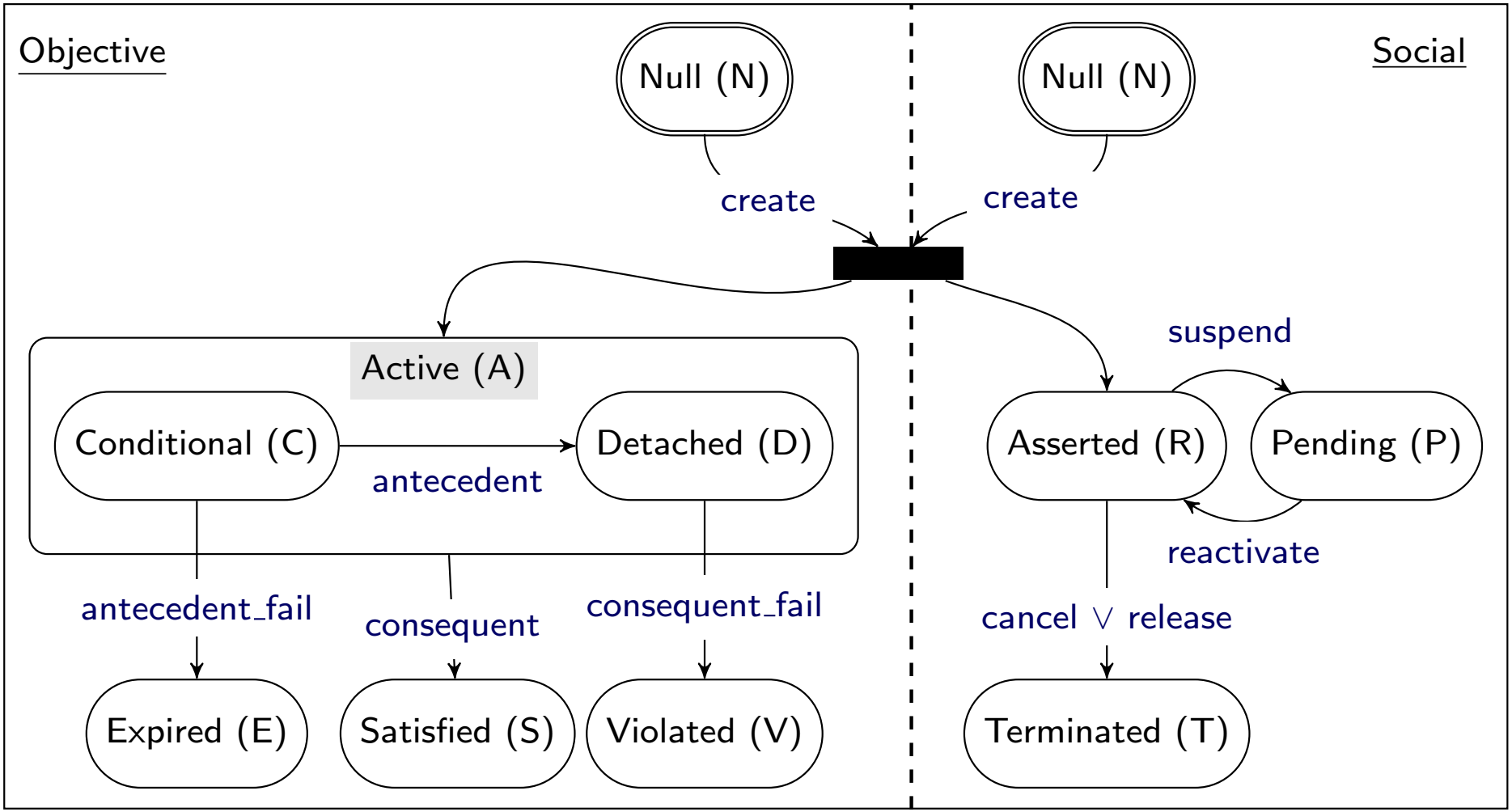


Maintenance Commitments Life Cycle

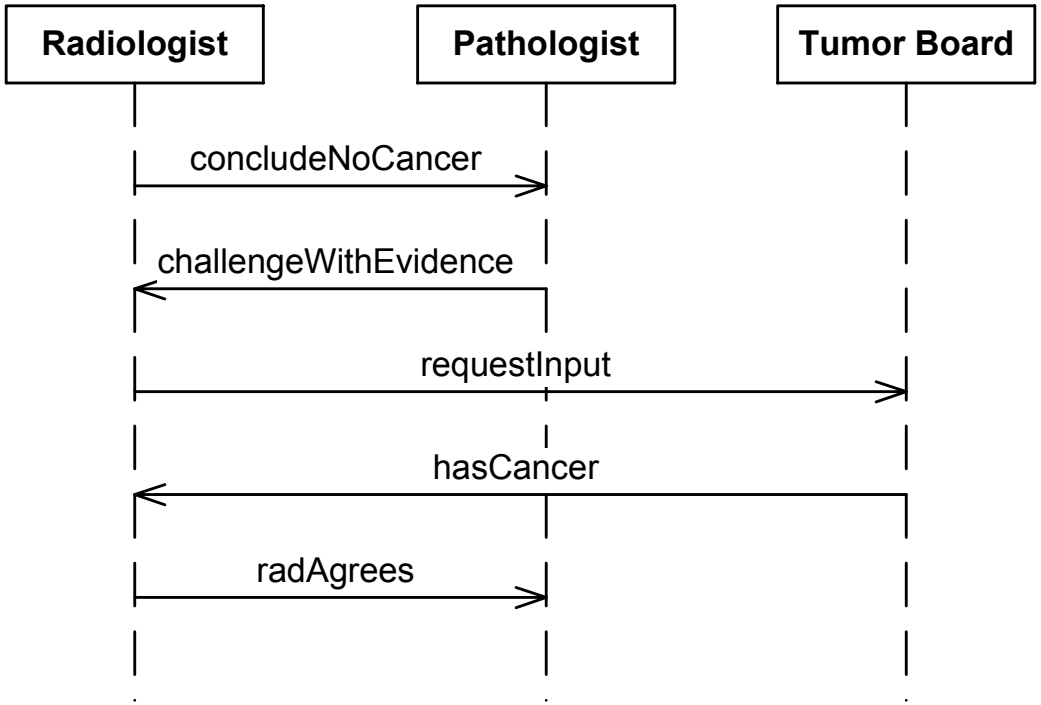


A New Life Cycle for Achievement Commitments

Commitment state = ⟨Objective state, Social state⟩



Application to Healthcare

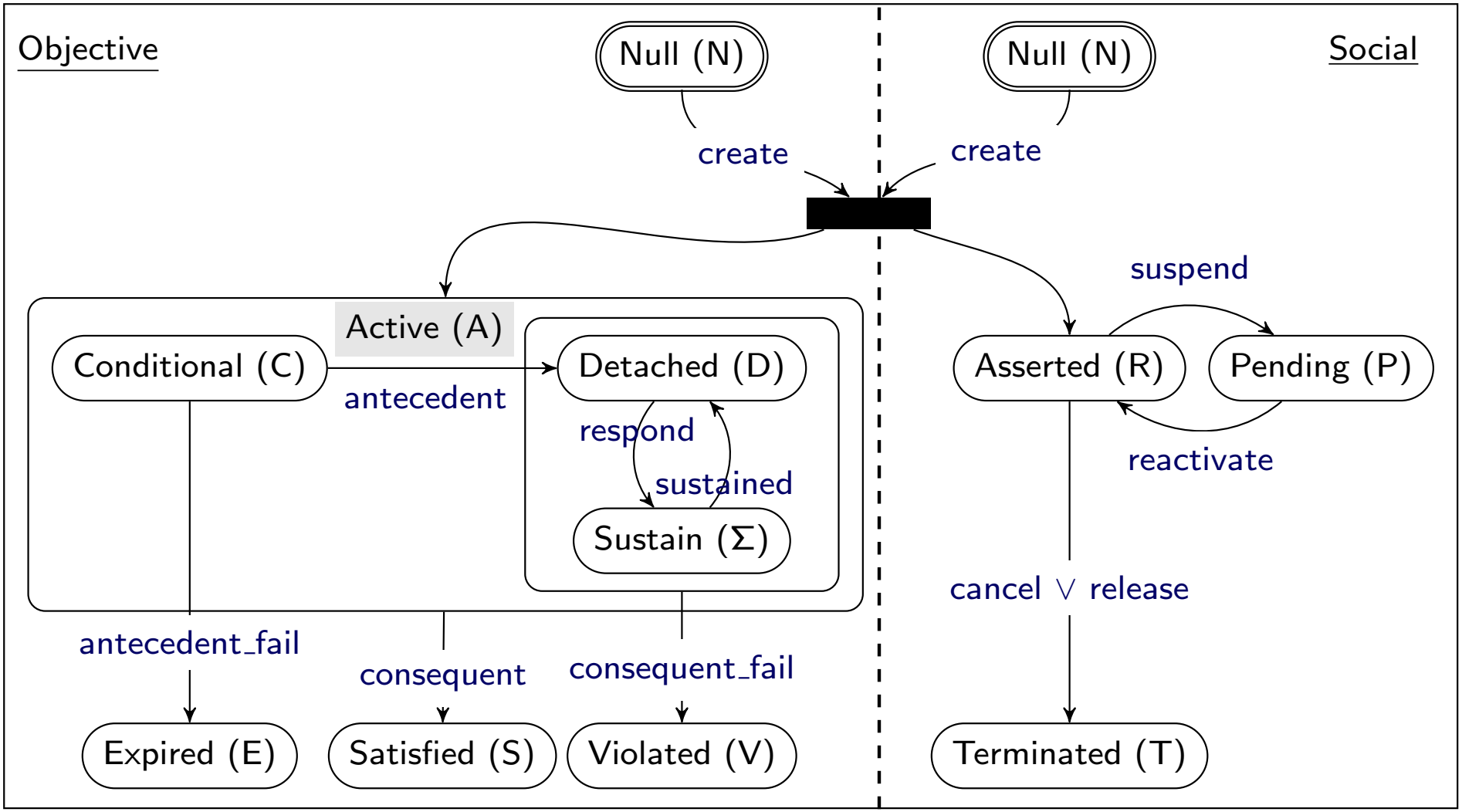


