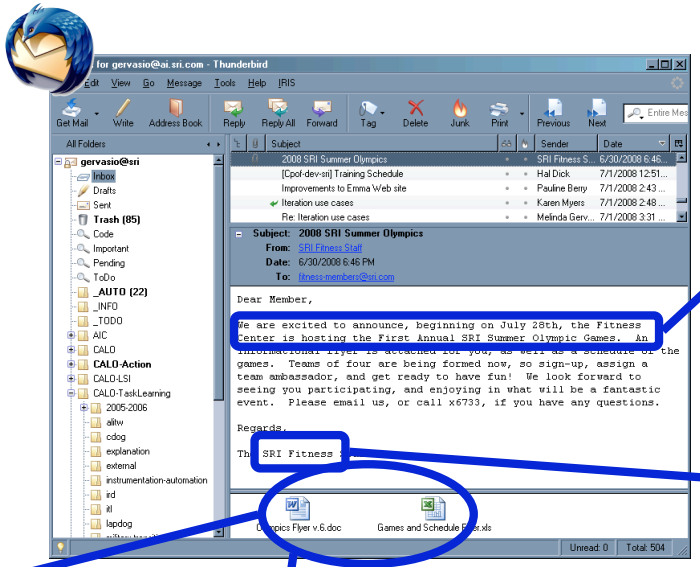
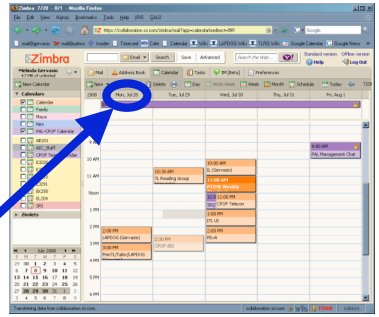
Learning Email Procedures for the Desktop

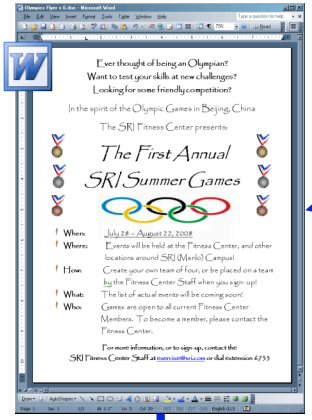
Melinda Gervasio, Thomas J. Lee, Steven Eker

Main Problem



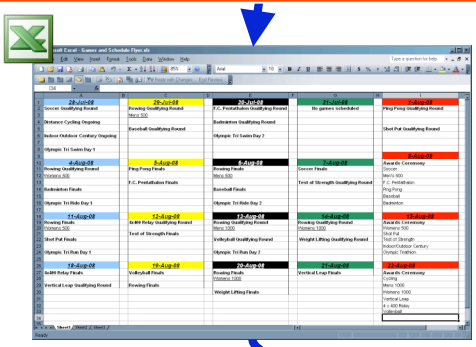
add to calendar

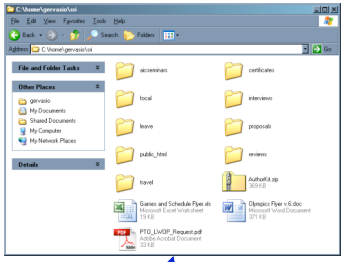




Email is not just about email (anymore)

