Language Technology II: Natural Language Dialogue

Dialogue Phenomena (2)

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Dialogue Acts

Dialogue Acts

- the speaker in a conversation (typically) has a certain intention, a purpose, a goal ➔ the speaker performs a **communicative act**
- Dialogue acts evolved from speech acts
- Speech act theory: do things with words (Austin 1962; Searle, Davis…)

Speech Act Theory

- What speakers “do” by utterances:
  - **constatives**: utterances used to make true/false statements or assertions
    The snow is green.
  - **performatives**: utterances used to change the world
    I name this baby Jonathan
    I chisten this ship „Queen Mary”
    I promise I'll never do this again
    I bet it'll rain this evening
    I declare war on Liliput.
    I apologize.
    I object.
    I warn you.

Speech Act Theory

- Constatives vs. performatives
- BUT:
  - performatives cannot be false, but they can **fail** to do things
  - some sentences are explicitly performative, others can be implicitly so
  - Apparently performative sentences need not be used as a performative at all
  - an utterance can be both constative ("truth-bearer") and performative ("action-performer")

  → performatives are not a special class of sentences;
  constatives and performatives are not necessarily disjoint phenomena;
  the performative/constative dichotomy does not really exist;
  both are special cases of **illocutionary acts**

Speech Act Theory

- Utterances are multi-dimentional *acts that affect the context*
  - **Locutionary act**: the act of uttering the words with their semantic content; saying something
  - **Illocutionary act**: the communicative act the speaker performs in saying the words (e.g., make a statement; request something; promise something; etc.) --> speech acts
  - **Perlocutionary act**: the act that occurs as a result of the utterance, the effect on the audience (e.g., making someone laugh, scared, convinced, pleased; etc.)

Speech Acts

Assertive	S commits to P being the case	Comment, suggest, swear, boast, conclude	H considers committing to P being the case
Directive	S attempts to get H do X	Ask, order, request, beg, invite, advise	H considers doing X
Commissive	S commits to future course of action X	Promise, plan, vow, bet, oppose	H expects S to do X
Expressive	S expresses psychological state T	Thank, apologize, welcome, deplore	H accepts T
Declarations	S changes world	Resign, name, fire	H accepts new state

Dialogue Act Recognition

- How do we decide what DA a user input is, e.g., statement vs. info-request
- At first glance, this looks simple
  - Different syntax:
    - Yes-no-questions have subj-verb inversion
    - Statements have declarative syntax
    - Commands have imperative syntax
- However, the mapping between surface form and illocutionary act is not one-to-one

Dialogue Act Recognition

- For example, what looks like a yes/no question

  Can you give me a list of the flights from A to B

  Can be a polite form of directive or request

  Please give me a list of flights from A to B

- What looks like a statement

  And you said you wanted to travel next week

  Can actually be a question, used to verify sth. (but, intonation!)

Dialogue Act Recognition

- Another example of “indirectness”:

  A: That’s the telephone.

  B: I’m in the bath.

  A: OK.

- Can be paraphrased as follows:

  A requests B to perform action (answer phone)

  B states reason why he cannot comply (in bath)

  A undertakes to perform action (answer phone)

Dialogue Act Recognition

- Idiom-based model:
  - Literal meaning (direct speech act)
  - Idiomatic meaning (indirect speech act)

  the grammar would list idiomatic meanings for each construction, e.g., Can you X? would have request as one possible meaning
- Inferential model: indirect speech acts arrived at by inference

Automatic DA Recognition

- This is one of the tasks of the dialogue management module (see next lecture)
- Plan-based interpretation
  - Essentially the inference model, differences lie in amount and depth of actual reasoning
  - Symbolic
  - Requires hand-coding and domain-knowledge
- Cue-based recognition
  - Essentially derived from the idiom model
  - Using a combination of utterance features and context features (supervised machine learning methods)
  - Requires hand-annotated data
- Machine learning!

Dialogue Acts/Moves

- Generalization of speech acts to conversational functions of utterances at various levels
- Various taxonomies, typically tuned for a specific task or domain
- Attempts at reusable schemes:
  - Conversation acts (Traum and Hinkelman 1992, Traum 1994); DAMSL (1997); MATE/DATE (2001); DIT++ (2005; 2010); LIRICS (2007)
  - ISO International Standard 24617-2 (July 2010) http://semantic-annotation.uvt.nl/

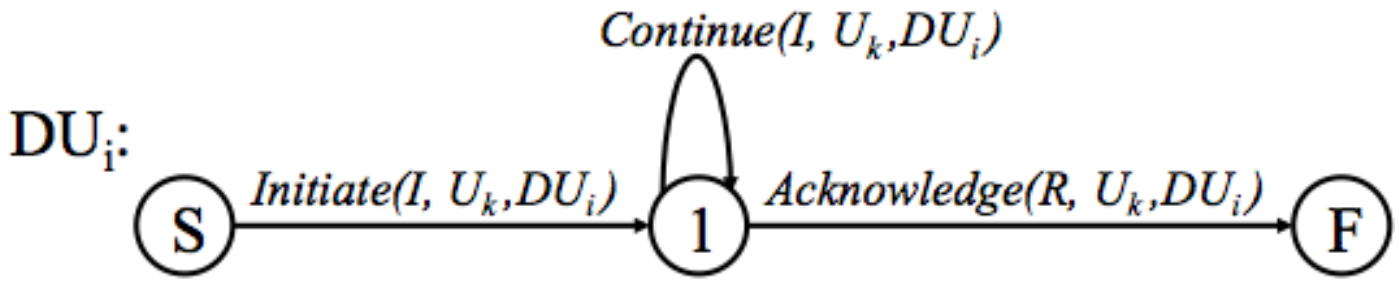
Conversational Acts

- Extension of speech acts theory (Traum 1994)
- Dimensions:
  - Turn-taking
  - Core speech acts
  - **Grounding acts**
  - Argumentational acts

Grounding Acts

Grounding Acts

- Discourse Unit (DU): unit of content to be grounded (cf. Clark's contribution)
- what is the function of utterance U w.r.t. the grounding of a DU_i?



(1) 1:A: Move the boxcar to Corning
2:A: and load it with oranges
3:B: OK

Init(A,1,DU1)
Cont(A,2,DU1)
Ack(B,3,DU1)

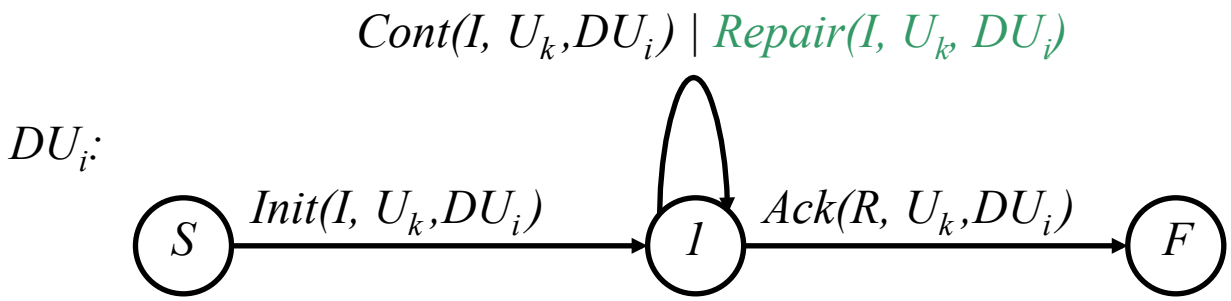
Grounding Acts

Label	Description
initiate	Begin new DU, content separate from previous uncompleted DUs
continue	same agent adds related content to open DU
acknowledge	Demonstrate or claim understanding of previous material by other agent
repair	Correct (potential) misunderstanding of DU content
Request Repair	Signal lack of understanding
Request Ack	Signal for other to acknowledge
cancel	Stop work on DU, leaving it ungrounded and ungroundable

