






A Mixed-Initiative System for Building Mixed-Initiative Systems

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  WASHINGTON DC AREA HOTELS LIST	0	10/14/05 4:34 pm	Jenniann 
Bid Assistance DT-WH, Dupont-Woodley 4* 11/9-11/11	0	10/17/05 12:20 am	whidbeyone
Bidding assistance 11/17-11/20 Dupont Circle	6	10/16/05 9:58 am	CreamandCrimson
4* J.W. Marriott WH/DT 10/9-10/11 \$112	8	10/15/05 3:00 pm	nancyroa
Bidding assistance -Washington DT/WH Feb 18,2006	5	10/14/05 3:11 pm	poutine45

BiddingForTravel.com



Priceline



Map



Orbitz



HERACLES

- alcmenetest
 - BiddingForTravel
 - Orbitz
 - Map

alcmenetest

address	<input type="text" value="2799 Jefferson Davis Highway"/> value
city	<input type="text" value="Crystal City"/> value
state	<input type="text" value="Virginia"/> value
zipcode	<input type="text" value="22202"/> value
checkin	<input type="text" value="11/04/05"/> value
checkout	<input type="text" value="11/06/05"/> value
BiddingFor-Travel	<input type="text" value="BiddingForTravel"/>

Retrieving Vector Layers:

HERACLES

- alcmenetest
 - BiddingForTravel
 - Orbitz
 - Map

BiddingForTravel

area	star	hotelname	biddingfortravel_price
Crystal City	3	Marriott Crystal City	\$70
Crystal City	3	Sheraton Crystal City	\$72
Crystal City	3	Hilton Crystal City	\$65
Crystal City	2.5	Courtyard Marriott Crystal City	\$49
Crystal City	3	Crystal Gateway Marriott	\$57
Crystal City	3	Crown Plaza	\$75
Crystal City	3	Hyatt Regency Crystal City	\$85
Crystal City	3	Double tree Crystal City	\$60

value

BiddingFor-Travel

Orbitz

Orbitz

HERACLES

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- Map

Orbitz

hotelname	wholeaddress	orbitz...
Marriott Crystal City	1999 Jefferson Davis Highway, Ci	\$119
Sheraton Crystal Cit	1800 Jefferson Davis Highway, Ci	\$149
Hilton Crystal City	2399 Jefferson Davis Highway, Ci	\$139
Courtyard Marriott C	2899 Jefferson Davis Highway, Ci	\$109
Crystal Gateway Ma	1700 Jefferson Davis Highway, Ci	\$149
Crown Plaza	1480 Crystal Drive, Crystal City, '	\$89
Hyatt Regency Cryst	2799 Jefferson Davis Highway, Ci	\$119
Double tree Crystal	300 Army Navy Drive, Crystal Cit	\$N/A

value

Orbitz

Map

Map

HERACLES

- alcmenetest
- BiddingForTravel
- Orbitz
- Map

Map

Star

3

Value

Geocoder

lat	lon	hotelname	wholeaddress	s...	orbi...	biddingf...
38.8556	-77.051	Marriott Cry	1999 Jefferson Dav	3	\$119	\$70
38.8575	-77.051	Sheraton Cr	1800 Jefferson Dav	3	\$149	\$72
38.8523	-77.052	Hilton Crysta	2399 Jefferson Dav	3	\$139	\$65
38.8461	-77.052	Courtyard M	2899 Jefferson Dav	2.5	\$109	\$49
38.8583	-77.051	Crystal Gate	1700 Jefferson Dav	3	\$149	\$57
38.8607	-77.049	Crown Plaza	1480 Crystal Drive,	3	\$89	\$75
38.8484	-77.052	Hyatt Regen	2799 Jefferson Dav	3	\$119	\$85
38.8635	-77.052	Double tree	300 Army Navy Dri	3	\$N/A	\$60

