



Science & Technology

Human Systems



Computational Modeling of Cognitive Processes in Plan Authoring

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**TC3 Workshop: Cognitive Elements Of Effective Collaboration
(January 15-17 2002, San Diego)**

Report Documentation Page

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Context



Task: Plan authoring

- Intelligent system collaborates with human user
- Human is in charge; system makes recommendations

Key Assumption:

- Human has a better “big picture” understanding of the situation than does the intelligent system

Benefit:

- When the system makes a good recommendation, the user can accept rather than having to manually enter a new step in the plan.
- Faster plan authoring



Challenge



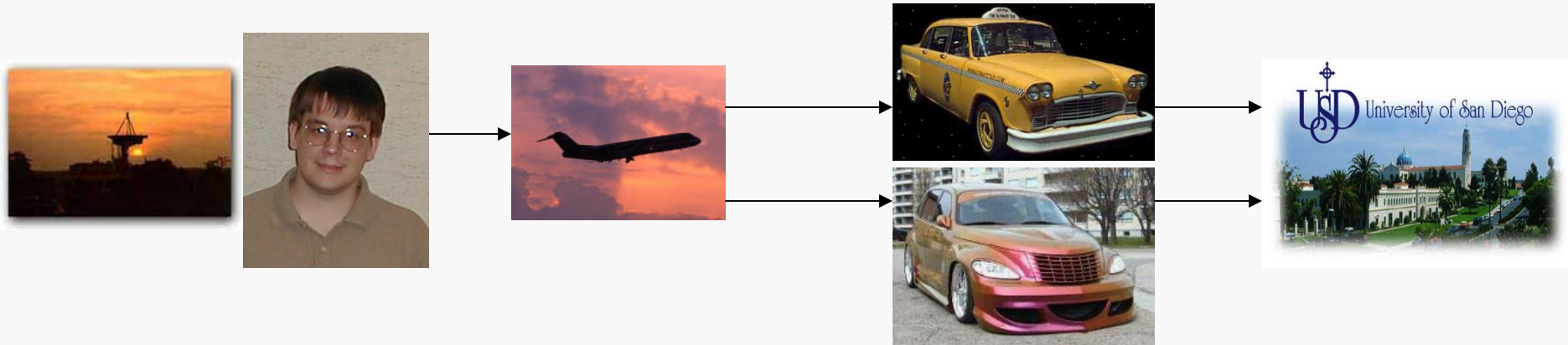
- An intelligent system can recommend actions for a plan based on its limited knowledge.
- We are considering situations in which the human has a better general understanding of the problem.
- The recommendation the system makes will, at first, be worse than what the human can do.
- How can we get the system to improve during the course of the planning process?



Our Main Theme

1. Determine:
 - a. Goals: **what** the user is trying to do
 - b. Approach: **how** the user is trying to do it
2. Generate suggestions that are compatible with both
 - i.e., Because the user is the expert, understand the user and then do things the user's way.

Goal: Travel from NRL to USD



System requirement: A cognitive model of the user



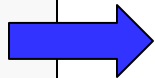
Cognitive Models

Task-Method-Knowledge (TMK):

- **Tasks:** What a part of a process does.
- **Methods:** How a part of a process works.
- **Knowledge:** What the process uses and alters.

