Commute UX: Telephone Dialog System for Location-based Services

Ivan Tashev, Michael Seltzer, Yun-Cheng Ju,
Dong Yu, Alex Acero

Microsoft® Research

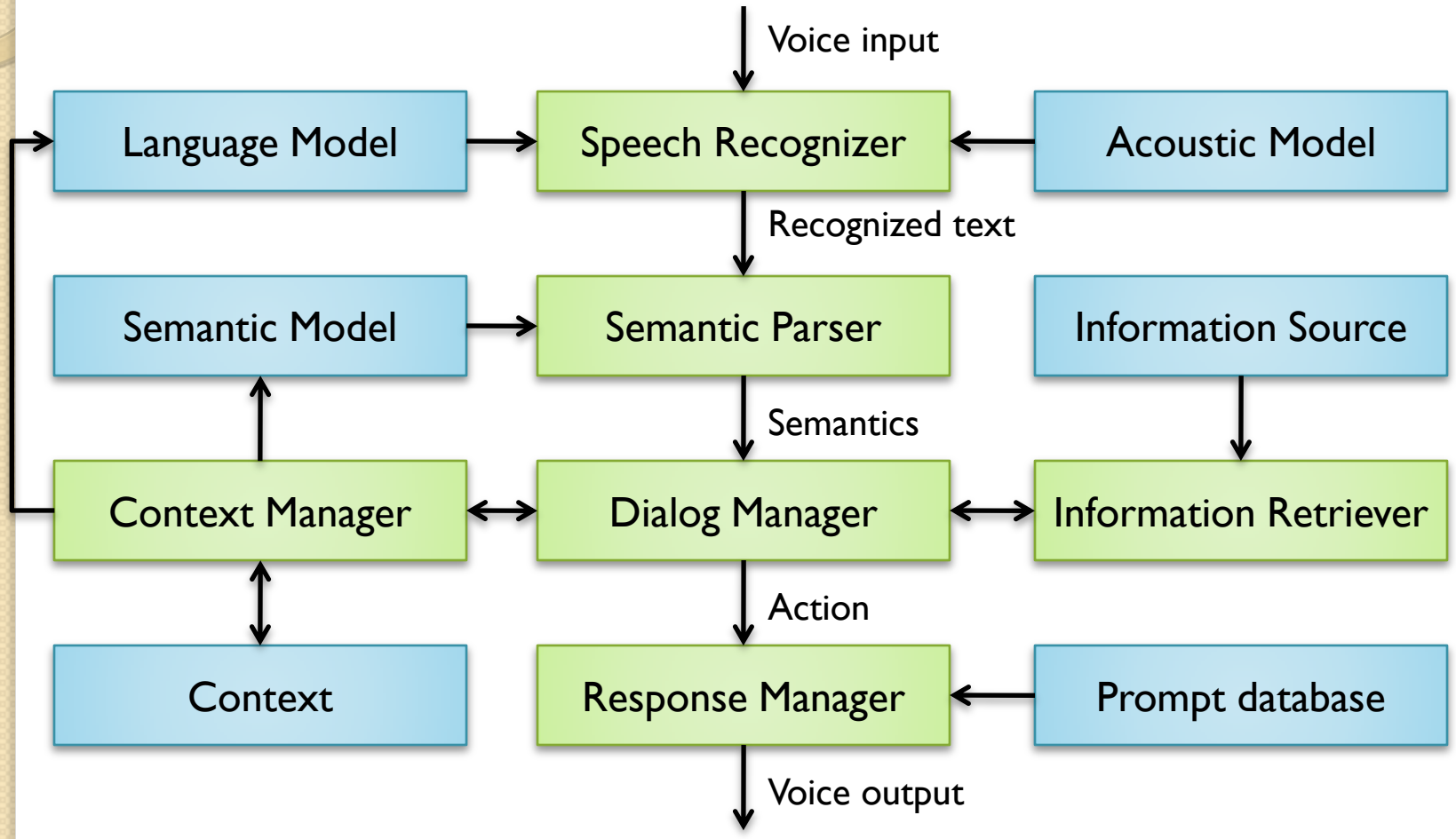
Overview

- Commute UX project
- System architecture
- Understanding locations
- Rendering locations
- Deployment and results
- Demo
- Conclusions and future work