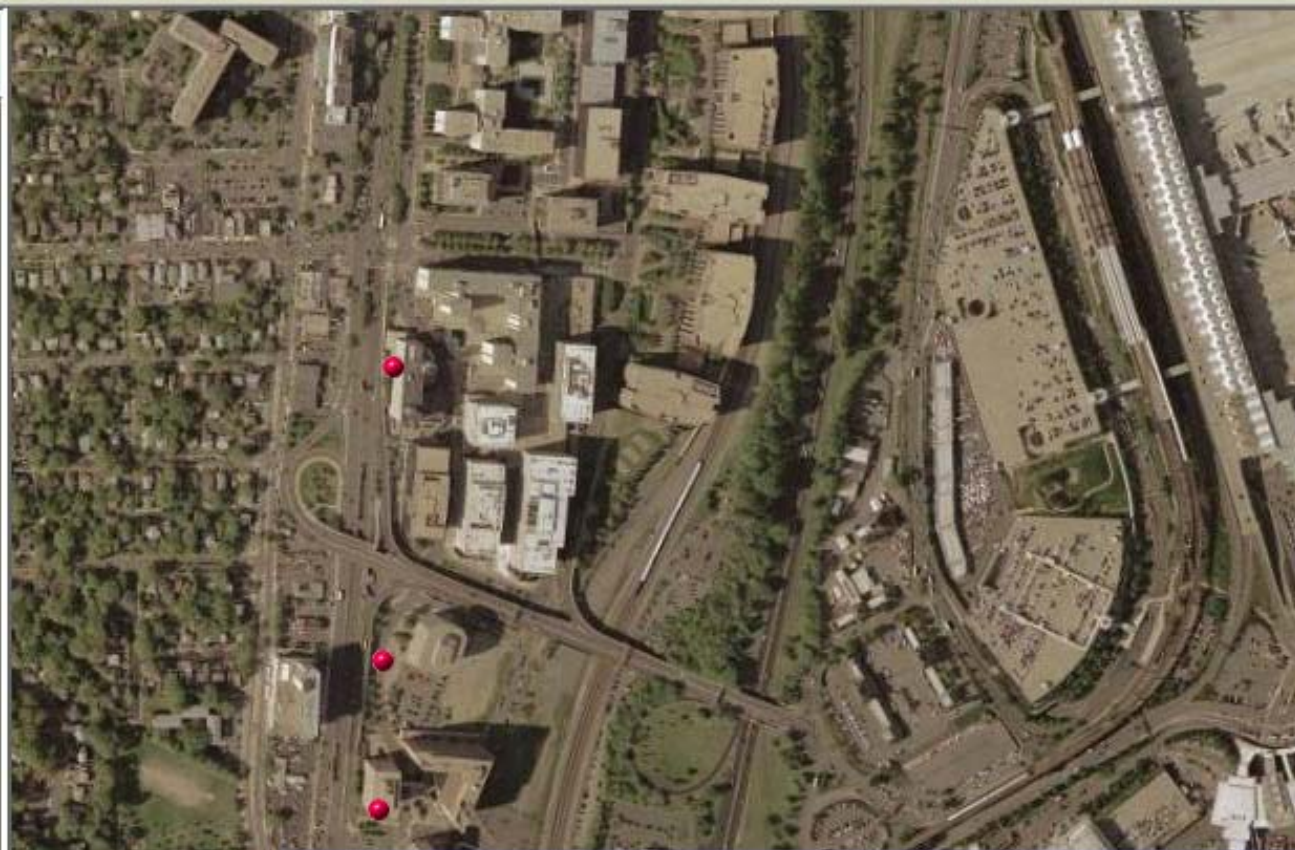
value



Retrieving Vector Layers: 0

HERACLES

- alcmenetest
- BiddingForTravel
 - Orbitz
 - Map



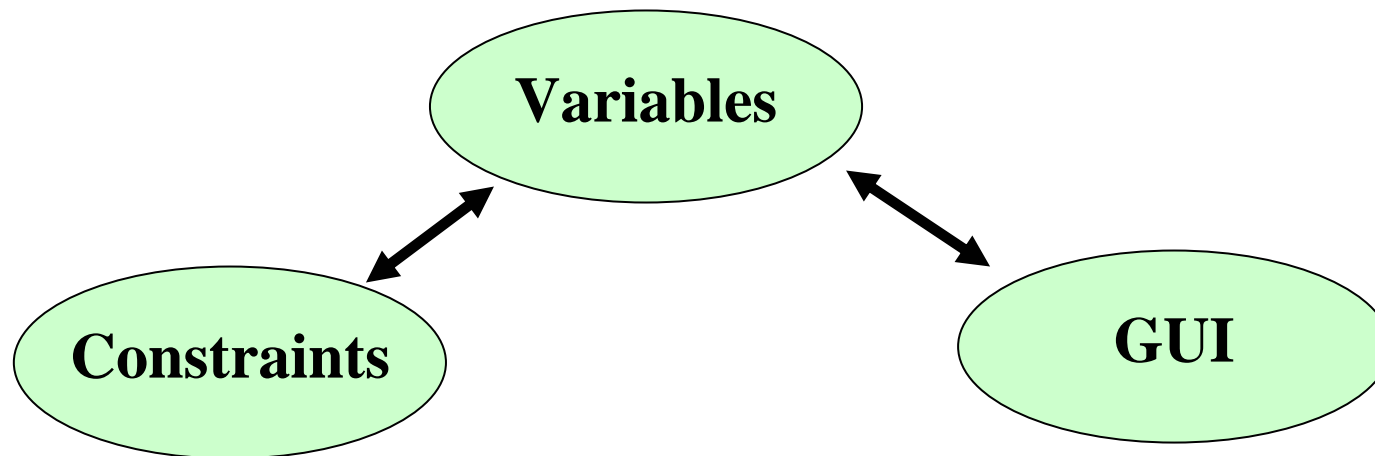
Name:Hyatt Regency Crystal City
Lat:38.848462
Lon:-77.052446
hotelname:Hyatt Regency Crystal City
wholeaddress:2799 Jefferson Davis Highway, Crystal City, Virginia 22202
star:3
orbitz_price:\$119
biddingfortravel_price:\$85

Retrieving Vector Layers:

url

Heracles (Hair·a·cles)

- ❑ Designed for implementing mixed-initiative, multi-source information assistants
- ❑ Break down tasks into hierarchy (templates)
- ❑ Use constraint propagation networks.




```

<CONSTRAINT NAME="mymap_keep_map_actualImage" TYPE="WrapperConstraint">
  <ARGS>
    <IN>mymap_keep_map_mediator</IN>
    <OUT>mymap_keep_map_image</OUT>
    <OUT>mymap_keep_map_reg</OUT>
  </ARGS>
  <CALL NAME="DOC">
    <XQUERY> <![CDATA[
      <row>
        <mymap_keep_map_mediator>{$mymap_keep_map_mediator}</mymap_keep_map_mediator>
        <query>(concat('http://oceanus.isi.edu:9090/mediator-servlet/CallMediator?domain=placedomain&query=q(mapname, map