(Traum 1998)

Adding Self-Repair

- *Self-repair (of DU_i by I):*

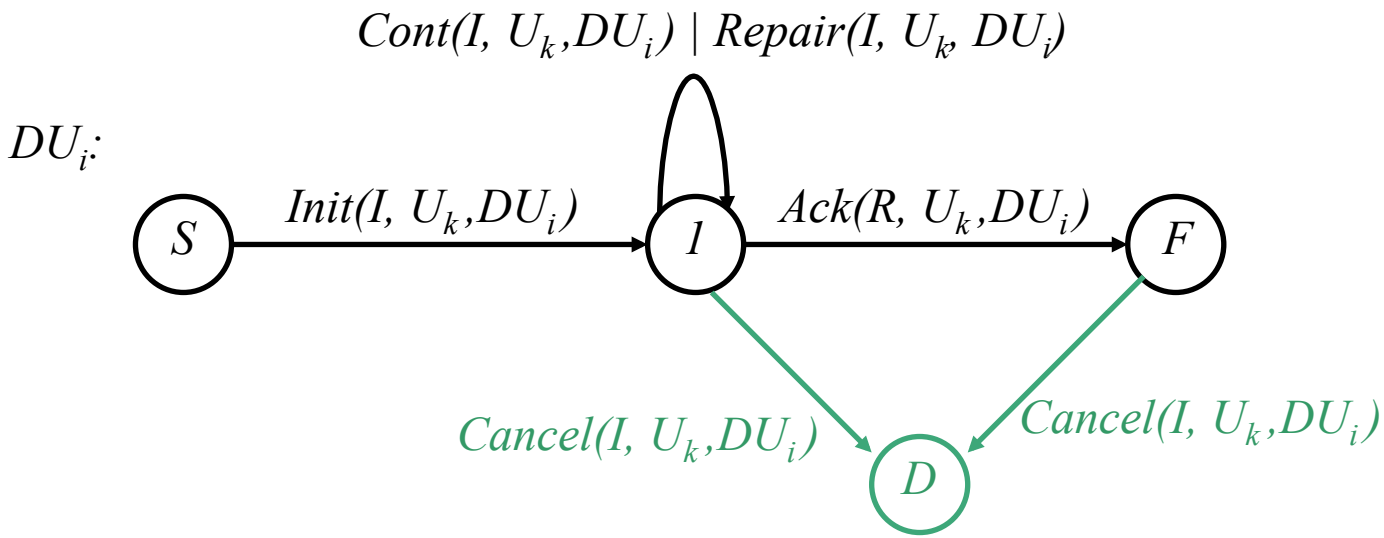


(2) 1:A: Move the boxcar to Bath
2:A: I mean, Corning
3:B: OK

Init(A,1,DU1)
Repair(A,2,DU1)
Ack(B,3,DU1)

Adding Cancelation

- *Abandoning of DU_i by I:*

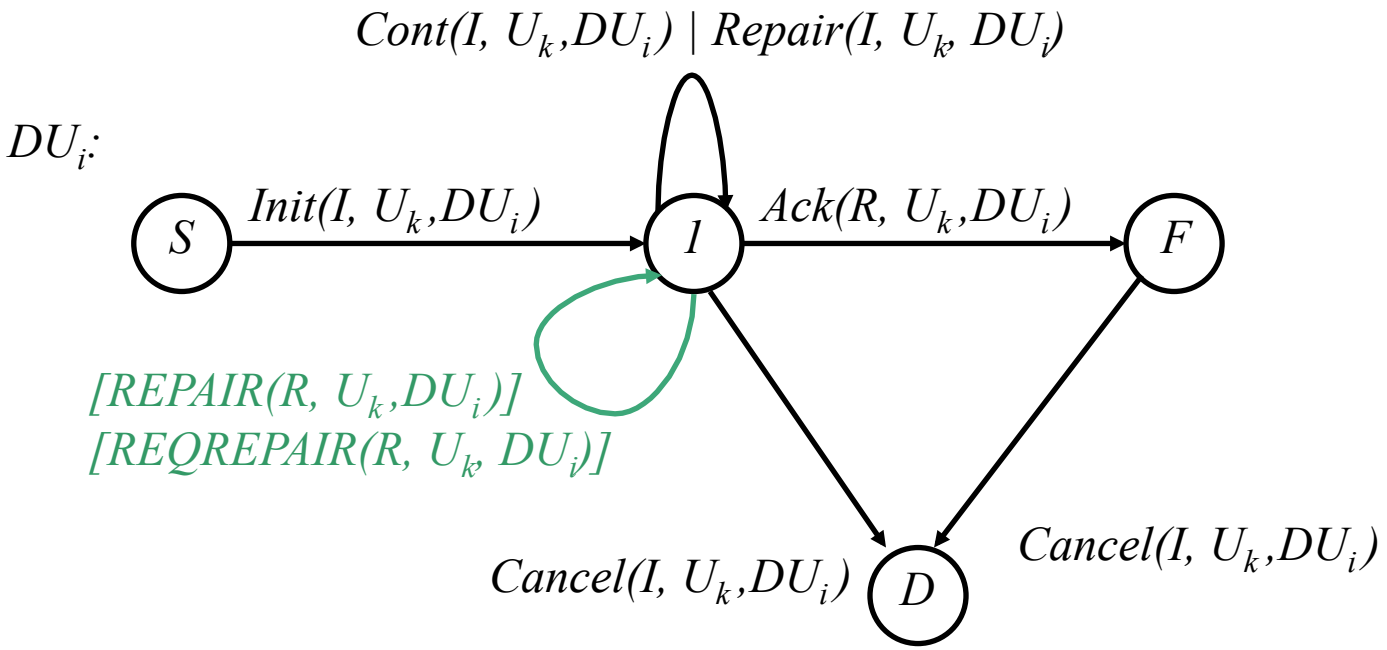


(3) 1:A: Move the boxcar to Bath
2:A: and load it with oranges
3:B: OK
4:A: Eh, no, forget that.

Init(A,1,DU1)
Cont(A,2,DU1)
Ack (B,3,DU1)
Canc(A,4,DU1)

Adding Other-Repair

- *Other-repair and repair-request (of DU_i by R):*



Other-Repair Example

(4) 1:A: Move the boxcar to Bath
2:B: To Corning

3:A: Oh, sure.

Init(A,1,DU1)
Repair(B,2,DU1)
≈ Init(B,2,DU2)
Ack (A,3,DU2)

(5) 1:A: Move the boxcar to Bath
2:B: Bath?