Commute UX project

- Aiming to improve the driver's experience during commute time
  - 24 minutes average commute time one way
  - 70% drive alone (numbers for USA)
- Why speech
  - Driving is hands-busy and eyes-busy
  - Speech is the safest communication channel
- First system: telephone info line
  - Able to reach large number of users
  - Free phrase queries
  - Traffic, gas prices, and weather
- Understanding and conveying locations – critical for the system

System Architecture

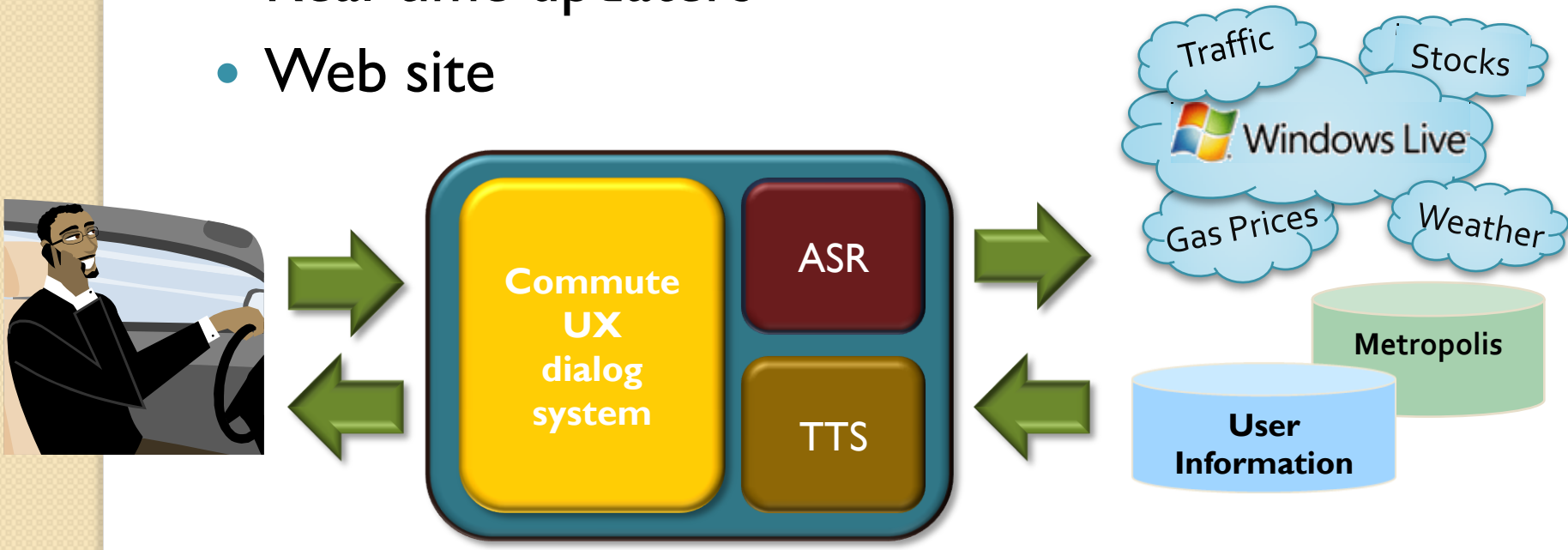


System Architecture (2)

- Speech Recognizer
  - Task dependent, slot based LM
  - Filler word N-gram and garbage collection
- Semantic parser
  - Task classification and task specific semantic slots
- Dialog manager
  - Two level state machine
- Context manager
  - Plays key role in the usability of the system
  - Updates the LM and the semantic model

System Architecture (3)

- Information Retriever
  - Connection to the backend database: geographic, personal, real-time info
- Response Manager
- Real-time updaters
- Web site



Understanding locations

- Understanding location is a complex problem
  - Large vocabulary, complex phrases
  - Ways to handle: limit the scope, n-best, TF-IDF
- Locations, locations:

Type	Example
City	Kirkland
ZIP	98034
Neighborhood	Juanita
Intersection	Corner of 150th Av NE and 36th St.
Zone	Within 1 mile from <point>
Road	I-405 northbound
Section	between exits 10 and 22 of I-405

Understanding locations: context

- Types of locations to understand is application and context dependent
- Location as context
  - Keep it once entered
  - Use it in the next phases of the dialogue
- Example:

  Q: "How is the traffic between Bellevue and Seattle?"