title, servername, topx, botx, lefty, righty, srs, height, width, resolution, format, imageurl, lat, lon):- onlymaps(mapname, maptitle, ser
vername, topx, botx, lefty, righty, srs, height, width, resolution, format, imageurl, lat, lon)^(mapname="BigUrbanArea")^(lat="'', $mymap_ke
ep_map_mediator//clat/text() ,'"^(lon="'', $mymap_keep_map_mediator//clon/text() ,'"^(resolution="2")^(width="'', $mymap_keep_map_mediator//
width/text() ,'"^(height="'', $mymap_keep_map_mediator//height/text() ,'" '))
        </query>
      </row>
    ]])</XQUERY>
  </CALL>
  <OUTPUT NAME="ocrel">
    <XQUERY> <![CDATA[
      for $line in $DOC//RESULT//row return
      <row>
        <mymap_keep_map_image>{$line//imageurl/text()}</mymap_keep_map_image>
        <mymap_keep_map_reg>
          <RegCoord>
            <CornerCoord>
              <latup>{$line//righty/text()}</latup>
              <latdown>{$line//lefty/text()}</latdown>
              <lonleft>{$line//topx/text()}</lonleft>
              <lonright>{$line//botx/text()}</lonright>
            </CornerCoord>
          </RegCoord>
        </mymap_keep_map_reg>
      </row>
    ]])</XQUERY>
  </OUTPUT>
</CONSTRAINT>