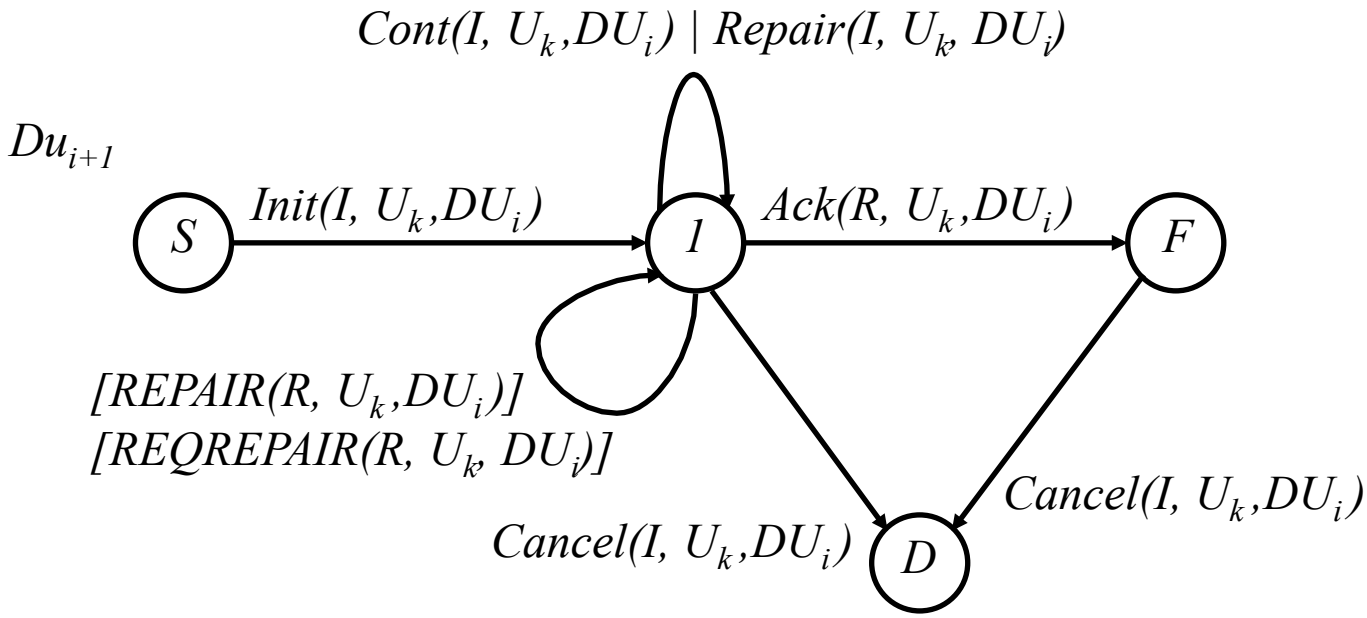
3:A: Oh, Corning.

4:B: OK

Init(A,1,DU1)
ReqRepr(B,2,DU1)
≈ Init(B,2,DU2)
Ack(A,3,DU2)
Repair(A,3,DU1)
Ack (R,4,DU1)

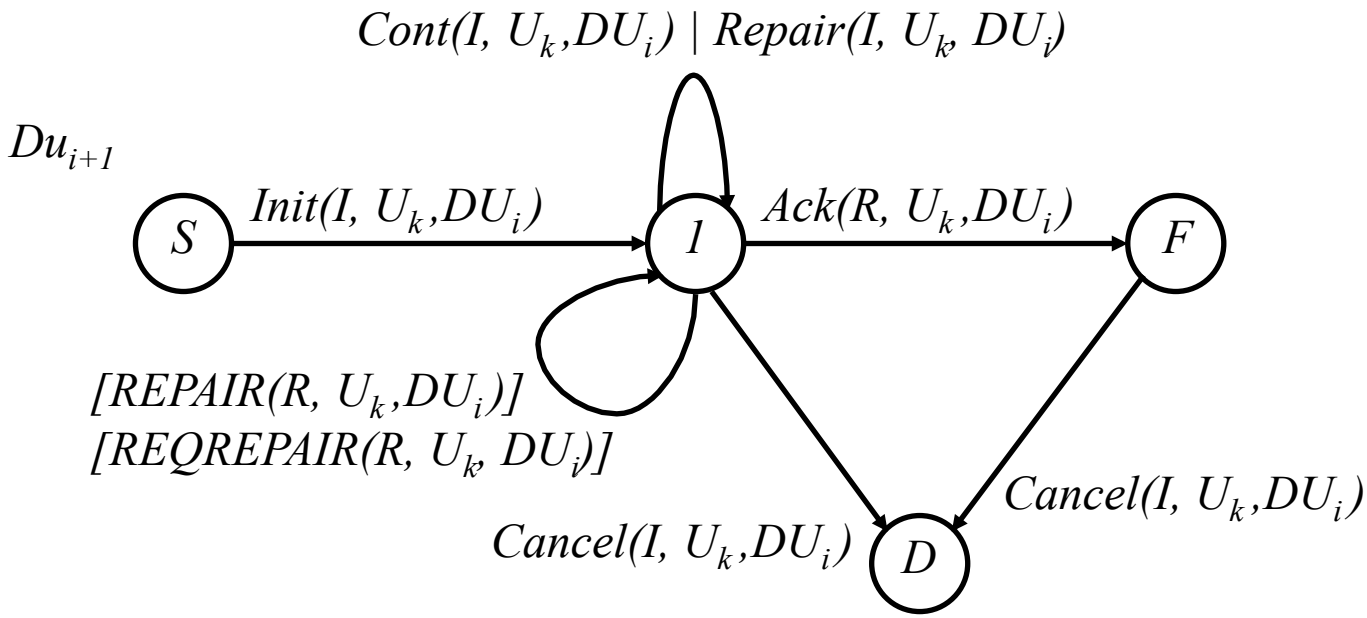
Recursive Embedding

- *Other-repair is itself an embedded DU_{i+1}*
  - *$Repair(R,U_k,DU_i) \approx Init(I,U_k,DU_{i+1})$*
  - *$ReqRepair(R,U_k,DU_i) \approx Init(I,U_k,DU_{i+1})$*