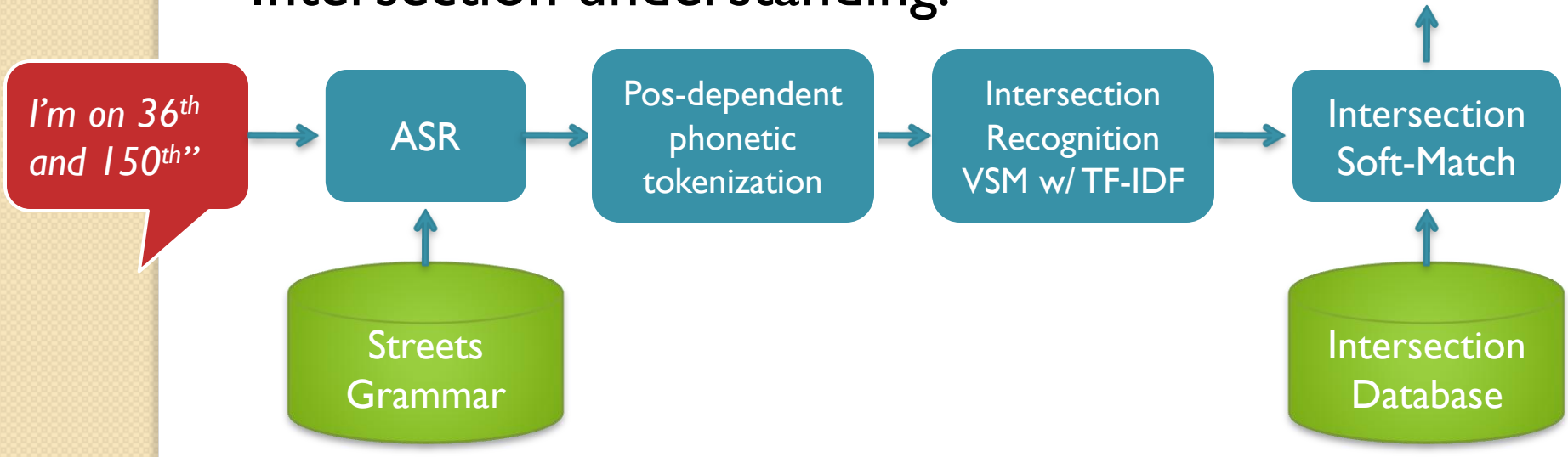
  A: "The traffic between Bellevue and Seattle via I-90 is …"

  Q: "How about via 520?"

  A: "The traffic between Bellevue and Seattle via SR520 is …"

Understanding locations: Intersections

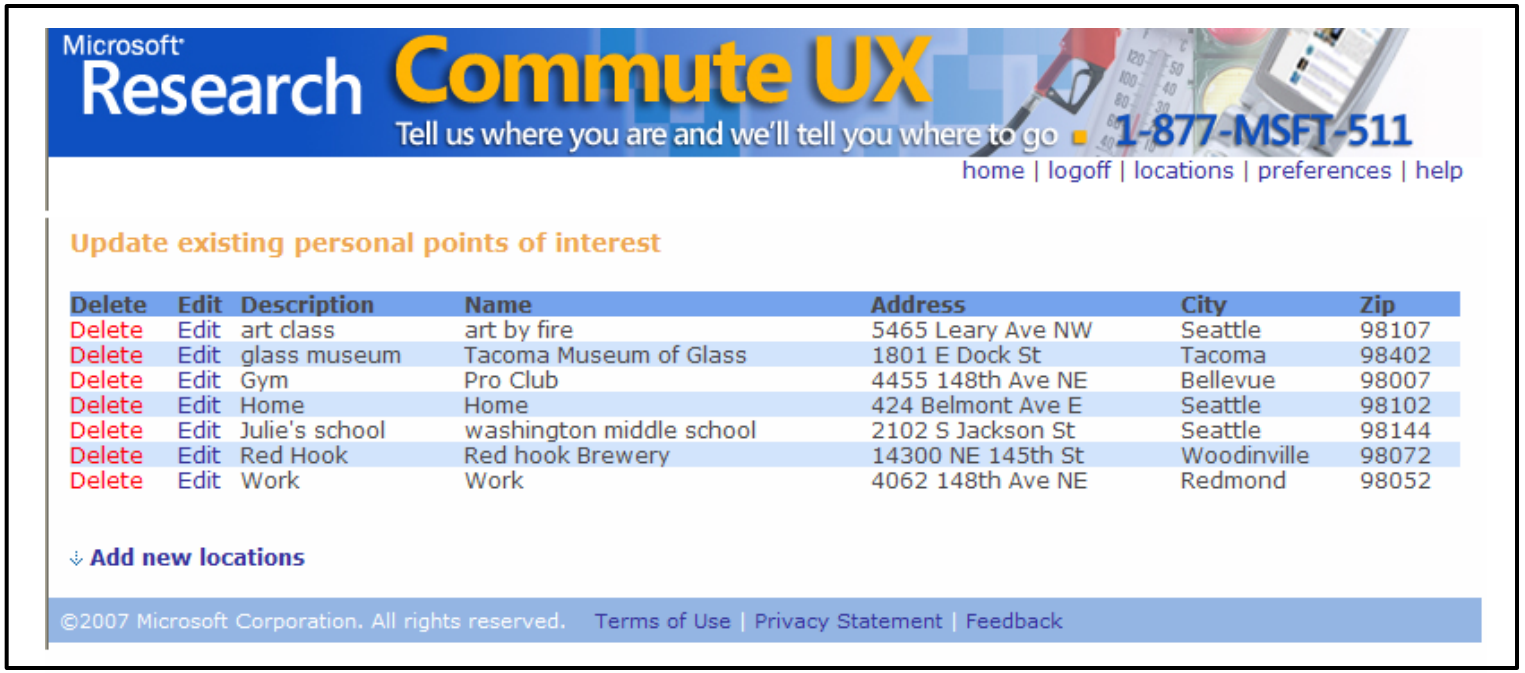
- We often use intersections when conveying locations to each other
  - Intersections are readily known
  - People often don't know exact address
- Intersection understanding:



For more details see our Interspeech 2007 paper

Understanding locations: Personalization

- Website integration for Personal Points of Interest (PPOI)
- Use like any other location
  - "How's the traffic from work to Julie's school"
- Example points of interest



Rendering locations

- Rendering the location is critical for the usability of the information system
  - Difficulties due to TTS quality
  - More difficult in noisy conditions
  - The driver is under cognitive load
  - Short term memory in humans is limited
- Four ways to render a location

Address only	14803 Northeast 51st Street
Address & POI	251 Rainier Avenue North, near Renton Chamber of Commerce
Intersection only	The corner of East Madison Street and 17th Avenue
Intersection & POI	The corner of NE Woodinville Road and 131st Avenue, near City Hall

- Final normalization and conversion

Rendering locations

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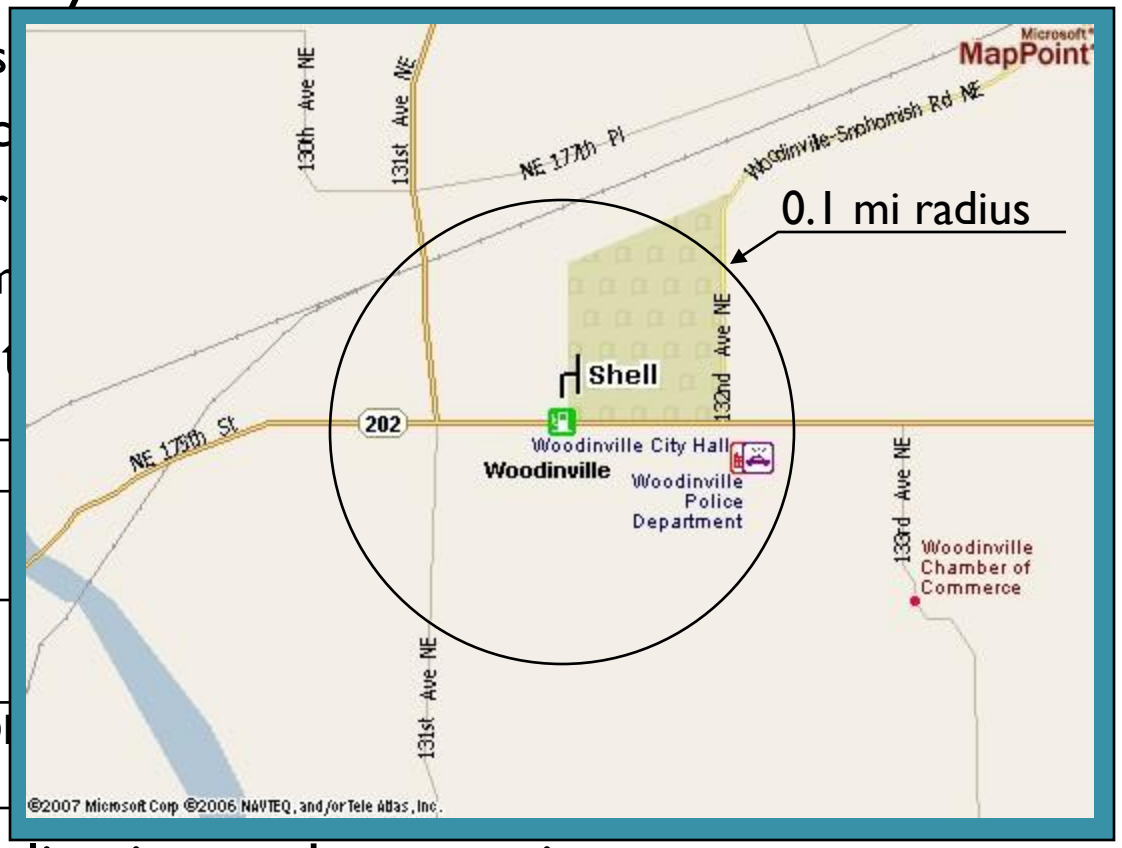

