Artificial Intelligence

Impacts of Increased Computing Power on Commerce

Eric Horvitz
Microsoft Research

Washington DC
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horvitz@microsoft.com
http://research.microsoft.com/~horvitz/

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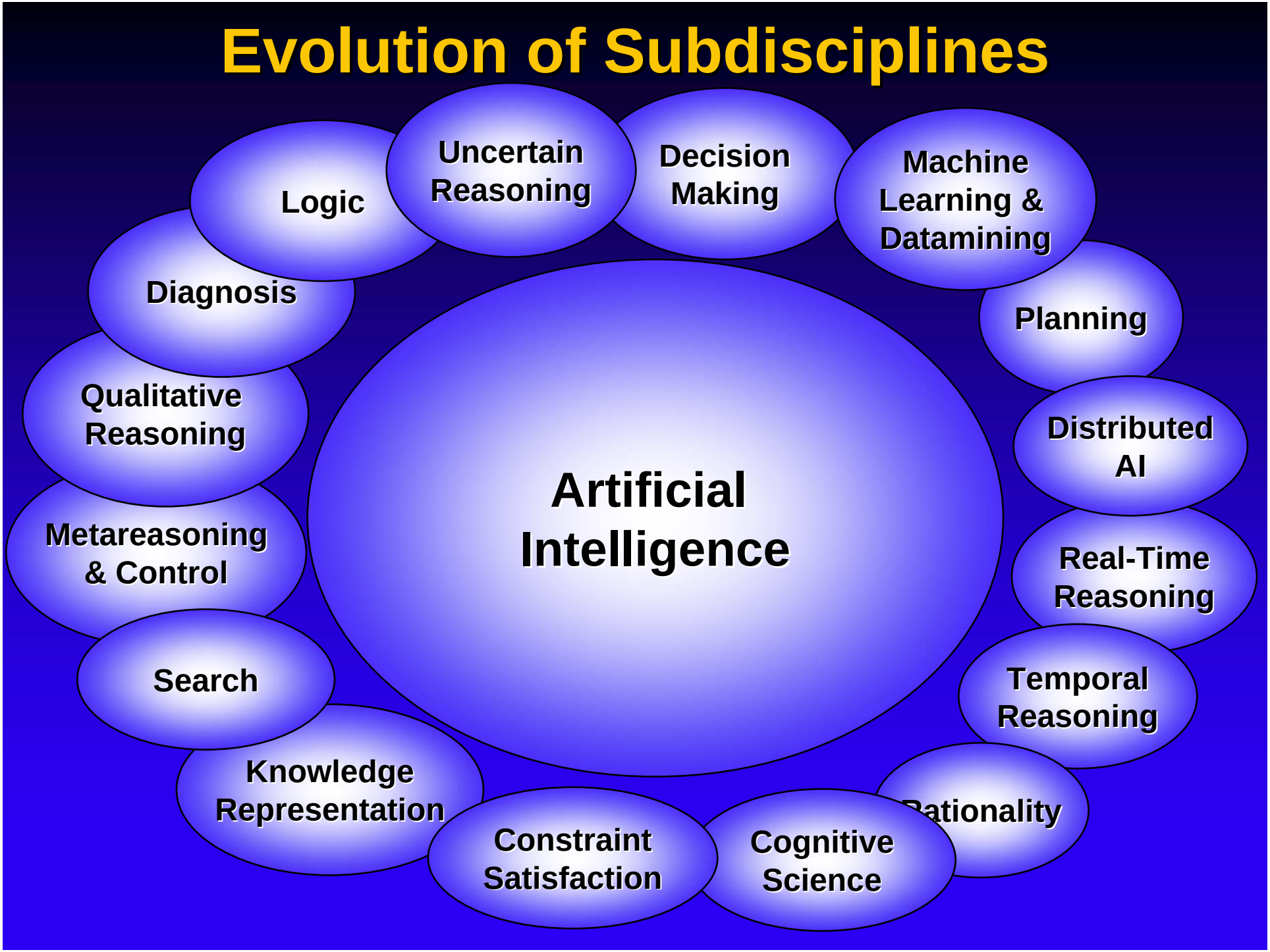
Artificial Intelligence