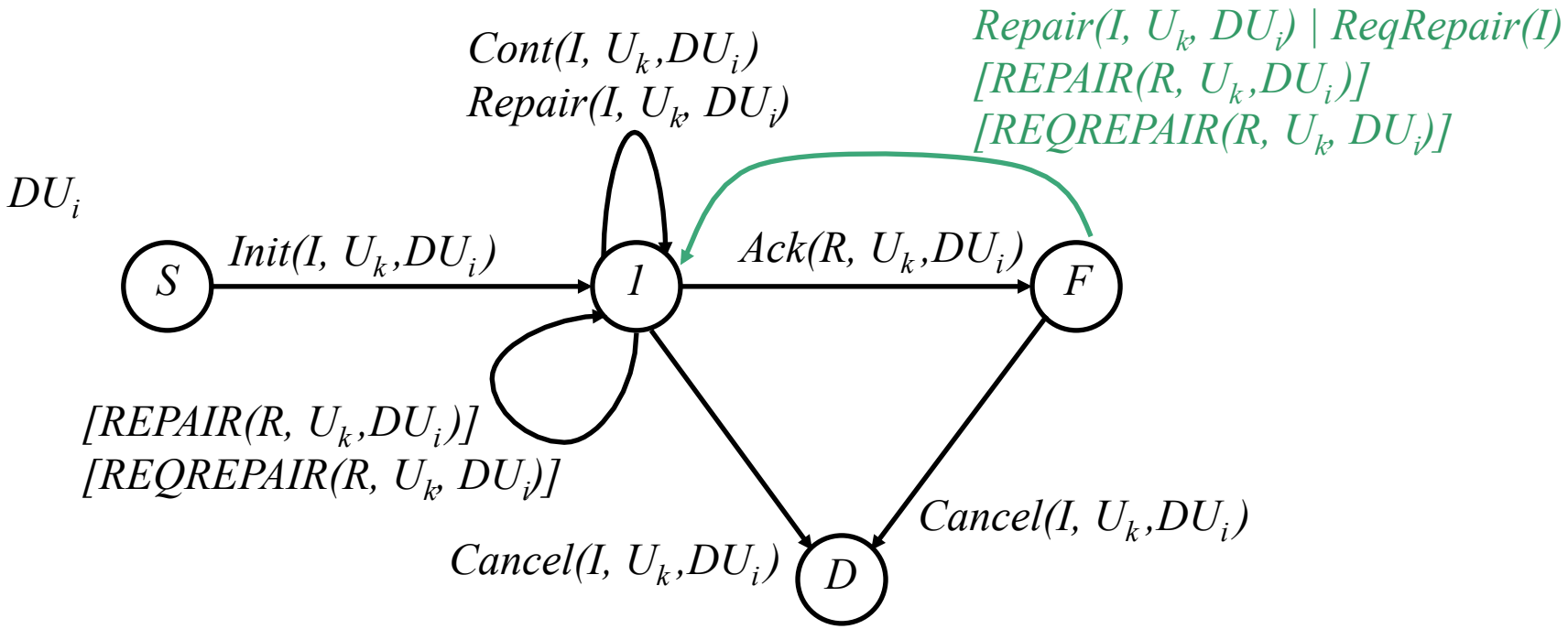
Recursive Embedding

- *Other-repair is itself an embedded DU_{i+1}*
  - *Repair(R,U_k,DU_i) ≈ Init(I,U_k,DU_{i+1})*
  - *ReqRepair(R,U_k,DU_i) ≈ Init(I,U_k,DU_{i+1})*



More Repair (Requests)

- *Other-repair and repair-request (of DU_i by I/R):*



Other-Repair (Request) Example

(6) 1:A: Move the boxcar to Corning
2:A: and load it with pineapples
3:B: OK
4:A: I mean, oranges.
5:A: OK.

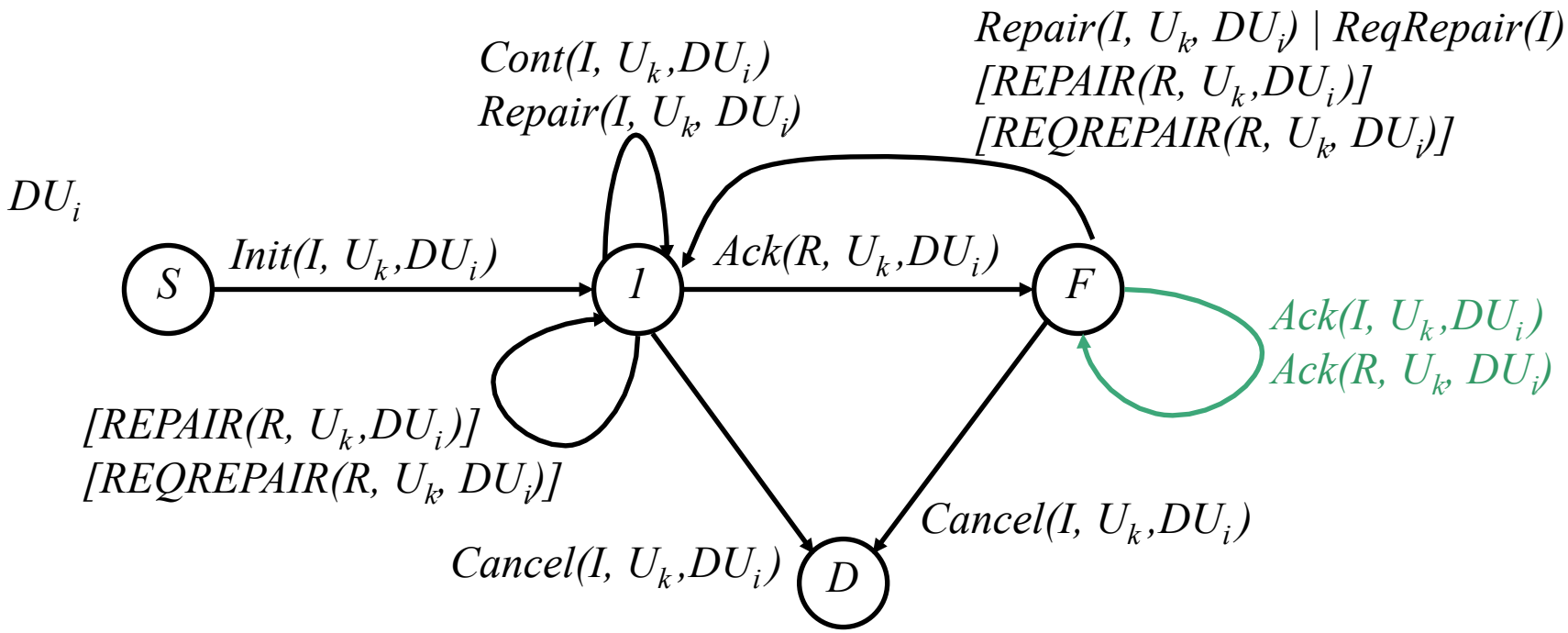
Init(A,1,DU1)
Cont(A,2,DU1)
Ack (B,3,DU1)
Repair(A,4,DU1)
Ack(B,5,DU1)

(7) 1:A: Move the boxcar to Corning
2:A: and load it with pineapples
3:B: OK.
4:B: Pineapples?
5:A: I mean, oranges.
6:B: OK.

Init(A,1,DU1)
Cont(A,2,DU1)
Ack (B,3,DU1)
ReqRepr(B,4,DU1)
Repair(A,5,DU1)
Ack(B,6,DU1)