$D_R = \underline{C}^d(\text{RAD}, \text{PATH}, \top, \text{boardAgreesNoCancer})$, $D_P = \underline{C}^d(\text{PATH}, \text{RAD}, \top, \text{boardAgreesHasCancer})$

Message	D_R **State**	D_P **State**
concludeNoCancer	⟨**Detached**, **Asserted**⟩	⟨*null*, *null*⟩
challengeWithEvidence	⟨*Detached*, *Asserted*⟩	⟨**Detached**, **Asserted**⟩
requestInput	⟨*Detached*, *Asserted*⟩	⟨*Detached*, *Asserted*⟩
hasCancer	⟨**Violated**, **Asserted**⟩	⟨**Satisfied**, **Asserted**⟩
radAgrees	⟨**Violated**, **Terminated**⟩	⟨*Satisfied*, *Asserted*⟩

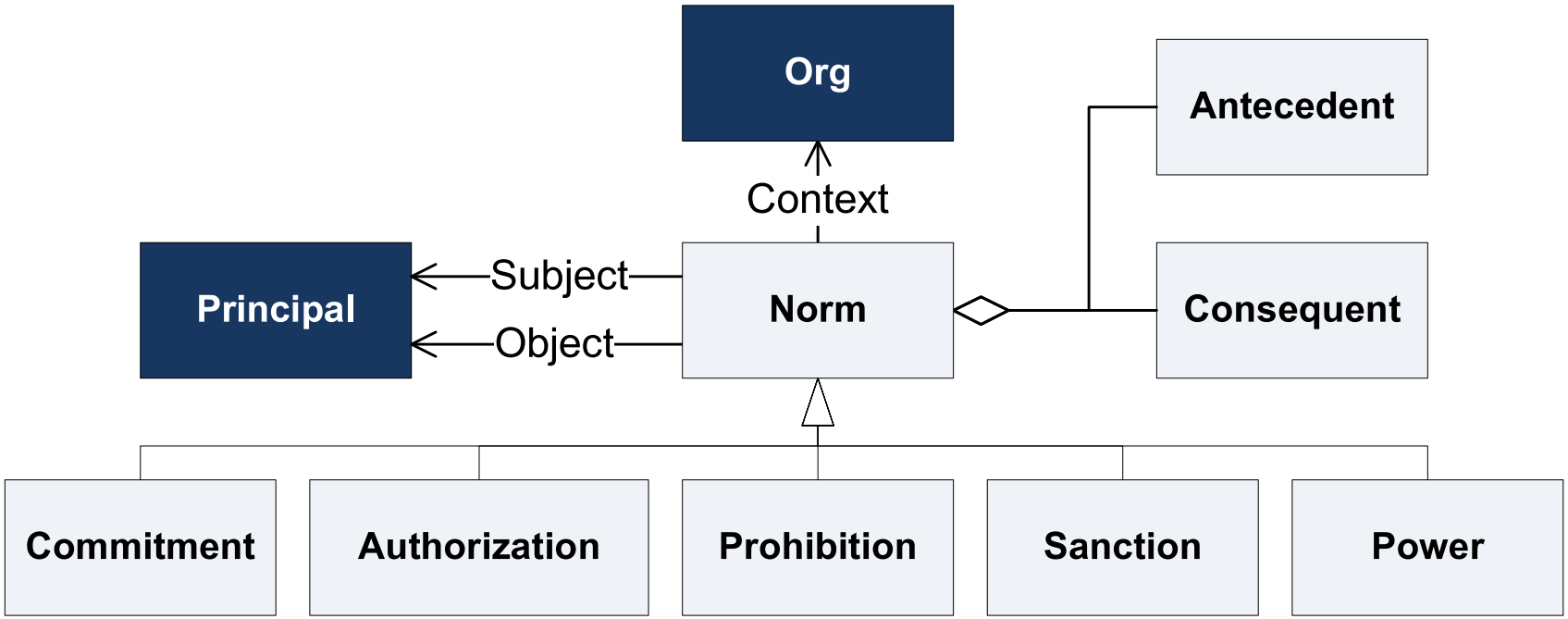
A New Life Cycle for Maintenance Commitments