visit website

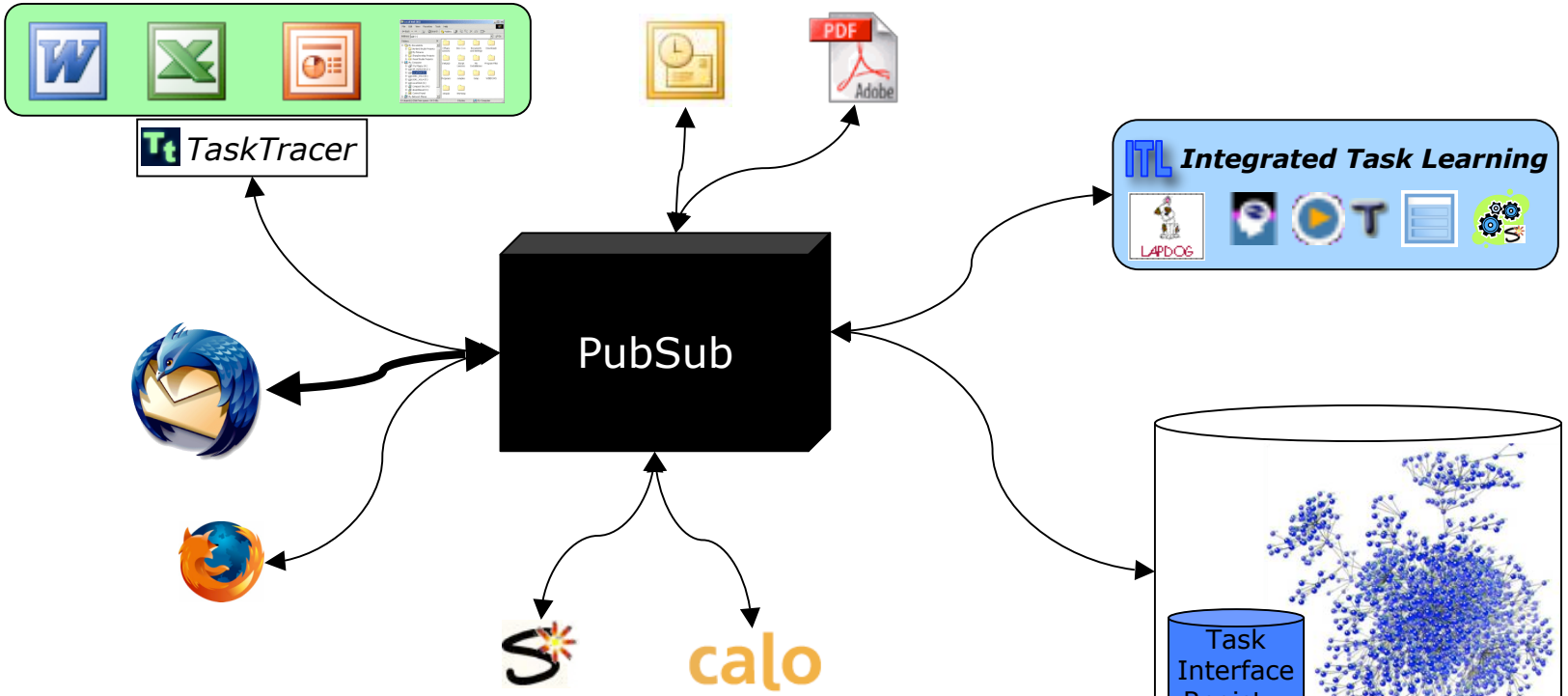




open Word and Excel documents

save documents to disk

Primary Challenge & Main Result: Learning Procedures Across Disparate Applications