```

} Input

Data Call

} Output

Heracles Constraint Structure



Alcmene (Alc·me·ne)

- We want to provide a system that allows end users to build a new application without having to program.
- Alcmene is built as an application in Heracles.
- A mixed-initiative system for building mixed initiative systems

HERACLES

• alcmene

alcmene

Save
Template

template name

debug

save

Add Variable

name

Create

HERACLES

• alcmene

alcmene

Save
Template

myprogram

template name

debug

save

Add Variable

result

name

Create

HERACLES

• alcmene

alcmene

Save
Template

myprogram

debug

save

template name

result

empty

edit

delete

value

Add Variable

Create

name

HERACLES

• alcmene

alcmene

Save
Template

 debug

template name

result

 edit

value

 tutorial

type

- string
- number
- image
- map
- subtemplate
- database
- sources**
- search

result value

Add Variable

name

alcmene

Save
Template

debug
template name

result

edit
value

tutorial
type

type

geocoder
bidding_for_travel

Geocode the address.
Input: 1. wholeaddress: such as 3767 clarington ave, Los Angeles
Output: 1. wholeaddress
2. lat
3. lon

result value

Add Variable

name

alcmene

Save
Template

debug

template name

wholeaddress

edit

value

result

<input type="button" value="edit"/>	<input type="text" value="wholeaddress"/>	<input type="text" value="lat"/>	<input type="text" value="lon"/>
-------------------------------------	---	----------------------------------	----------------------------------

value

edit

tutorial

type

type

Geocode the address.

Input: 1. wholeaddress: such as 3767 clarington ave, Los Angeles

Output: 1. wholeaddress

2. lat

3. lon

result value



alcmene

Save
Template

debug

template name

wholeaddress

edit

value

result

<input type="text" value=""/>		
<input type="text" value="wholeaddress"/>	<input type="text" value="lat"/>	<input type="text" value="lon"/>

value

edit

Add Variable

name

alcmene

Save
Template

debug

template name

wholeaddress

edit

value

result

wholeaddress	lat	lon
3767 Clarington Ave, Los Angeles, CA 90034	34.023086	-118.401261

value

edit

Add Variable

name



Automating the linking of sources

- Search to suggest possible plan paths
 - Users might have some ideas of the goal but don't always know how to get there.
- Partial Plan Execution
 - User don't always know what to expect for the output
 - Data sources are dynamic