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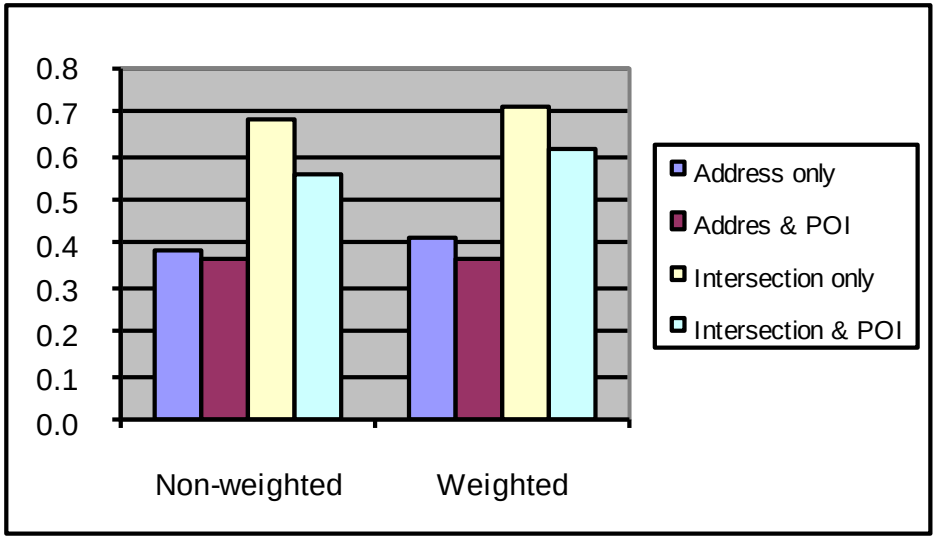
Rendering locations: user study

- 40 users were asked to hear and type two addresses and to tell their preferences (133 trials)
- The accuracy is relatively the same, except for Intersection & POI case
- Users strongly prefer rendering with intersections
- Recommended order:
  - Intersection
  - Address
- "POIs are useful only when you know them"

Question type	Number	Sum	Accuracy (%)
Address only	67	57.5	85.82
Address & POI	65	53.5	82.31
Intersection only	65	54.0	83.08
Intersection & POI	69	47.7	69.13