All instrumentation events and automation requests go through PubSub

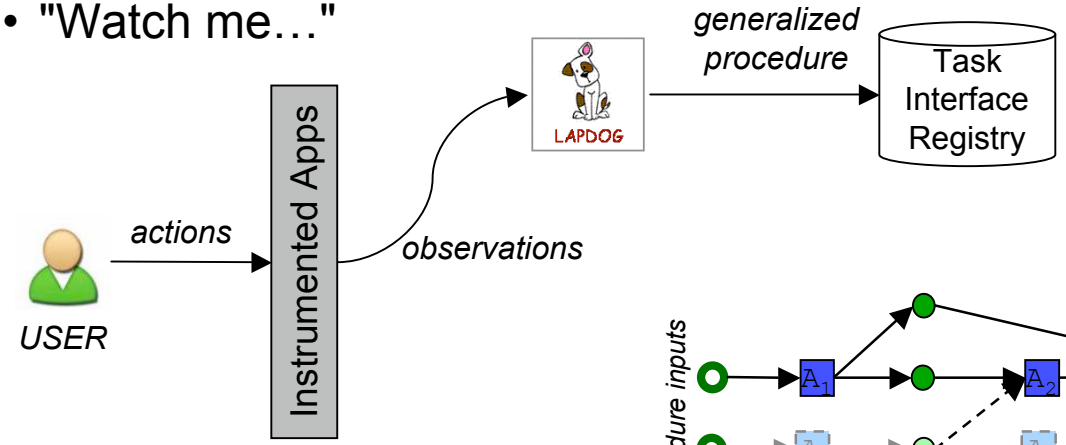
CALO KB

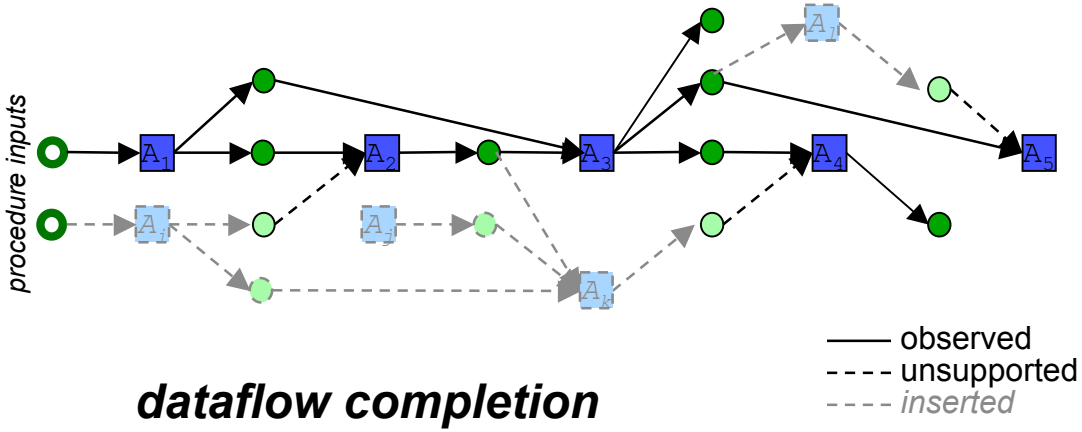
Shared ontology, centralized knowledge base

Tools & Techniques: LAPDOG in a Nutshell

learning from demonstration

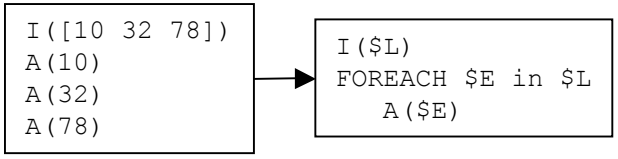
- "Watch me…"





dataflow completion

- ensure all action inputs are supported
- insert information-producing actions (information extractors, data manipulators, KB queries) to provide missing dataflow



generalization

- parameter generalization
- structural generalization

Tools & Techniques: Dataflow Completion

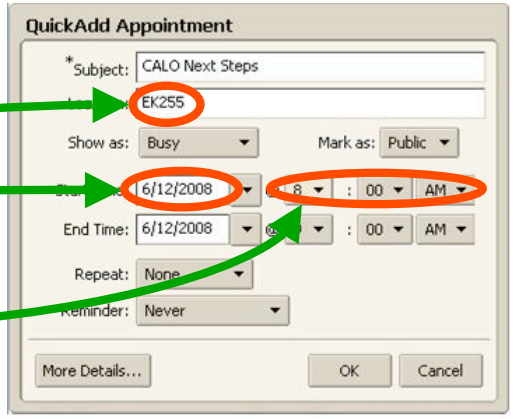
Observation: User reads email

Subject: Meeting
From: bill.mark@sri.com
Date: 6/11/2008 5:22 PM
To: knoblock@isi.edu, tgd@orst.edu, bui@ai.sri.com
Cc: melissa.oconnor@sri.com

Let's get together tomorrow at 8:00am in EK255 to discuss next steps.

