

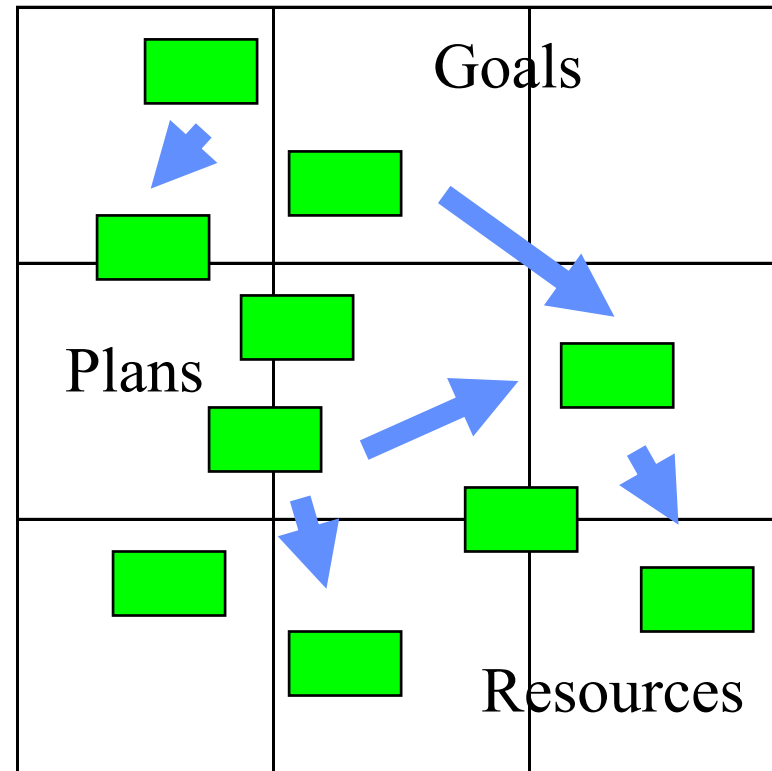
Exception Handling

Exception Handling

- all coordination mechanisms face “exceptions”
any deviation from an optimal process
- examples
 - contract net: dishonest/fickle agents ...
 - markets: irrational agents, collusion, monopolies ...
 - resource sharing: poaching ...
 - collab design/planning: agent conflicts ...
 - any: [partial] agent & communication failures ...

Many Exception Causes

- Conflicting goals
- Flawed plans
- Buggy agents
- Hostile agents
- Resource failures
- Unmanaged agent dependencies
- Unforeseen Opportunities
- ...



Many Partial Solutions

- from multiple domains e.g.
 - manufacturing control
 - adaptive workflow
 - [D]AI
- no comprehensive theory
 - of exception types (problem space)
 - of exception handling (solution space)

Citizens vs Survivalists

- two main exception handling approaches:
 - survivalists: “compile in” robust EH protocols and skills into every agent
 - citizens: use lightweight protocols and agents buttressed by social institutions

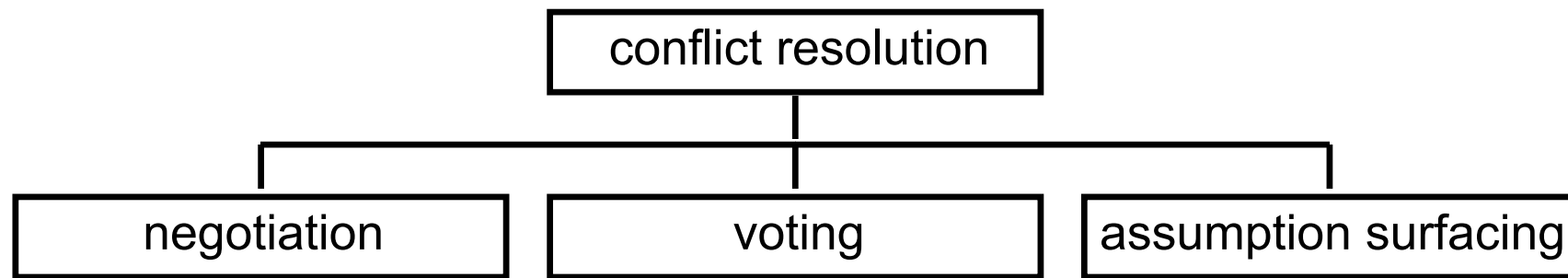
Survivalist Pros & Cons

- Self-contained agents; good for disasters
- Difficult to develop
 - increases agent complexity
 - difficult to anticipate all exceptions
 - severe requirements hinder inter-operability
- Poor performance
 - heavyweight protocols, redundant monitoring
 - “weak” agents can undermine entire community
 - many failures/resolutions require a systemic view

Examples

- most current agents are “survivalist”
 - enhanced protocols
 - e.g. contract net with cancellation penalties
 - re-planning
 - STEAM
 - conflict management