Commitment state = ⟨Objective state, Social state⟩



Types of Normative Relationships

Unified logical form: Norm(subject, object, context, antecedent, consequent)



- The context is fixed in our setting
- Read each as "The subject is authorized [by] the object . . ."

Outline

Types: Practical Commitment

A promise to bring about the consequent if the antecedent holds

Example

Sharp will be responsible for ensuring an adequate supply of spare parts to distributors or repair facilities so warranty returns can be repaired and sent back to the field without undue delay.

Types: Dialectical Commitment

A claim staked by its subject, i.e., that the consequent is true if the antecedent is

Example

OEM Partner represents and warrants that any OEM Partner's Technology, Specifications, and Bills of Materials provided by OEM Partner to Patriot Technologies contain all of the information . . .

Types: Authorization

The subject may bring about the consequent if the antecedent holds

Example

Danger will have the right to use the test results internally for product management and planning purposes.

Types: Prohibition

The subject must not bring about the consequent if the antecedent holds

Example

Danger shall not issue a press release mentioning Sharp without Sharp's prior consent, which shall not be unreasonably withheld or delayed.

Types: Power

The subject is empowered that the antecedent counts as the consequent

Example

. . . the non-defaulting party, in its sole discretion, shall have the right to terminate this Agreement, in addition to any other remedy or remedies which may be available to it under this Agreement, at law or in equity.

Types: Sanction

The subject faces consequences for violating a specified norm

Example

Purchaser will pay late charges equal to 15% per month on any unpaid portion of the Purchase Price [if Purchaser fails to pay in the full amount at the time of transaction].

Extraction Problem and Approach

- Classify each sentence occurring in a contract as one of
  - Not a norm, dialectical commitment, practical commitment, authorization, prohibition, sanction, power
- Limitations: cannot handle
  - Norms that do not correspond 1-1 with sentences
- Approach
  - Surface patterns
  - Language parsing
  - Heuristics
  - Machine learning

Semantic Verb Classes: 1

- *State*
  - Examples: Retain, have, be, own, remain, include
  - Dialectical Commitment: Each joint owner shall **have** an equal and undivided ownership interest in the Joint Works ...
- *Event*
  - Examples: Move, perform, deliver, notify, market
  - Practical Commitment: Sharp shall **provide** Approved Carriers and Carrier Customers with Products for testing, evaluation and field trials in accordance with terms agreed upon between Sharp and such parties

Semantic Verb Classes: 2

- *Physical*
  - Examples: Produce, pay, develop, utilize, design
  - Authorization: Danger will have the right to **use** the test results internally for product management and planning purposes
- *Social:*
  - Examples: Terminate, sell, approve, waive, purchase
  - Power: In the event this Agreement terminates for a reason other than for Danger's material breach, Danger shall have the right to **purchase** any Sharp owned tooling and test equipment for a Product at a reasonable price

Key Textual Features with Examples

Subject contains organization name	Motorola; Google
Clause signal	if; unless
Modal verb	may; should
Negation present	not; neither
Only present	only
Main verb expresses an event	deliver; perform
Main verb expresses a state	have; be
Main verb has physical consequence	produce; pay
Main verb has social consequence	terminate; approve
Practical commitment signal	agree to
Dialectical commitment signal	it warrants; it is understood that
Authorization signal	shall have the right to ⟨physical⟩
Prohibition signal	must not
Power signal	shall have the right to ⟨social⟩
Sanction signal	responsible for any breach