More Acknowledgements

- *Acknowledgements of completed DU_i by I or R*

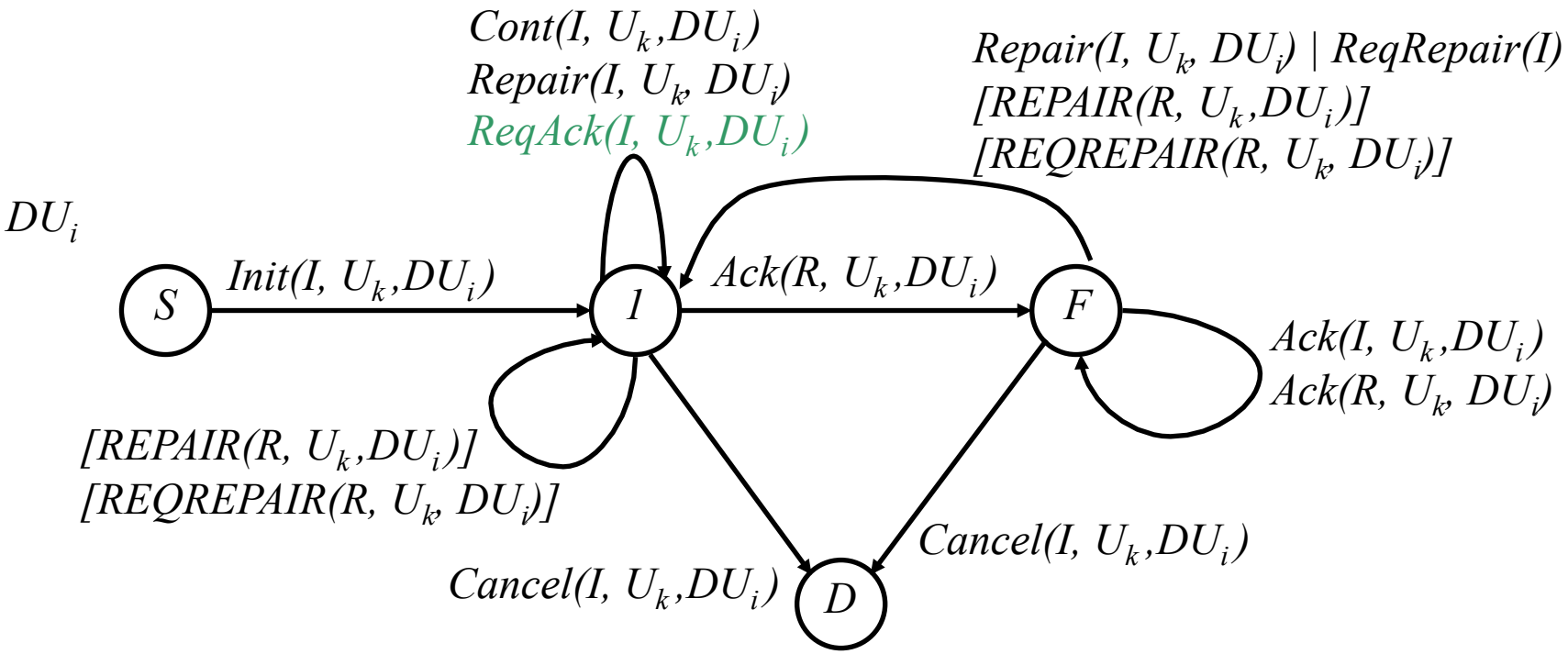


Acknowledgements Example

(8) 1:A: Move the boxcar to Corning	Init(A,1,DU1)
2:A: and load it with oranges	Cont(A,2,DU1)
3:B: OK	Ack(B,3,DU1)
4:B: To Corning, load with oranges.	Ack(B,4,DU1)
4:A: OK	Ack(A,5,DU1)

Acknowledgement Requests

- *Acknowledgement request by I*



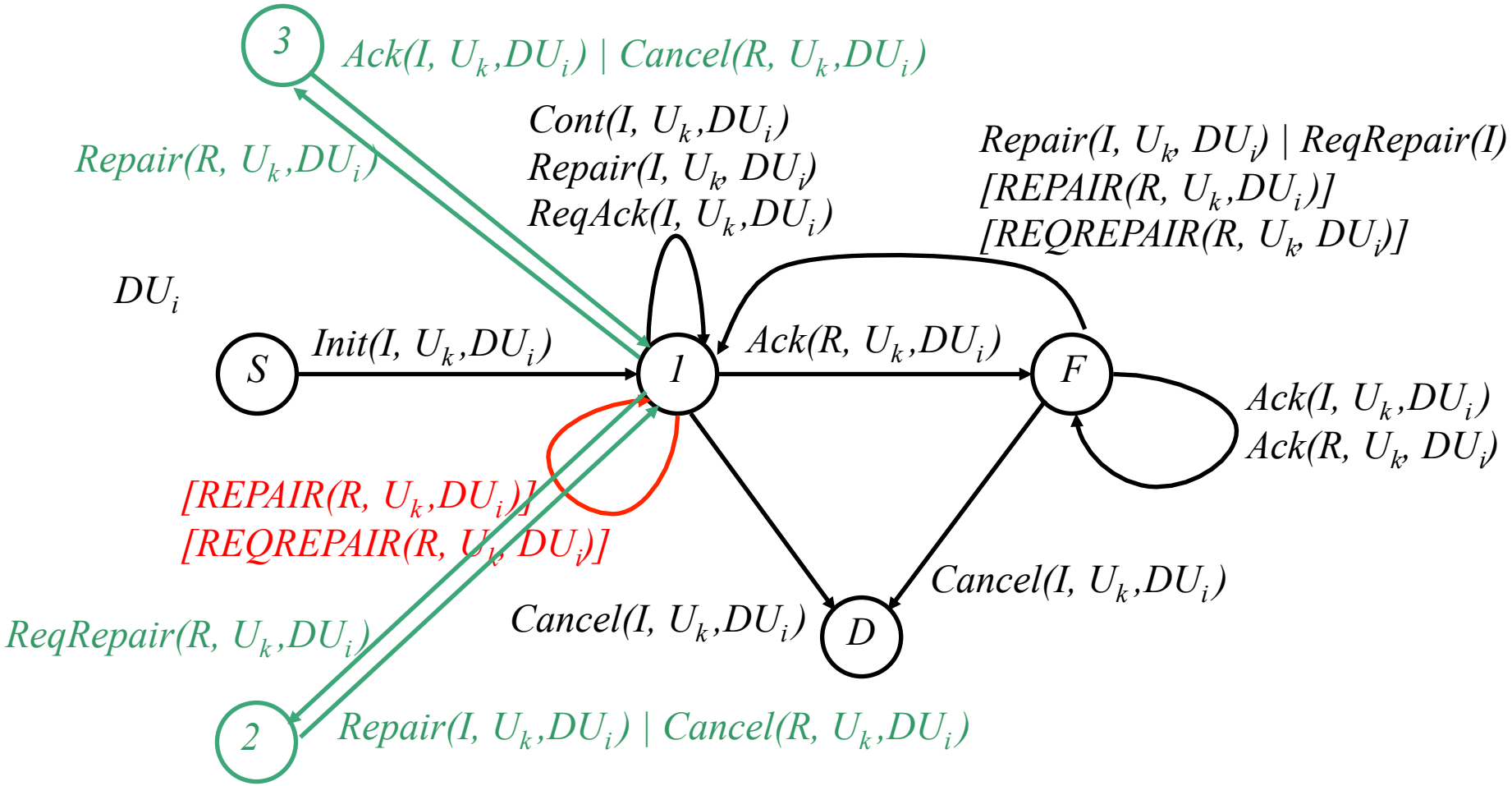
Acknowledgement Request Example

(8) 1:A: Move the boxcar to Corning	Init(A,1,DU1)
2:A: and load it with oranges	Cont(A,2,DU1)
3:A: OK?	Ack(B,3,DU1)
4:B: Corning, oranges.	Ack(B,4,DU1)
5:A: Yes	Ack(A,5,DU1)
6:B: OK.	Ack(B,6,DU1)