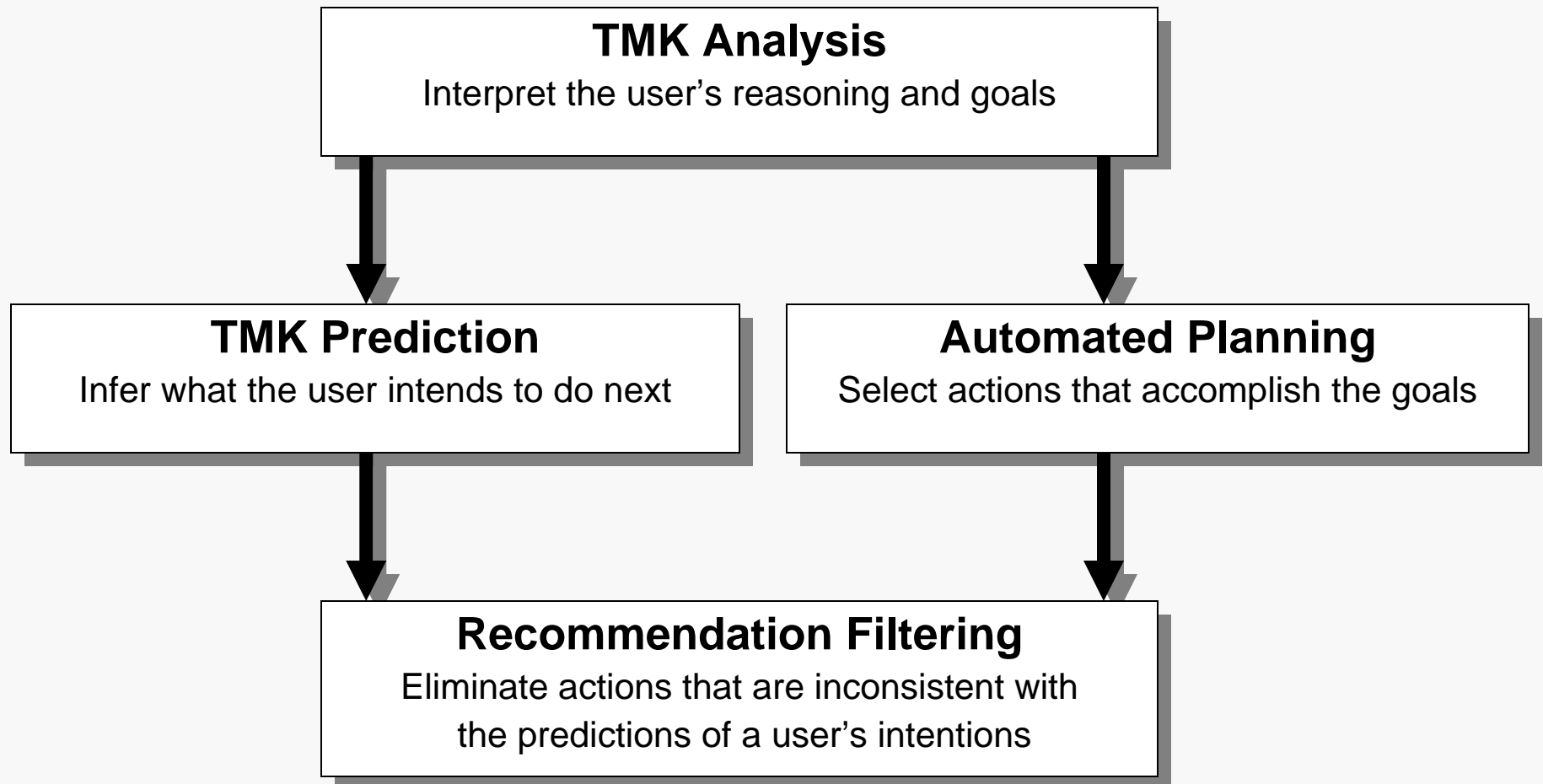
Existing work on TMK has involved:

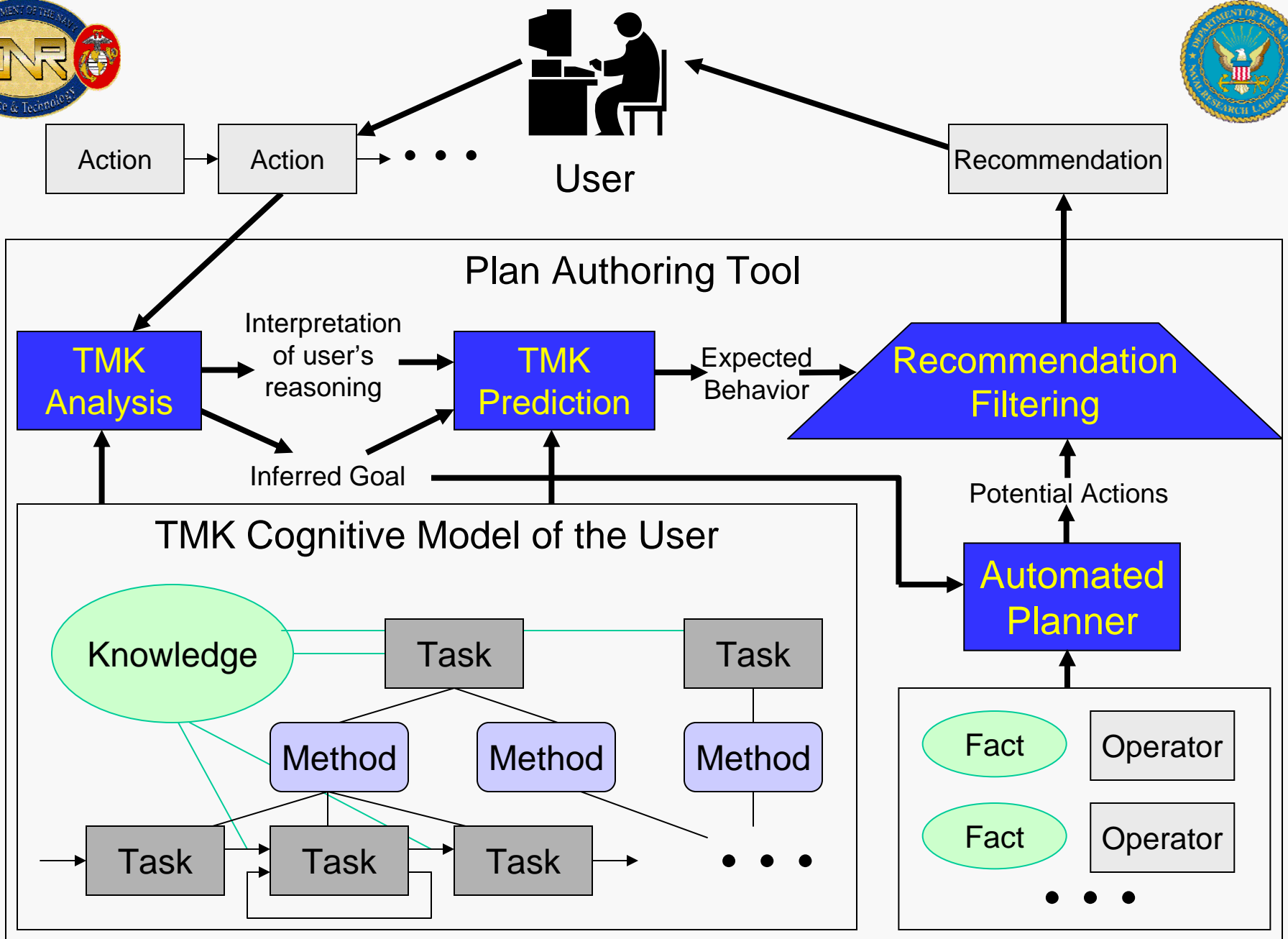
- Intelligent systems that automatically adapt
- Executable cognitive models of recorded protocols
- Many other topics
- ***But never cognitive models of users***