Experimental Setting

- Gold standard
  - Selected 1,000 sentences from real-life contracts
  - Remove 38 sentences longer than 80 words each (often broken) to reduce noise and processing overhead
  - Remove 94 duplicate sentences
  - 868 sentences left after cleansing
  - Manually annotate each sentence with its norm type
- Features
  - Manually selected and automatically extracted
- Classification methods
  - Support Vector Machine (SVM)
  - Logistic regression (LR)
  - Naïve Bayes (NB)
- Evaluation
  - Ten-fold cross validation
  - Test on fresh data with model built from gold standard

Extraction Results (Ten-Fold Cross Validation)

Class	**LR**			**SVM**			**NB**		
	P	R	F	P	R	F	P	R	F
Practical C	0.87	0.80	0.83	0.88	0.70	0.78	0.83	0.81	0.82
Dialectical C	0.75	0.79	0.77	0.67	0.84	0.74	0.69	0.83	0.76
Authorization	0.67	0.69	0.68	0.68	0.65	0.66	0.65	0.76	0.70
Prohibition	0.64	0.68	0.66	0.64	0.61	0.63	0.68	0.59	0.63
Power	0.74	0.78	0.76	0.69	0.76	0.72	0.78	0.66	0.72
Sanction	0.43	0.25	0.32	–	–	–	–	–	–
Not a norm	0.58	0.47	0.52	0.42	0.33	0.37	0.60	0.20	0.30
Average	*0.75*	*0.74*	*0.74*	*0.71*	*0.71*	*0.71*	*0.72*	*0.73*	*0.72*

Test on 100 Previously Unseen Sentences

Applying Logistic Regression

Norm Type	Instances	Precision	Recall	F-Measure
Practical C	46	0.91	0.89	0.90
Dialectical C	41	0.90	0.88	0.89
Authorization	7	0.75	0.43	0.55
Prohibition	3	0.25	0.67	0.36
Power	1	–	–	–
Sanction	1	–	–	–
Not a norm	–	–	–	–
Average	—	*0.86*	*0.83*	*0.84*

Outline

Identifying Commitment Operations from Interactions

Ten-fold cross-validation using SVM on marked up Enron email sentences

Commitment Operation	**P**	**R**	**F**	**Count**
Commissive create	0.87	0.97	0.92	342
Directive create	0.94	0.97	0.95	162
Delegate	0.86	0.33	0.48	12
Discharge	1.00	0.02	0.04	38
Cancel	–	–	–	7
None	0.98	0.98	0.98	3,540
Total				4,101

Skewed distribution. Features include

1. Modal verb (shall, will, may, might, can, could, would, must)
2. Type of subject (first person, second person, third person)
3. Tense
4. Deadline

Determining Commitment Operations from Text

Commitments being the most prominent normative relationship

S	R	Content	Operation	$\mathbf{T}_{S,R}$	$\mathbf{T}_{R,S}$
Kim	*Dorothy*	I will also check with Alliance Travel Agency ...	create(C_1)		
Kim	*Dorothy*	I checked with our Travel Agency ...	discharge(C_1)		$\uparrow$
Rob	*Kim*	By Wednesday Aug 16 2001, please send all copies of your documentation ...	create(C_2)		
Kim	*Rob*	Rob, please forgive me for not sending this in by Aug 15	cancel(C_2)		$\downarrow$

Results

Ten-fold cross-validation using SVM on marked up chat sentences from HP IT corpus

Commitment Operation	**Precision**	**Recall**	**F-measure**
Commissive create	0.79	0.85	0.82
Directive create	0.73	0.85	0.83
Subcontract	–	–	–
Discharge	0.64	0.70	0.67
Cancel	0.22	0.13	0.16
None	0.97	0.97	0.97

Results

Evaluation on independent test datasets using SVM for email and LR for chat, respectively

	Email			Chat		
Classifier	**P**	**R**	**F**	**P**	**R**	**F**
C-create	0.97	0.84	0.90	0.90	0.89	0.89
D-create	0.94	0.78	0.86	0.83	0.51	0.63
Discharge	–	–	–	0.66	0.71	0.69
Cancel	–	–	–	–	–	–
Subcontract	1.00	0.33	0.98	–	–	–
None	0.96	0.99	0.98	0.96	0.98	0.94

Outline

Conclusions

- Norms provide an invaluable basis for social computing in the broad sense of the term
- But success requires
  - Expanding our representational framework
  - Considering both social and logical aspects of norms
  - Tackling the not so neat challenges of norms in practice
  - Accommodating existing bodies of practice, such as contracting and law
- This presentation hints at the above but the hard work remains
- Please join in the fun!

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Links

http://www.csc.ncsu.edu/faculty/mpsingh/