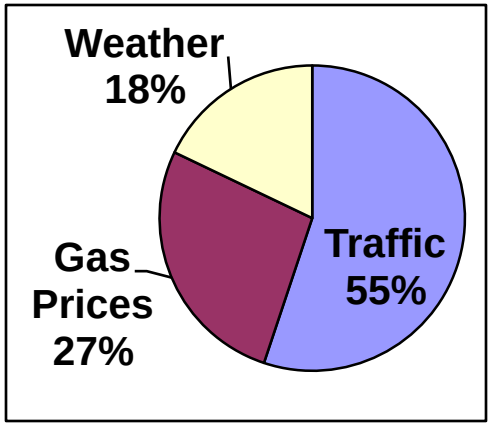
Recognition accuracy



User preferences

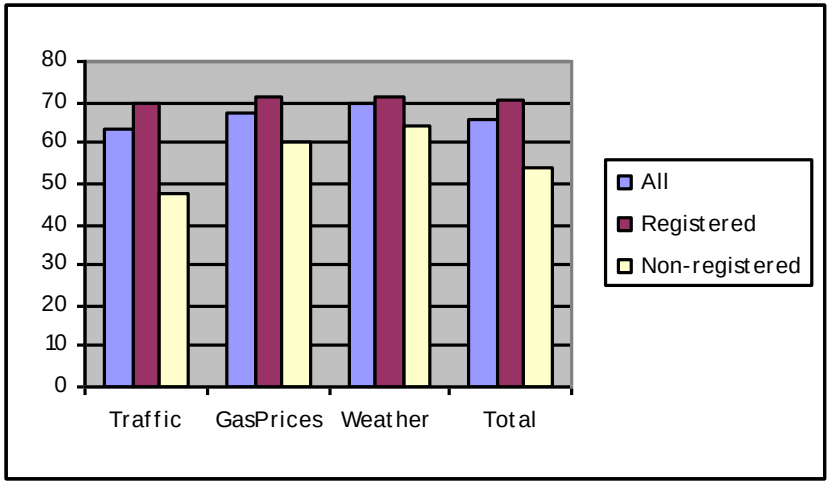
Deployment: calls analysis

- System demonstrated to ~800 Microsoft employees
- Total of 276 registered users
- Eight weeks period (March 12 – May 6, 2007)
- Total of 698 calls, ~12.5 per day
- 40 users accounted for 50% of the calls
- Total of 927 task attempts



Task Type	All	Registered	Non-registered
Traffic	3.56	3.33	4.08
Gas Prices	3.73	3.54	4.14
Weather	3.80	3.61	4.41
Total	**3.65**	**3.44**	**4.14**