Overview of Decision Making Architecture







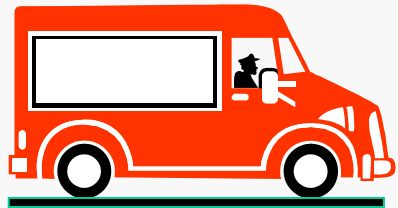
An Illustrative Logistics Example



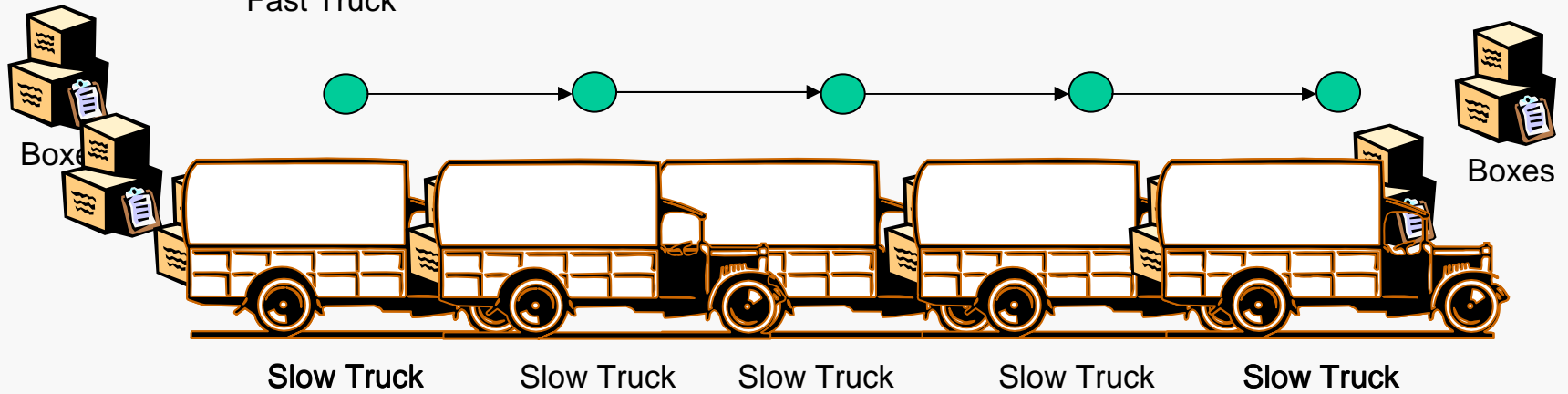
- User has some boxes to ship and two available trucks.
- One truck is faster, so a planner will recommend it.
- The user wants to use the slower truck.
- Challenge: Recognize that the user has chosen the slower truck and make recommendations that abide by that choice.