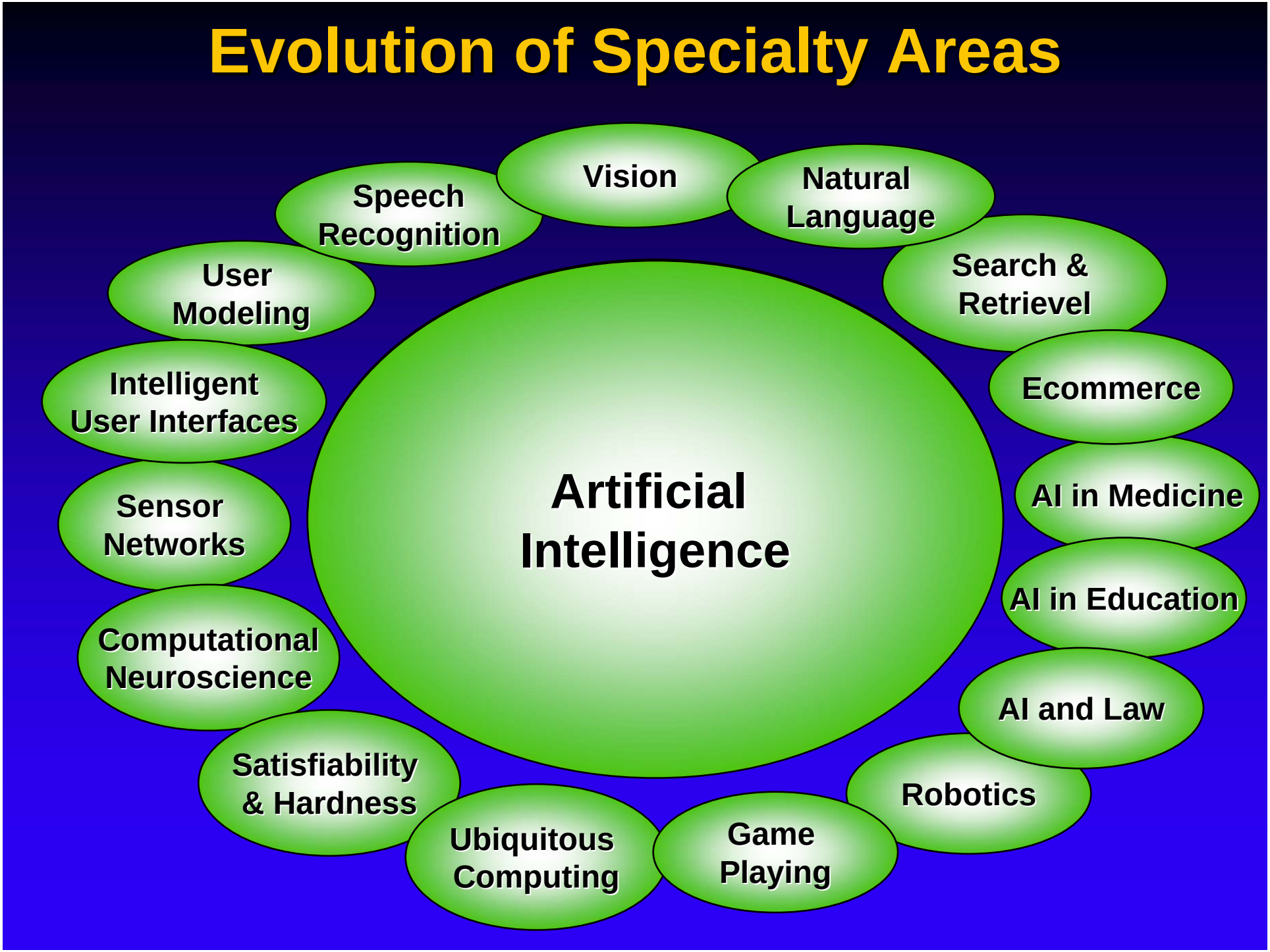
Automating tasks that have required human intelligence …and beyond.