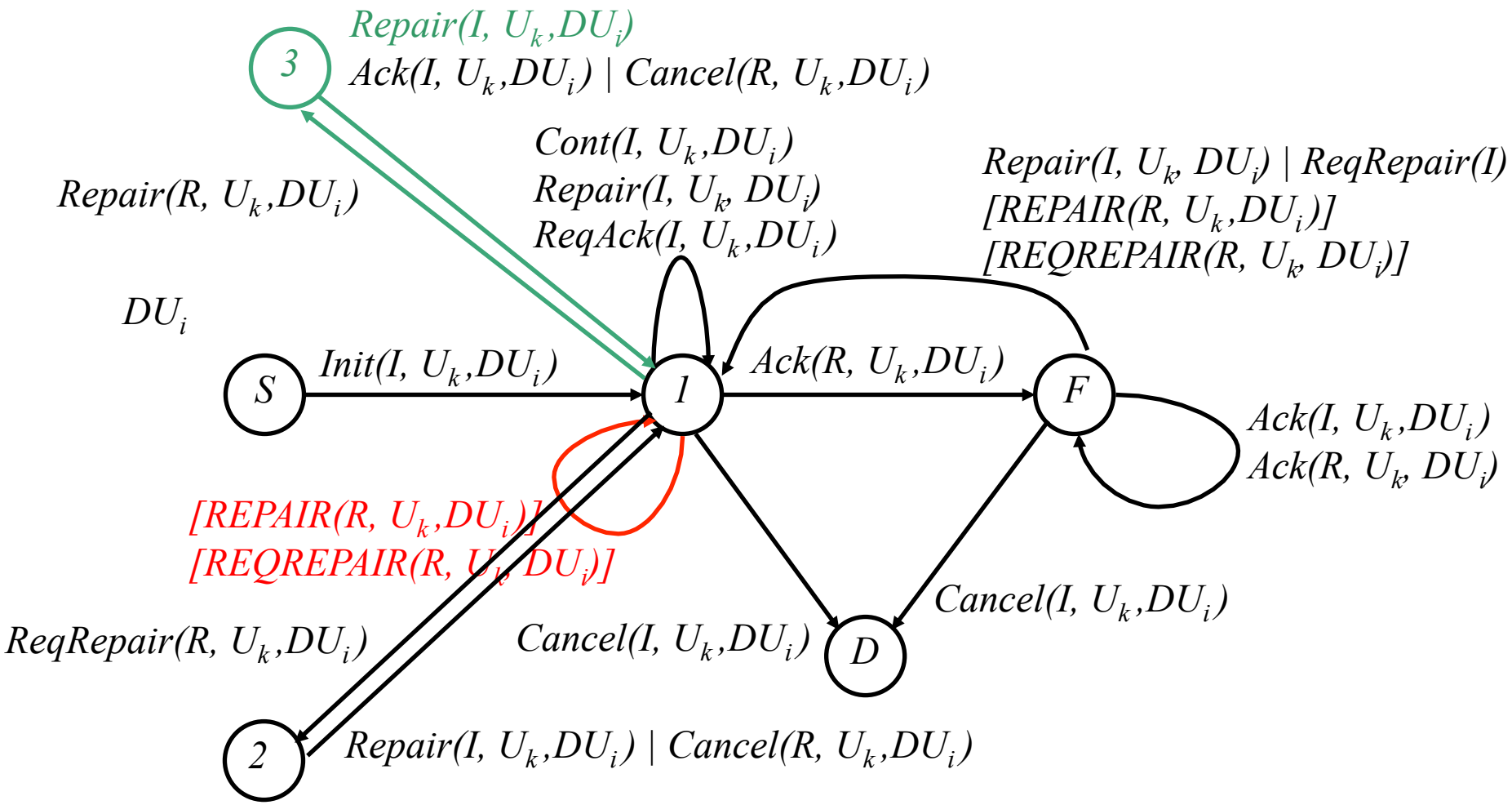
Is Recursion Necessary?

- Recursion adds computational complexity and is expensive
- Unlimited recursion depth is psychologically unlikely
- Pushdown storage → finite model

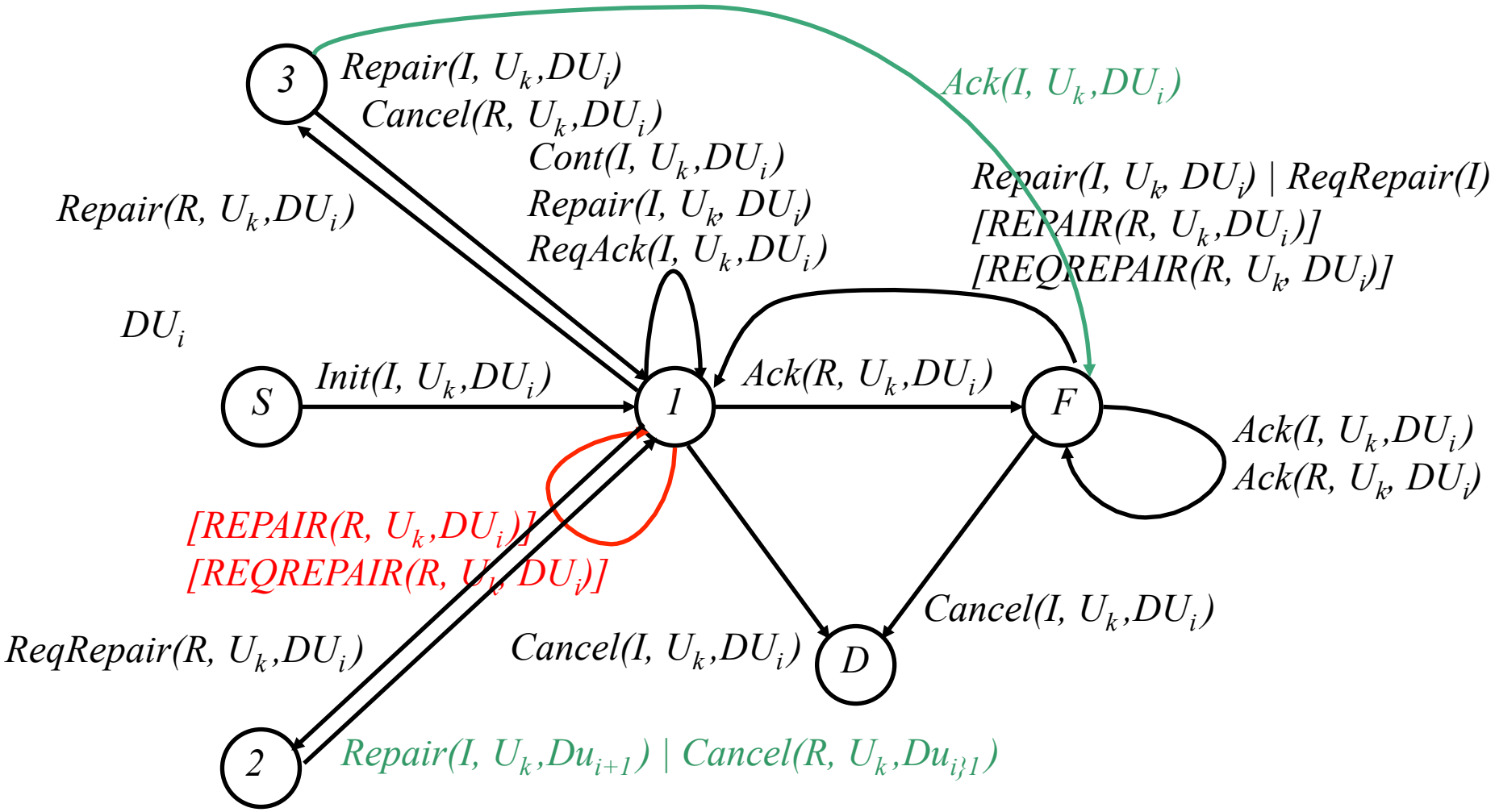
Finite Model (1)