What the user wants

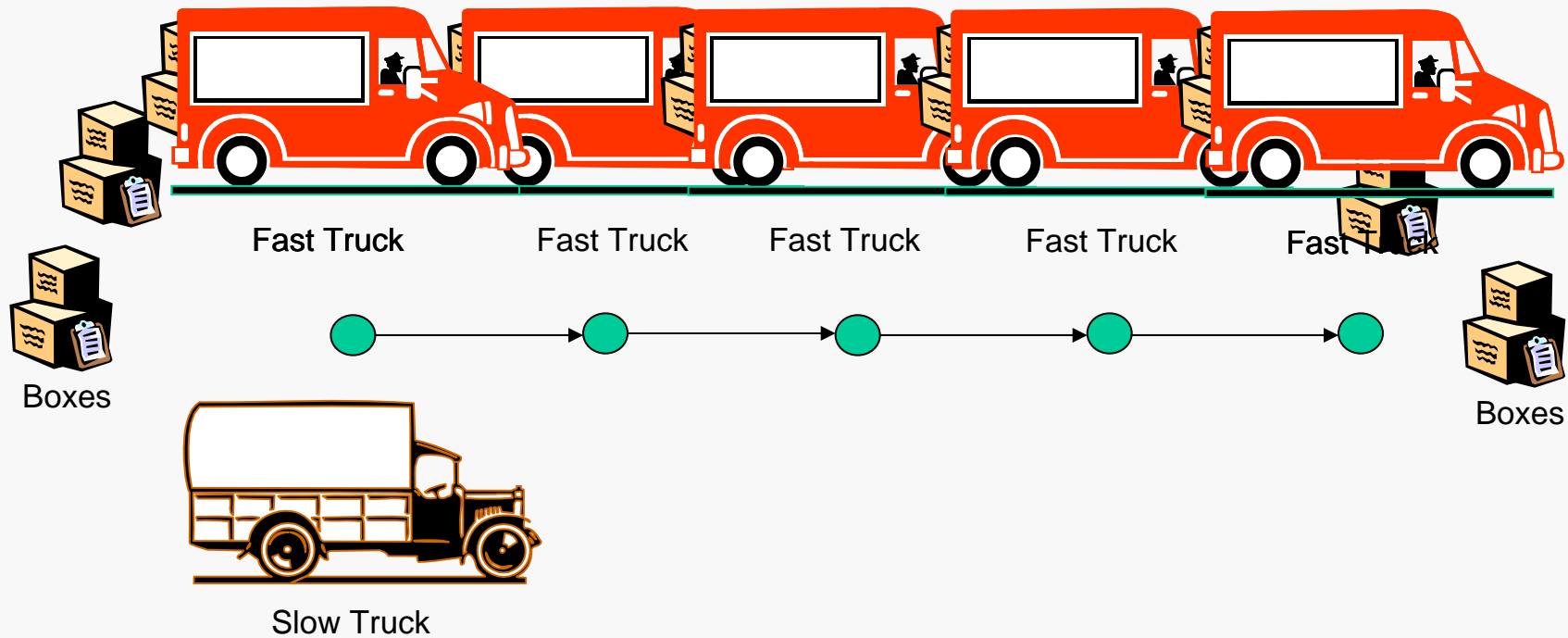


Fast Truck



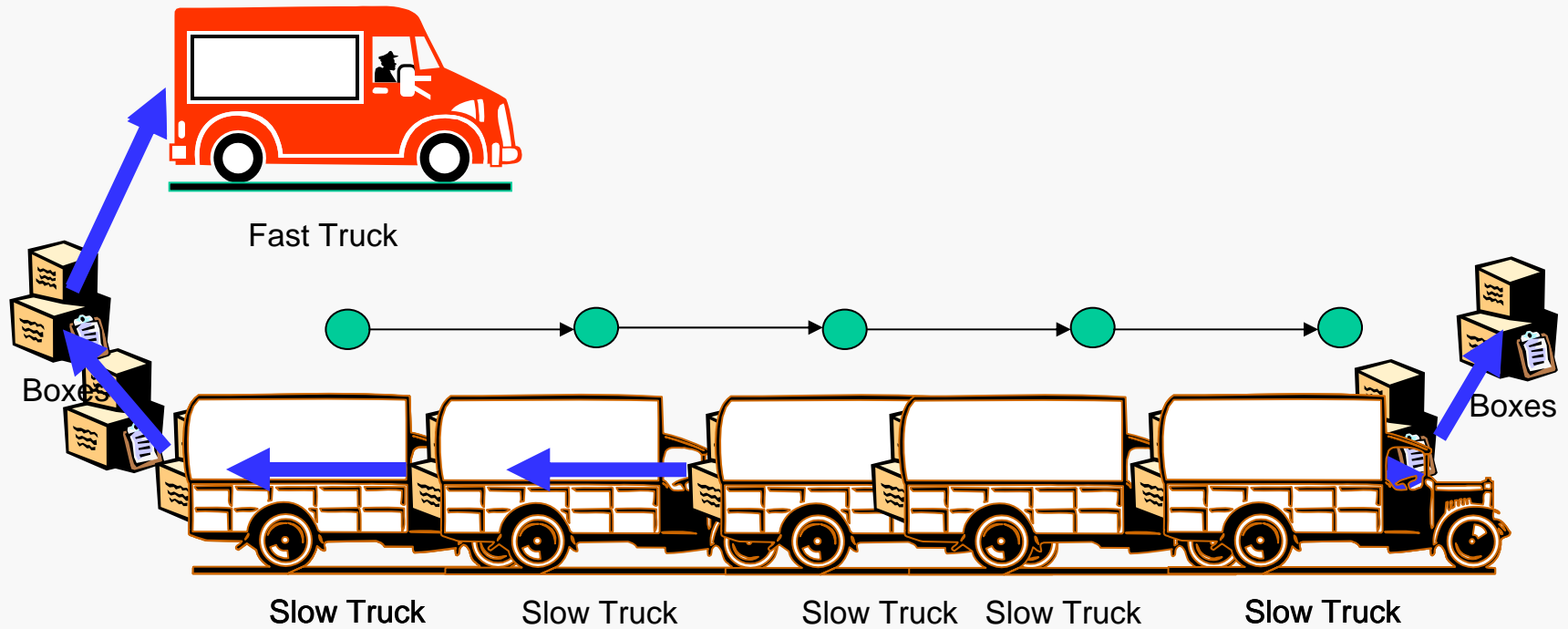


What the automated planner would do



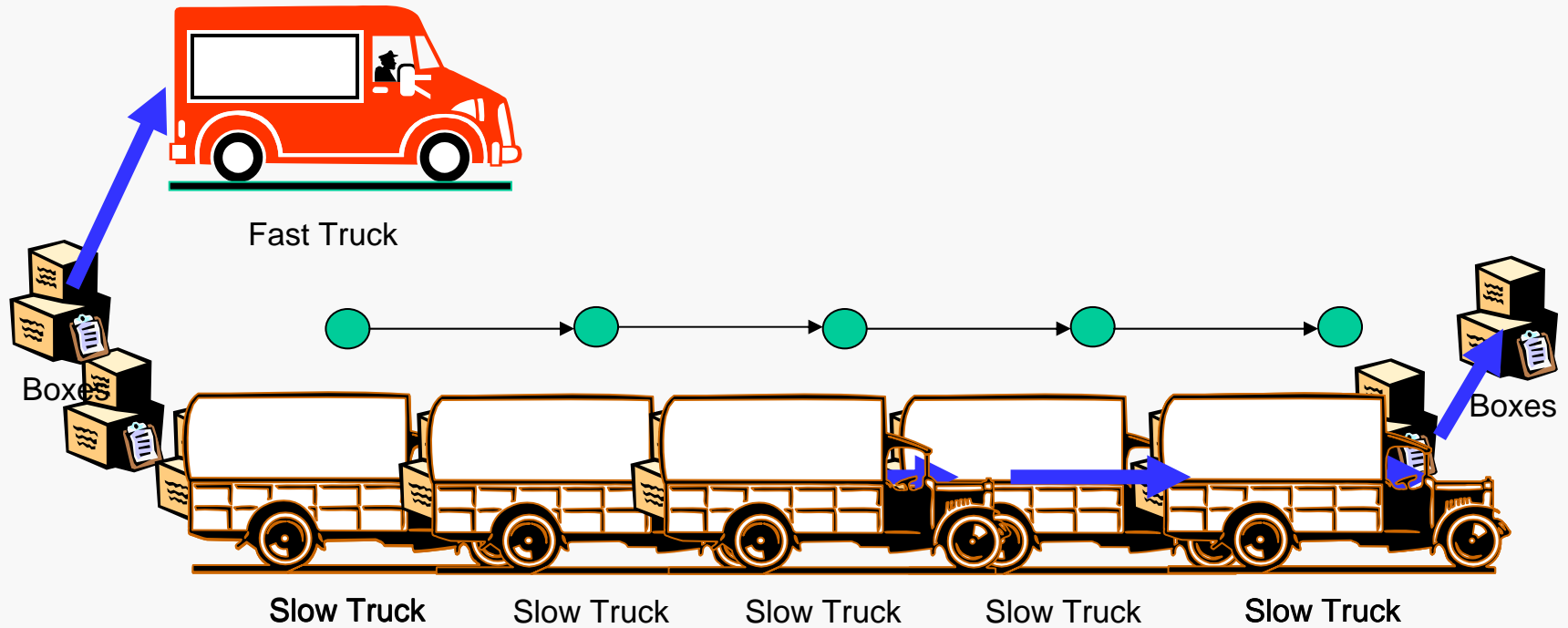


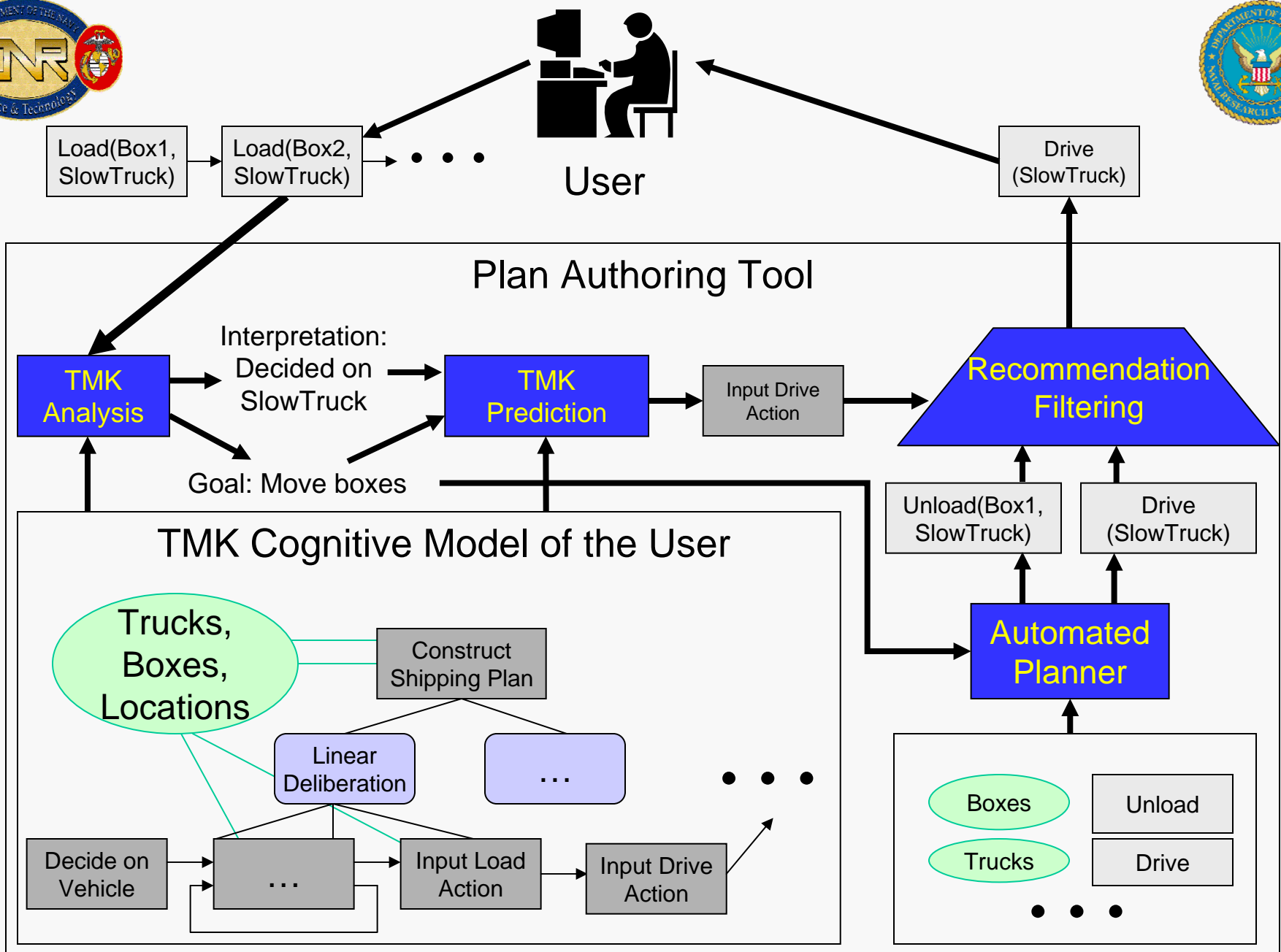
Recommendations *without* cognitive modeling





Recommendations *with* cognitive modeling







Domain Applicability

- Data-intensive environments
 - System can make a significant contribution
 - Decisions require additional background knowledge and/or subjective judgments
 - System must collaborate with the user
 - Expert human users
 - System's approach should match user's preference
-
- Example: Noncombatant Evacuation Operations (NEOs)
 - Tasks: Deliberative and execution-time planning
 - Data: Doctrine, SOPs, and records of past NEOs are available
 - Requires that human have final authority over decisions



Open Issues



- Is TMK adequate for modeling users?
 - If not, what augmentations are needed?
- Where do TMK user models come from?
 1. Encoded by system designers from cognitive studies?
 2. Extracted automatically through experience?
 3. A combination of (1) and (2)?
- Is information from user actions adequate for judging user intentions?
 - If not, what other information can enable coordination between the user and the system?



Summary



- Intelligent system collaborates with a human user; the system provides recommendations during plan authoring.
- Cognitive model is used to infer *what* the user wants to do and *how* the user wants to do it.
- User's cognitive model is composed of Tasks, Methods, and Knowledge (TMK)
- Proposed tool recommends actions for doing what the user wants in the way that the user wants to do it.