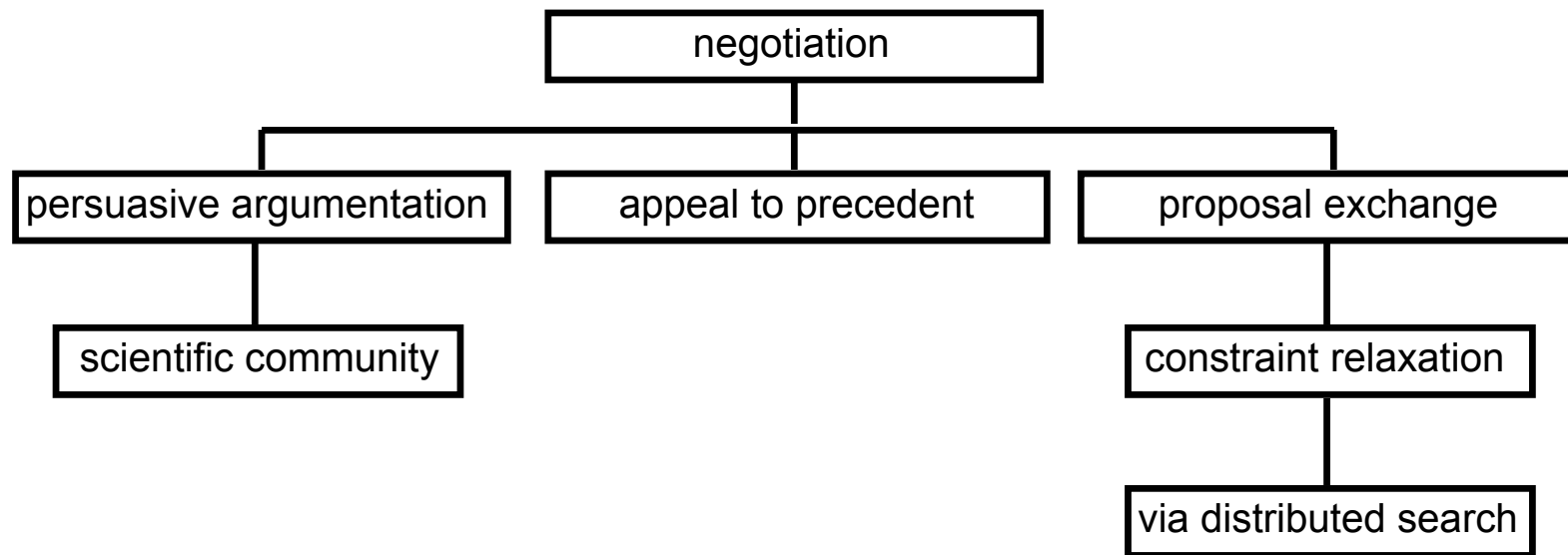
Conflict Management



Negotiation

- definition
 - resolving conflicts between self-interested agents
 - via the exchange of offers and counter-offers
- negotiation protocol components
 - initiators: propose ...
 - reactors: answer, refine, refuse ...
 - completers: reject, agree ...

Negotiation Techniques



Citizen Pros & Cons

- Systemic view
 - longitudinal view
 - global cost/benefit tradeoffs
- Economies of scale
- Specialized skills
- Simplified agents & interaction protocols
 - reduce overhead
 - facilitate interoperability
 - reduce reliance on individual agent's quality
- Bottleneck? Fragile for true disasters?