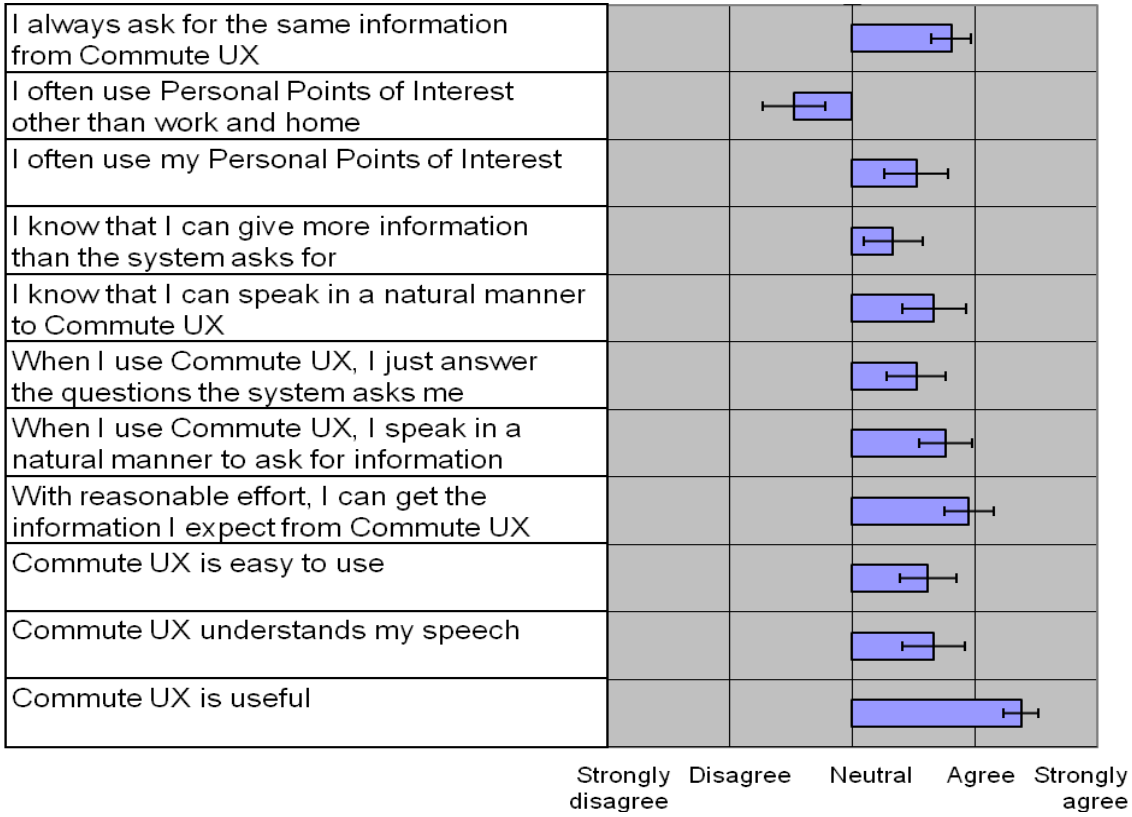
Average number of turns per task



Task completion ratio, %

Deployment: user preferences

- Solicited 112 users and received 23 responses



Commute UX: demo

- Cheapest gas, city recognition
- Nearest gas station, intersection recognition
- Traffic, personal point of interest (home)
- Traffic, default route
- Traffic, *via* clause
- Weather, location passed as context

Demo 1

Demo 2

Conclusions and future work

- Created a telephone based free phrase dialog system for traffic, gas prices and weather
- Understanding and proper rendering of locations is critical for the system
- Using personal points of interest reduces the number of turns and increases the success ratio
- Future opportunities to improve the system trough personalization, user adaptation, reducing the number of turns

Finally

Thank you for your attention! ☺

Feel free to give it a try:

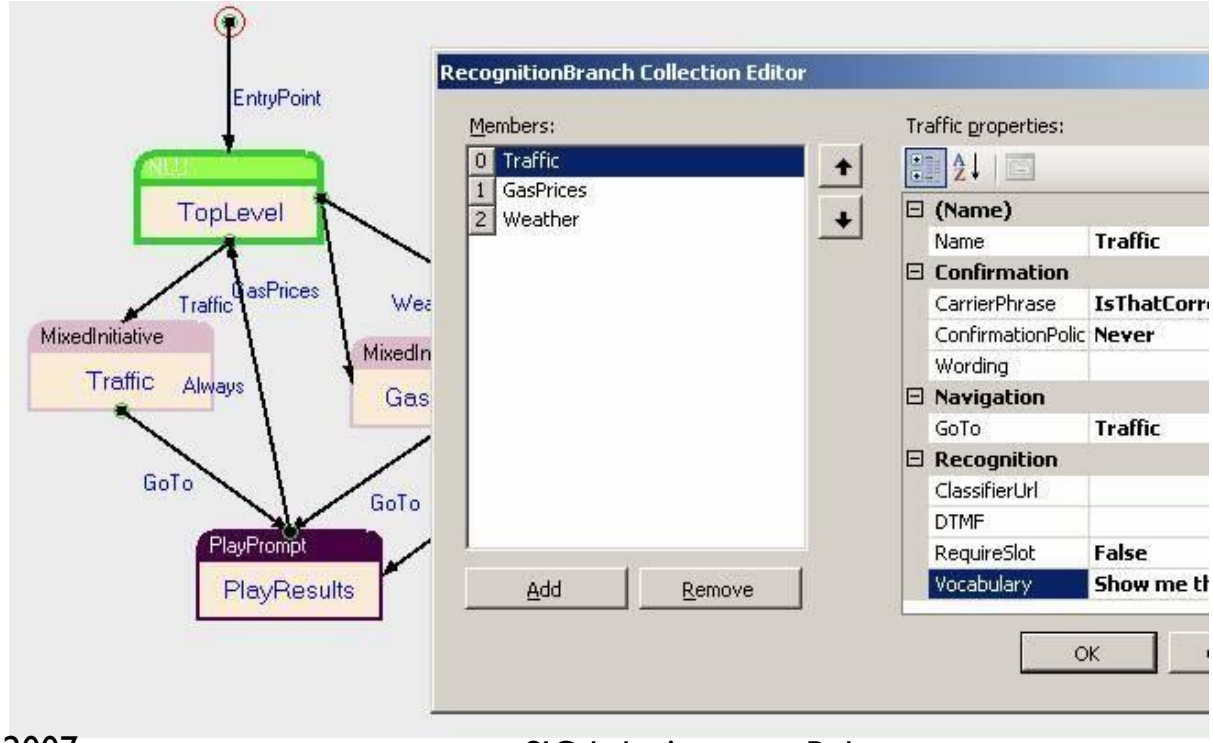
- 1-877-MSFT-511 (toll free in USA)
- Information for Washington state only
- Compare with 511 traffic info line