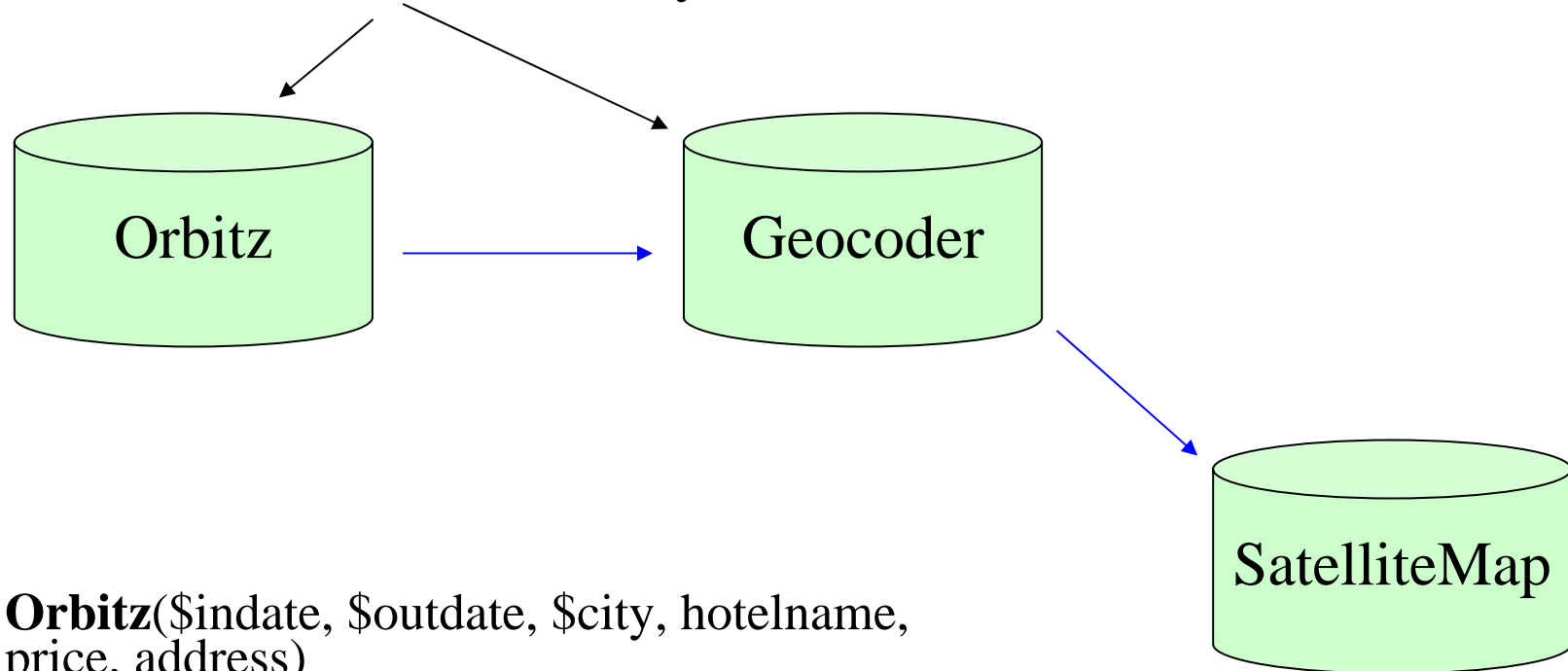


Search Steps

- Defining source domain model and type
 - **Orbitz**(\$indate, \$outdate, \$city, hotelname, price, address)
 - **Geocoder**(\$address, lat, lon)
 - **SatelliteMap**(\$lat, \$lon, \$*, image)
- Searching through the domain model space
 - Suggest the possible paths to users.
- Show the intermediate results (Partial Plan Execution)