Bill

Observation: User schedules a meeting




```
readEmail(
  +to={knoblock@isi.edu,
tgd@orst.edu, bui@ai.sri.com}
  +cc={melissa.oconnor@sri.com}
  +subject="Meeting"
  +body="Let's get together
tomorrow at 8:00am in EK255 to
discuss next steps.\n\nBill"
  -emailid=id://1092.23)
```

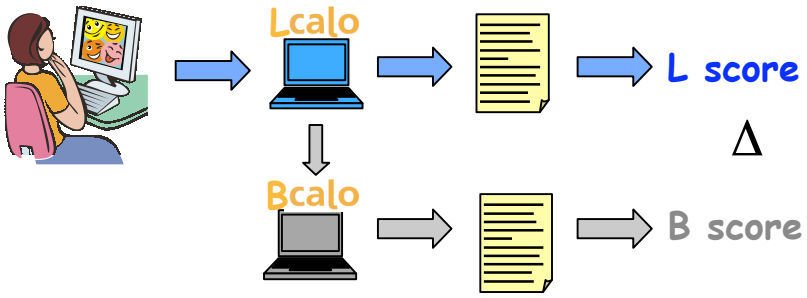
```
extractMeetingInfo(
  +emailid=id://1092.23
  -date=20080612
  -time=T080000
  -location=EK255
)
```

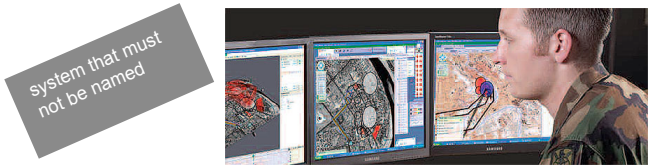
```
addMeeting(
  +summary="CALO Next Steps"
  +date=20080612
  +time=T080000
  +location=EK255
  -meetingid=id://2017.34
)
```

- ***Algorithm***: dynamic programming in space of information-producing actions
- ***Completors***: information extractors, KB queries (relational paths), string manipulators, template instantiators, …

Evaluation: Ongoing Deployments

learning procedures for the electronic desktop





learning procedures for briefing content creation and collection, operations planning

learning query and display plans to support intelligence analysis

- Proof of Concept
  - examples of desktop procedures (*see paper*)
- CALO Annual Test
  - SAT-style test to measure performance delta due to learning
  - LAPDOG successfully used to teach procedures to answer two questions
- Ongoing User Study
  - gather use cases for ITL

- Military Transition
  - exercised in several Double Helix events
  - Grand Challenge in December 2008 (BCBL, Fort Leavenworth)
    - pitting team with PAL-enhanced systems against team with regular systems

Implications of Work

Fitting in with other email work

- *Email is not just about email (anymore)*.
- expanding the reach of learners for *atomic* tasks (e.g., classification, extraction, ranking)

Related Work

- unstructured activities (*Stumpf et al., AAAI05*)
- workflows (*Kushmerick et al., IUI05, AAAI06*)

Implications

- broad-based instrumentation & automation standards needed
- semantic data types—shared ontology

Current & Future Work

- uncertain dataflow supports
  - integrated task learning
  - interactive learning, procedures
- learning workflows
  - activity recognition, proactive assistance

Points for Discussion

Beyond handcrafted applications/combinations of learners

- clean separation between what is learned and how it is used
  - if just learning: make it easy for others to *use* the learning
  - if already using the learning: make it easy to *reuse* the learning
- sharing inputs/outputs between different learners
  - semantic data types, common ontologies
  - centralized knowledge base
- communicating with other (AI) components
  - shared data representation, ontology
  - instrumentation/automation