Comments: commuxfb@microsoft.com

Backup slides

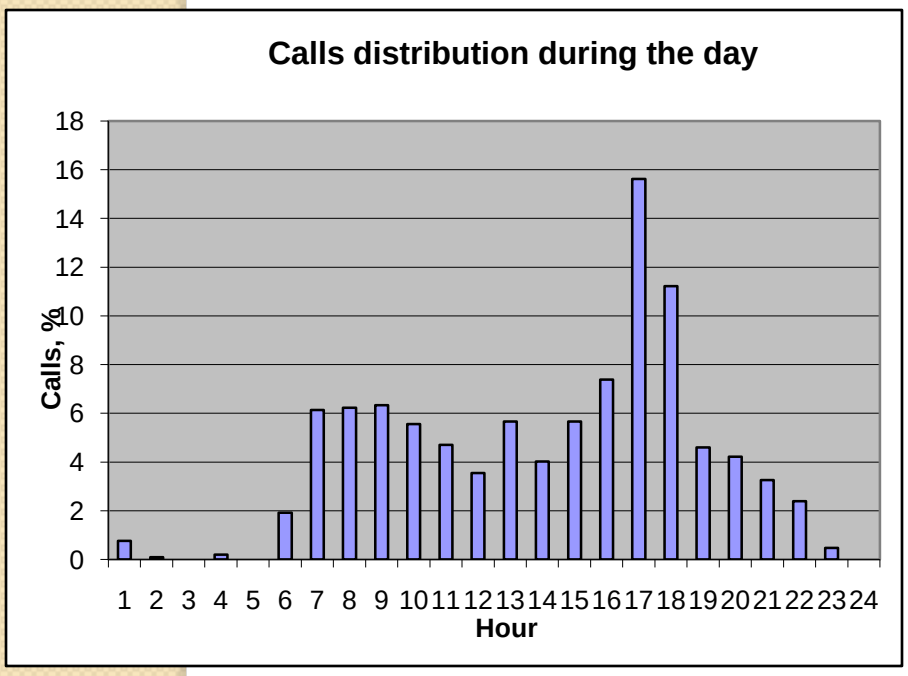
System architecture (4)

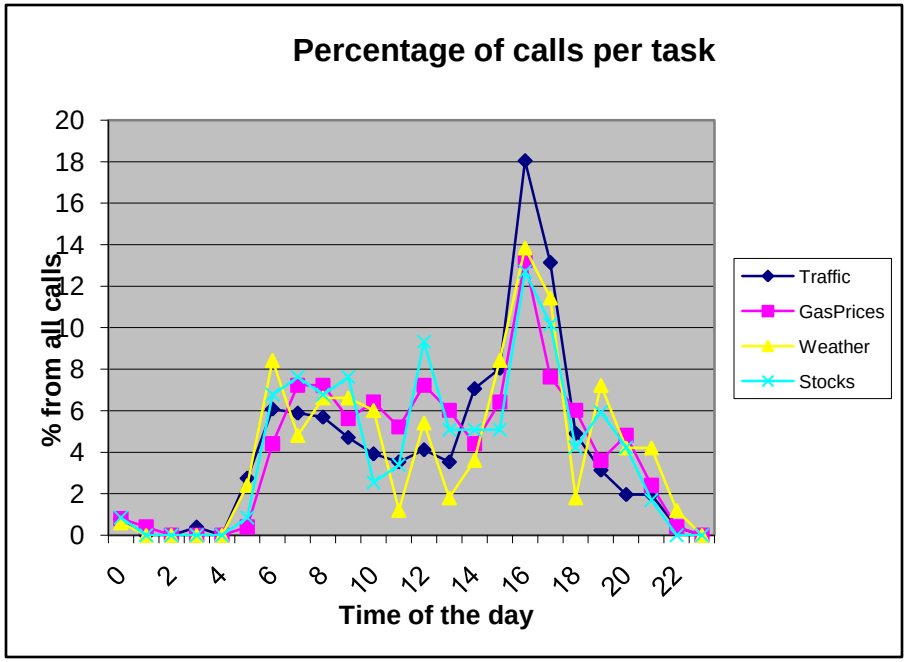
- Built on top of Microsoft Speech Server
- SQL server powered backend
- Integrated into VS graphical design environment



Deployment: calls analysis (2)

- Peaks at morning and evening rush hours
- No substantial changes in the task proportion during the day





Deployment: calls analysis (3)

- Usage per day of the week