Searching through the domain model space

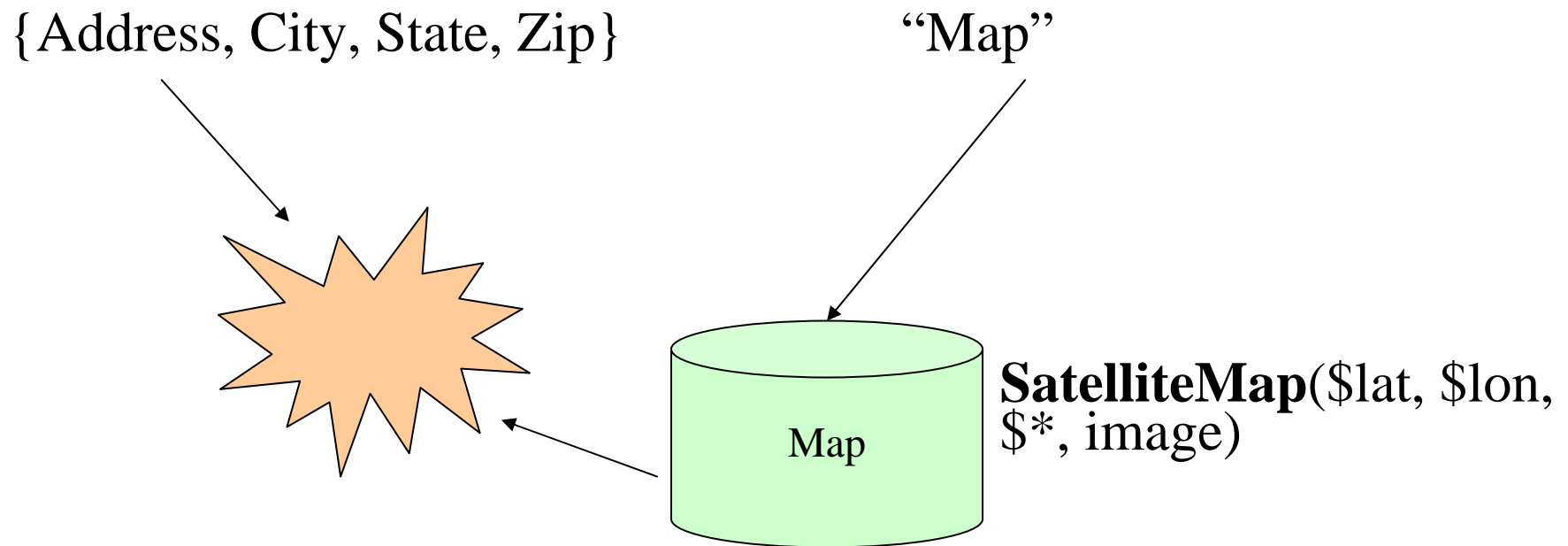
{ address, indate, outdate, city }



- ❑ **Orbitz**(\$indate, \$outdate, \$city, hotelname, price, address)
- ❑ **Geocoder**(\$address, lat, lon)
- ❑ **SatelliteMap**(\$lat, \$lon, \$*, image)

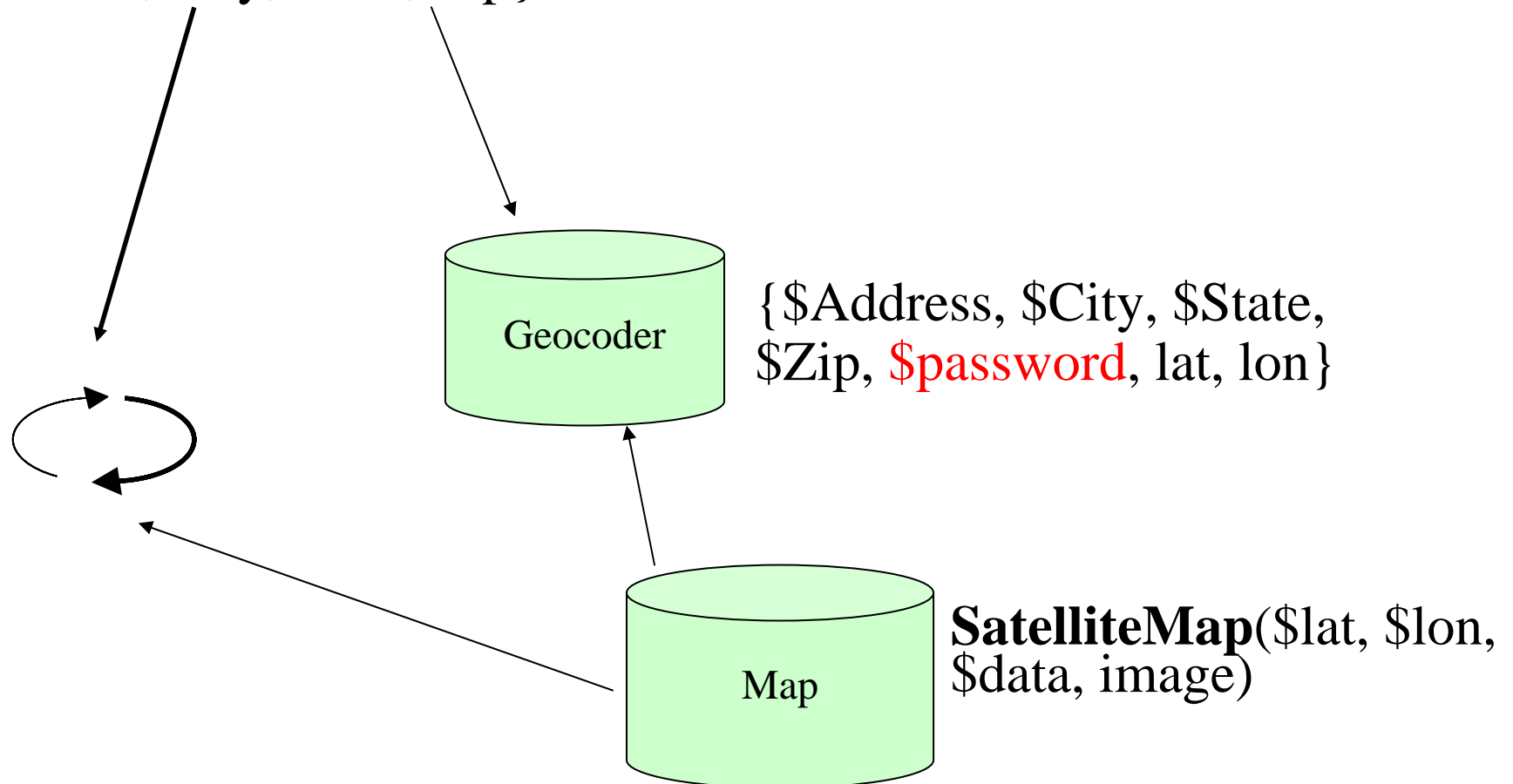
Searching through the domain model space II (Bound search)