- **Representation & reasoning with knowledge**
- **Sensing, learning & adaptation**
- **Search & optimization**
- **Theoretical principles & applications**
- **Embedded *vs*. foreground; real-time *vs*. offline; autonomous *vs*. supportive, interactive.**

Evolution of Subdisciplines



Evolution of Specialty Areas



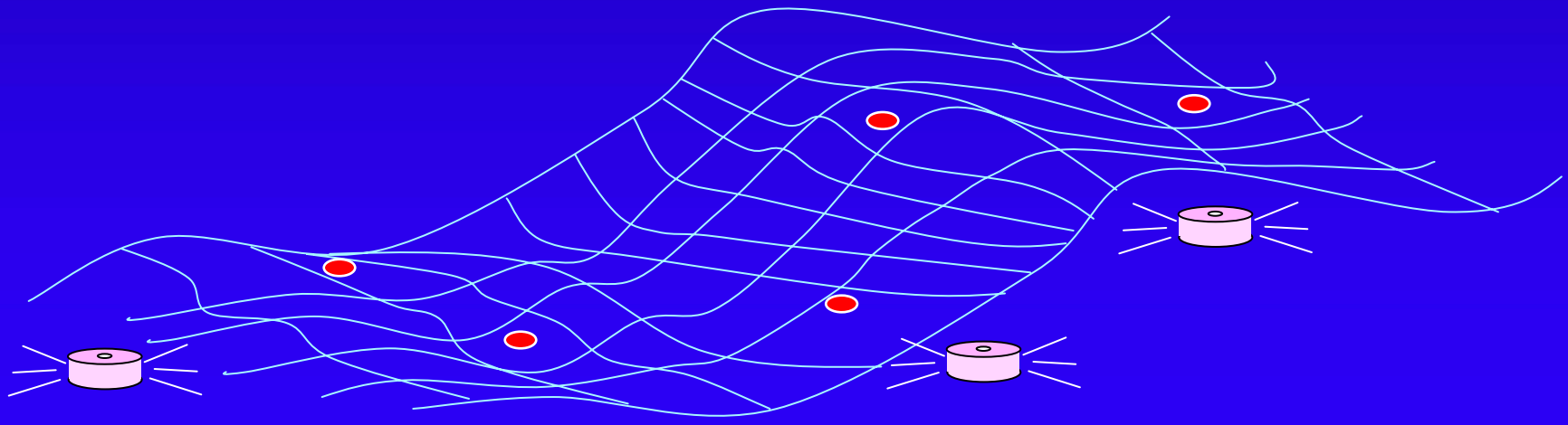
AI at Forefront of "Computational Revolution"

Industrial revolution

Computational revolution

Acceleration of Methods, Applications, Infrastructure

- Learning and reasoning prowess
- Computation
- Memory
- Sensors, connectivity, and content



Expectations: AI in daily life

- Communications
- Time management
- Health & safety
- Education
- Goals, informational needs
- Games, recreation, activities
- Products, purchases, marketing
- Opportunistic planning
- Augmentation of cognition

Expectations: AI in Science

- Automated discovery
- Design of experiments
- Triaging of resources
- Interpretation of data
- Probing complexity
- Biology, chemistry, medicine, climate

Key insights and technological breakthroughs will be enabled through AI methods

Expectation: AI and Infrastructure

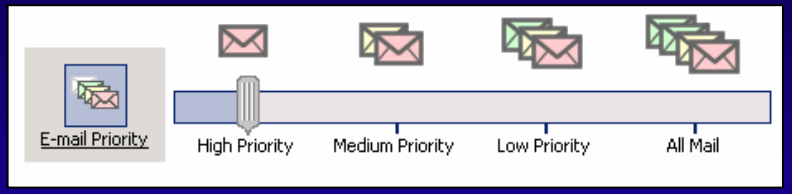
- Transportation
- Commerce decision making
- Agriculture
- Engineering & architecture
- Power & conservation