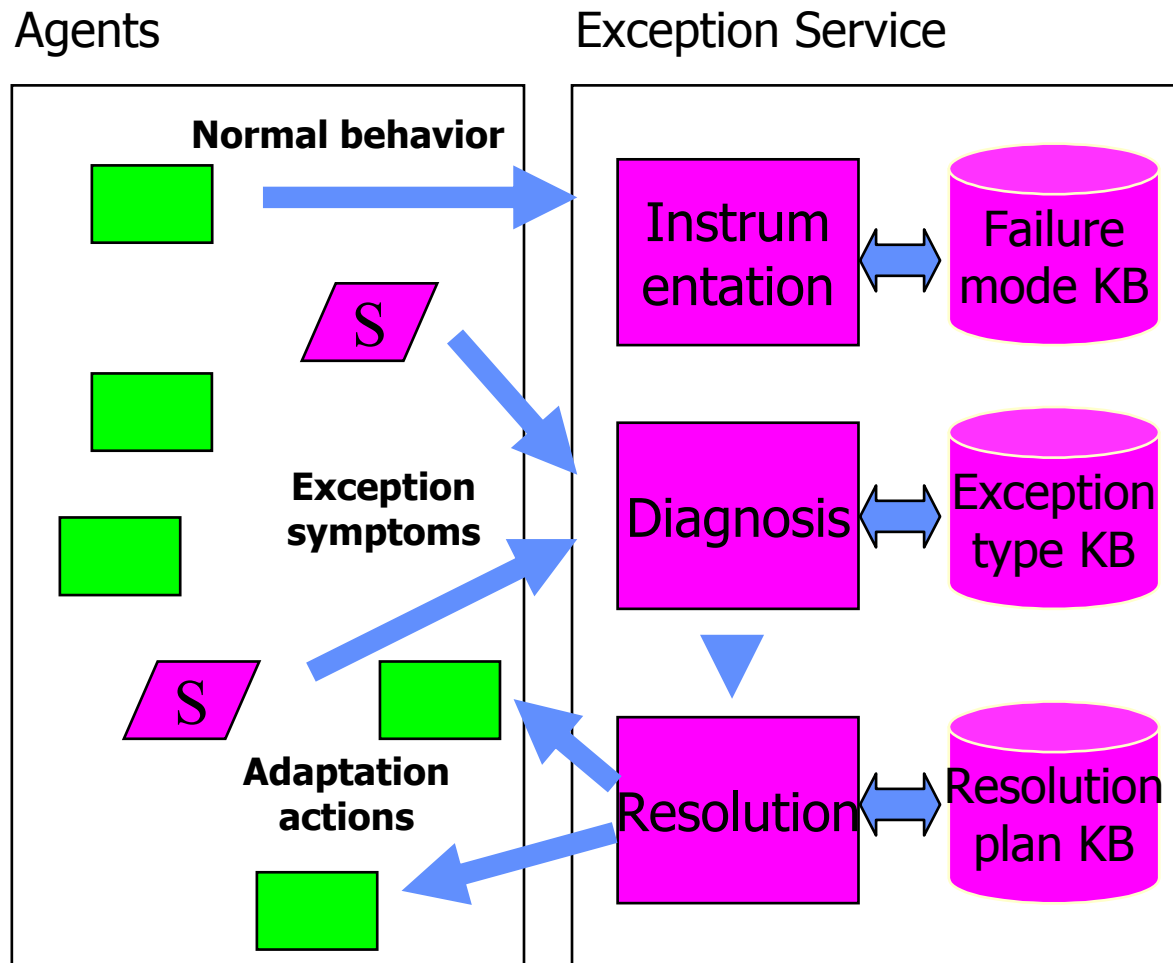
Examples

- “citizen” (mediated) approaches are emerging
 - UMASS Intelligent Home
 - C-ReCS

Intelligent Home

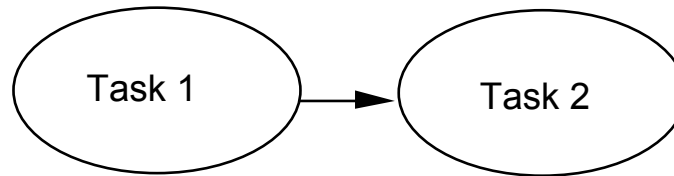
- every agent maintains a “subjective” model of inter-agent task inter-dependencies
 - agents use dependency model to select appropriate coordination mechanisms
- a diagnostic system infers the need to update subjective model

C-ReCS

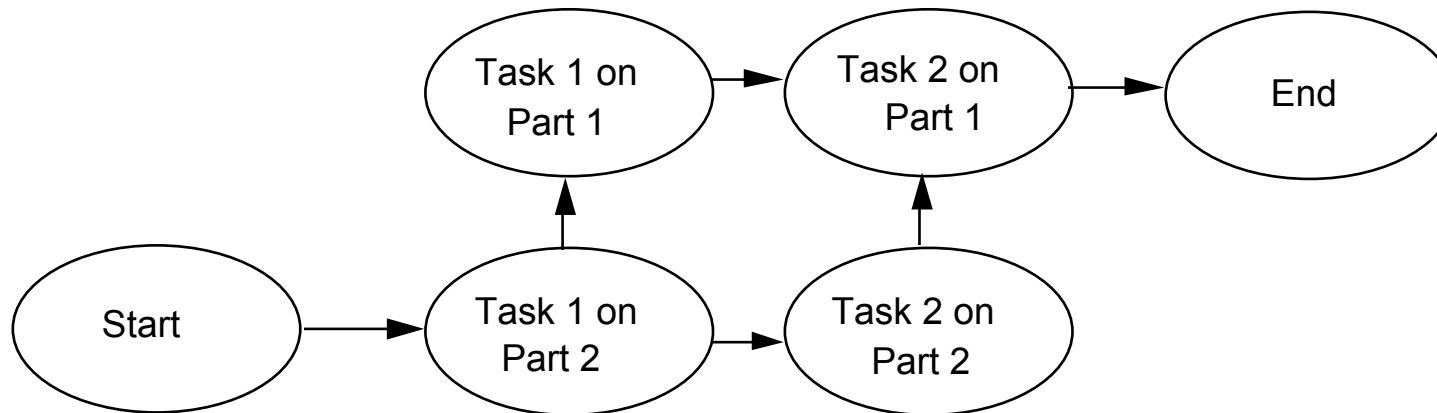


Example Strategy

- If behind schedule & upcoming serial steps



- Then try pipelining



Lessons

- exceptions are important
- a young area
- need to clarify content & key dimensions of
 - exception type space
 - resolution mechanism space
 - e.g. citizen vs survivalists
 - mappings from problems to solutions