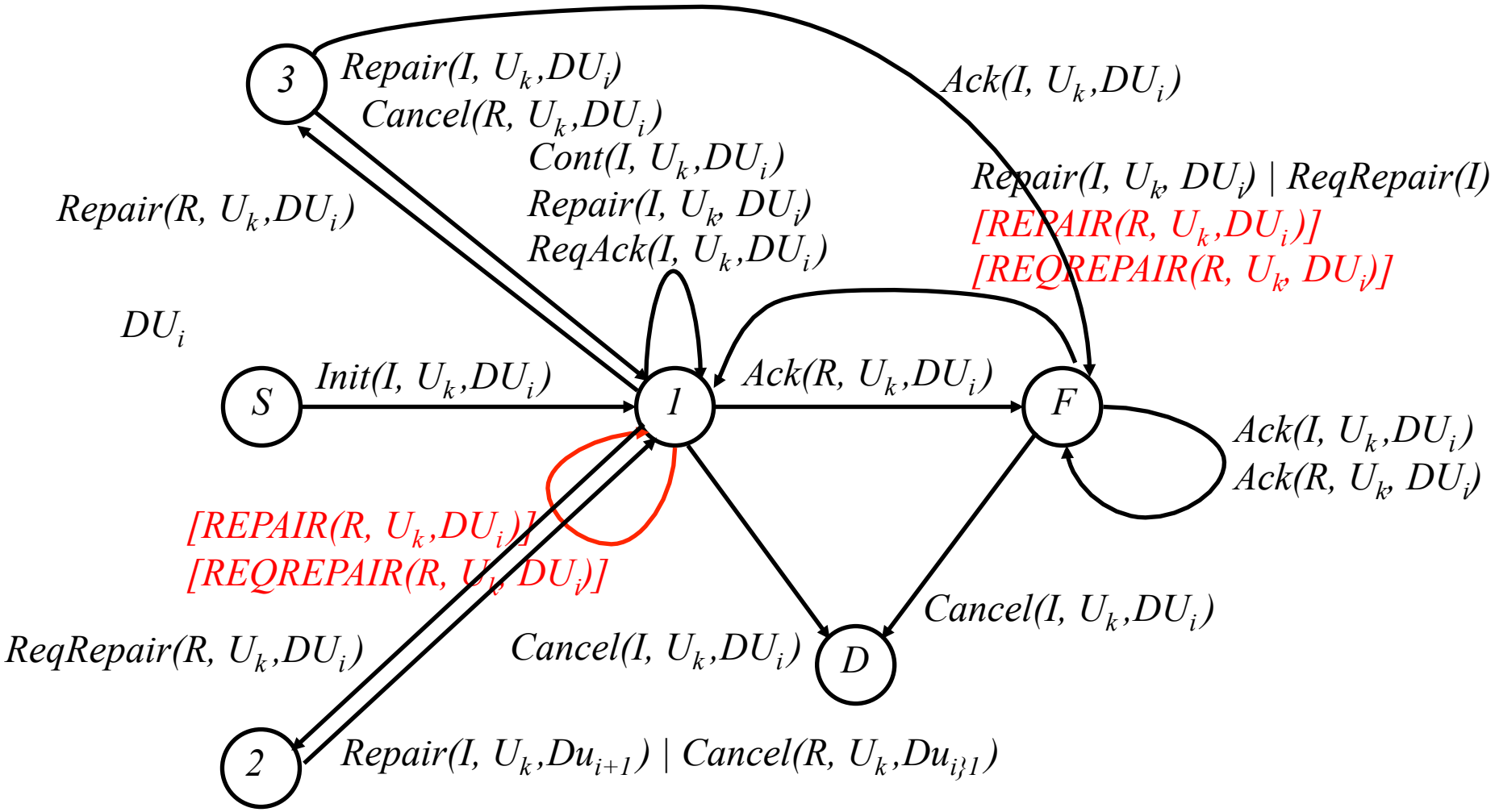
Finite Model (2)



Finite Model (3)



Finite Model (4)



Issues / Deficiencies

- Degrees of groundedness just binary
  - But there is evidence of graded groundedness
- Utterance unit size (cf. Ex.1)
  - Problem for coding, but any practical solution goes
- Discourse unit size (cf. Ex.1, 7, …)
- Grounding act ambiguity/unspecificity
  - Entertain multiple possibilities, eliminate later ?
  - Best-first strategy with revision/backtracking ?
- Extension to multimodal or embodied interaction?

DAMSL: Forward vs. Backward-Looking Functions

DAMSL

- DAMSL: hierarchical general DA classification scheme for task-oriented dialogue
  - **Forward looking function** (like speech act)
  - **Backward-looking function**: relationship to previous utterance(s) by other speaker (including grounding)
  - Information level
    - Task: doing the task
    - Task management: talking about the task
    - Communication management: managing communication
    - Other
  - Communicative status: intelligibility, interpretability, self-talk...

DAMSL: Forward Looking Functions

- Statement — a claim
- Information request — a question
  - Check — a question confirming info
- Influence-on-addressee (= Searle's directives)
  - Open-option — a weak suggestion or list of options
  - Action-directive — command or instruction
- Influence-on-speaker — (= Searle's commissives)
  - Offer — offer to do something (subject to confirmation)
  - Commit — commitment to do something
- Conventional
  - Opening — greetings
  - Closing — farewell
  - Thanking — thanking and responding to thanks

Backward Looking Functions

- Agreement (speaker's attitude toward an action, plan, object, etc.)
  - Accept
  - Accept part
  - Maybe
  - Reject
  - Reject part
  - Hold
- Answer (answer to question)
- Understanding (whether speaker understood previous turn)
  - Signal-non-understanding
  - Signal-understanding
    - Acknowledgement (demonstrated by a continuer or assessment)
    - Repeat-paraphrase (demonstrated by a repetition or rephrase)
    - Completion (demonstrated by collaborative completion)

ISO DIS 24617-2

http://semantic-annotation.uvt.nl/ChiangMai-tutorial-T4.ppt

Conversation Structure

Conversation Structure

- Local: relations between pairs or sequences of turns
- Global: the overall structure of an entire conversation

Local Structure

- Adjacency pairs (Schegloff 1968):
  - Adjacent turns
  - Produced by different speakers
  - Ordered: First^Second
  - Typed: particular First requires a particular Second
    - Greet-greet, ask-answer, request-grant, offer-accept, compliment-downplay, etc. ⇒ preferences, expectations
- Insertion sequences: APs can be embedded
  - E.g., “sub-dialogue”, misapprehension-correction, clarification

Local Structure: Insertions

- "Sub-dialogue":
  A: Where are you going?
  B: Why do you want to know?
  A: I thought I'd come with you.
  B: I'm going to the supermarket.
- Clarification:
  A: I'd like three sausages.
  B: Which ones? Merquez or Lyoner?
  A: Merquez.
  B: Here you go.
- Miscomprehension-Correction:
  A: When is the next train from SB to Hamburg?
  B: The next train to Homburg is at 1 p.m.
  A: Hamburg, not Homburg.
  B: Ah, Hamburg?
  A: Yes.
  B: The next connection to Hamburg Hauptbahnhof is at 3 p.m.

Dialogue Games/Sequences

- Some sequences of dialogue acts occur regularly, are even conventionalized; cf. adjacency pairs
  - Greeting-greeting
  - Question-answer
  - Compliment-downplayer
  - Accusation-denial
  - Offer-acceptance
  - Request-grant
  - …
- Obligation to respond
- Preferred responses

Local Structure: Preferences

- Significant silence (option 1 at a TRP)
  - If A selects B to speak next, but B doesn't
    - Then (assuming B has heard & understood)
      B's silence can be interpreted as a hesitation to give a dispreferred Second,
      e.g., B does not know the answer to A's question, B's response to A's offer or request is negative, etc.
- Other cases (silence at options 2 or 3 at a TRP) are just insignificant delays (pauses or lapses)

Local Structure: Insertions

- "Sub-dialogue":
  A: Where are you going?
  B: Why do you want to know?
  A: I thought I'd come with you.
  B: I'm going to the supermarket.
- Clarification:
  A: I'd like three sausages.
  B: Which ones? Merquez or Lyoner?
  A: Merquez.
  B: Here you go.
- Misapprehension-Correction:
  A: I'd like three sausages.
  B: Three pairs.
  A: No, three single pieces.
  B: OK.