- ❑ Metadata description and Data Indexing of sources
- ❑ Locating possible goal by keyword search



Cycles and Binding sources

{Address, City, State, Zip}





Multiple candidate paths available

- The number of candidate plan paths can be very large
- Execute all of them
 - Many of them are not useful or correct.
 - Reduce the result spaces



Dealing with path explosion

- ❑ Problem: A source might return 100,000 tuples.
- ❑ Sampling the result and continue expanding
 - Segmenting the result using some attributes (i.e. Gender – M/F) and map selected attribute as a binding to existing variables.
 - Randomly
- ❑ Cap the source that generates too many results



Other technical issues

- Constraint Specification
 - Basic operations depending on the variable type with Excel like expression
- Record Linkage
 - Integrating existing record linkage system into Alcmene
- Semantic Mapping between variables
 - Inducing source descriptions for automated web service composition.



Related Work

□ **Heracles**

- [Ambite et al 2005] Heracles II: Conditional constraint networks for interleaved planning and information gathering. *IEEE Intelligent Systems*, 20(2):25--33, March/April 2005.

□ **Wrappers**

- [Muslea et al 2001] Hierarchical wrapper induction for semi-structure information sources. *Autonomous Agents and Multi-Agent System*. 4(1-2):93-114

□ **Dynamic Webpages**

- [Miller & Myers 1997] Creating dynamic world wide web pages by demonstration. Technical report, Carnegie Mellon University School of Computer Science. CMU-CS-97-131.
- [Wolber et al 2002] Designing dynamic web pages in the WYSIWYG interface. *In Proc. of the 6th IFIP Working Conference on Visual Database System*.
- [Macias & Castells 2003] Dynamic web page authoring by example using ontology-based domain knowledge. *In Proc. of the 8th International Conference on Intelligent User Interfaces*.

□ **Mixed-initiative Planning Application**

- [Myers et al. 2002] Passat: A user-centric planning framework. *In Proc. of the 3rd International NASA Workshop on Planning and Scheduling for Space*
- [Kim et al. 2004] An Intelligent assistant for interactive workflow composition. *In Proc. of the 9th international conference on Intelligent User Interface*, 125-131.



Conclusion & Future work

- A mixed-initiative system for building mix-initiative systems.
- Status
 - Initial prototype allows the definition of simple types of variables and constraints
- Next step
 - Automatic linking of sources



?