A: When is the next train from SB to Hamburg?
B: The next train to Homburg Hauptbahnhof is at 1 p.m.
A: Hamburg, not Homburg.
B: Ah, Hamburg?
A: Yes.
B: OK, the next connection to Hamburg is at 3 p.m.

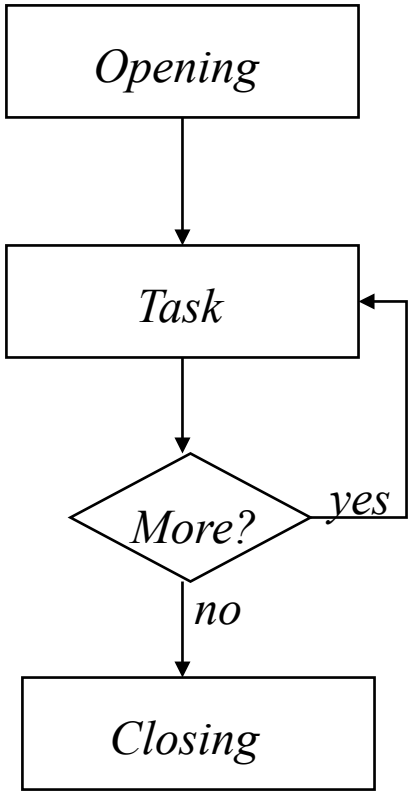
Dialogue Structure and Coherence

- Grosz and Sidner (1985)
  - Linguistic structure: discourse segments signaled by cues, e.g., discourse markers, prosody, etc.
  - Intentional structure: discourse segment purposes and relations between them (dominance, satisfaction-precedence); subdialogues vs. true interruptions
  - Attentional structure: entities in focus spaces corresponding to discourse segments; antecedents for anaphoric links; stack-model of focusing

Global Structure

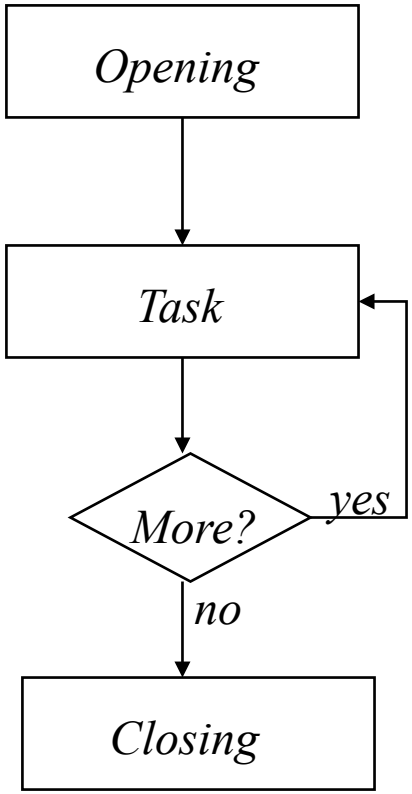
- Generic structure of a conversation:
  - Opening: “initialization” (establish contact, greetings, pleasantries)
  - Body: exchange about the subject matter(s) (accomplishing task(s), discussing topic(s)), sometimes a task is ended by a summary
  - Closing: winding down, farewell, breaking contact
- Conventions apply in all sections

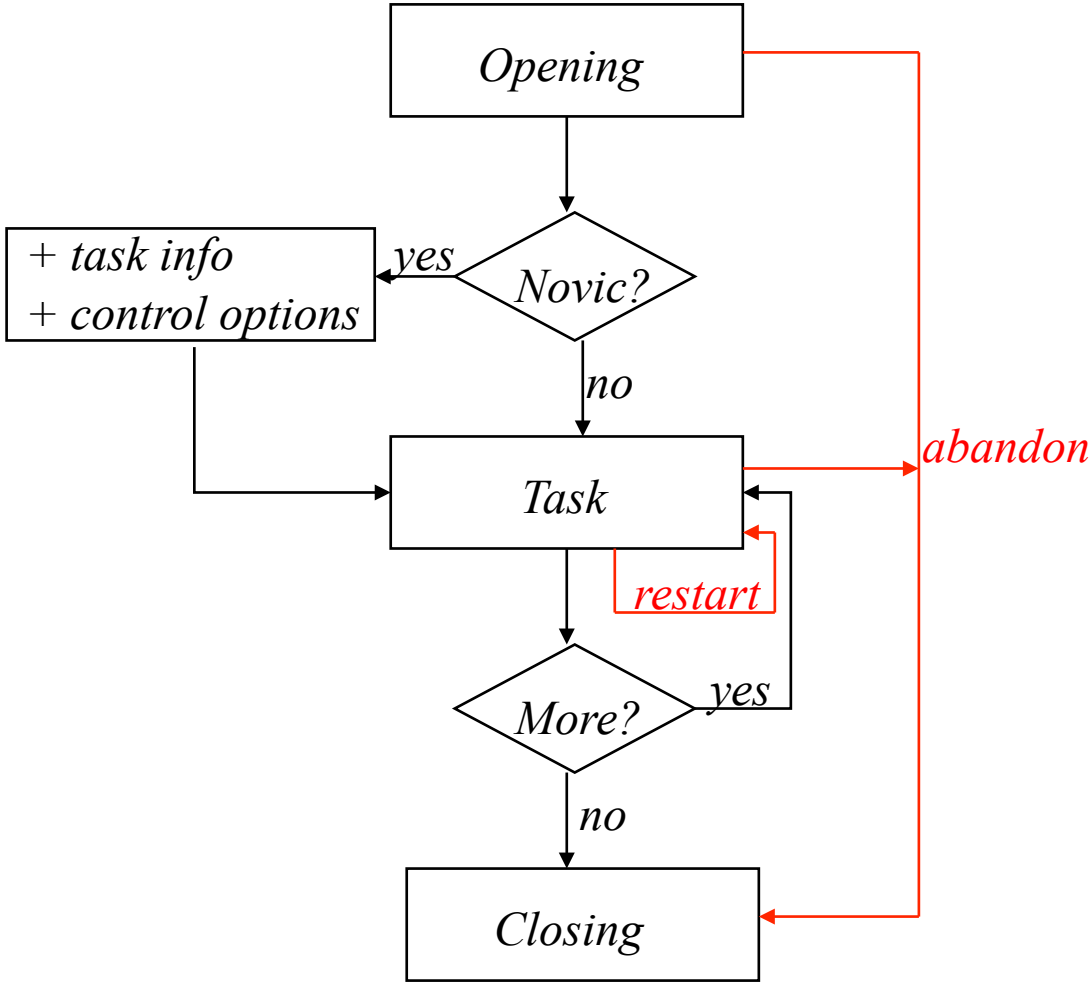
Global Structure



+ *task info*
+ *control options*

Global Structure





Conclusions

- Characteristics of human-human dialogue that also (should) hold for human-computer dialogue:
  - Turn-taking
  - Initiative and Collaboration
  - Global and local structure
  - Dialogue economy
  - Dialogue acts and indirectness
  - Grounding
- they present challenges for modeling and automatic processing

Reading

- D. Jurafsky and J. H. Martin. Speech and Language Processing. Chapter 19. Prentice Hall. 2000.
- H. Clark. Using Language. Chapters 4 and 8. Cambridge University Press. 1996.
- DAMSL annotation manual

  http://www.cs.rochester.edu/research/cisd/resources/damsl/RevisedManual/
- ISO Standard 24617-2:

  http://semantic-annotation.uvt.nl/

  http://semantic-annotation.uvt.nl/DIS24617-2.pdf

  http://semantic-annotation.uvt.nl/ChiangMai-tutorial-T4.ppt