AI and the Consumer

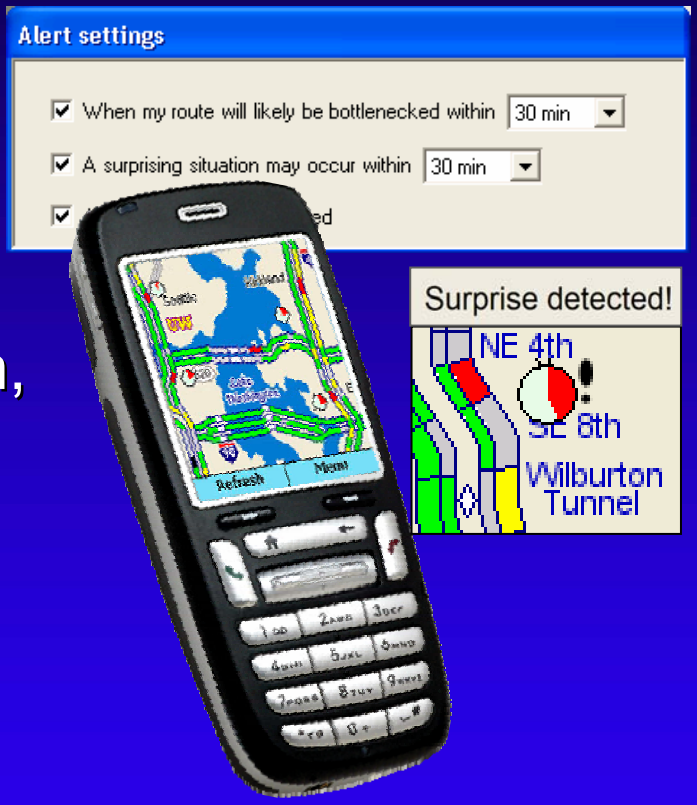
- Evolving relationship with computation
- Sensing, reasoning & learning
- Personalized smart applications
- Products & services
- Challenges *and opportunities* with data & privacy

Evolving relationship with computation

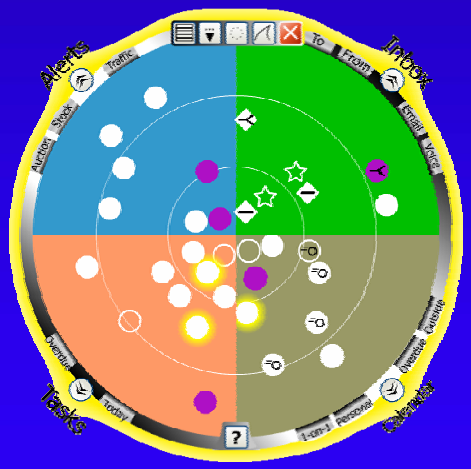
-Triage of alerts & messages



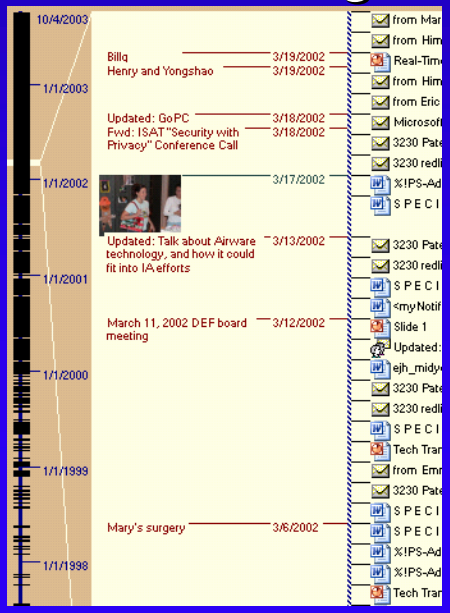
-Predictive, proactive services



-Rich visualizations of inferences

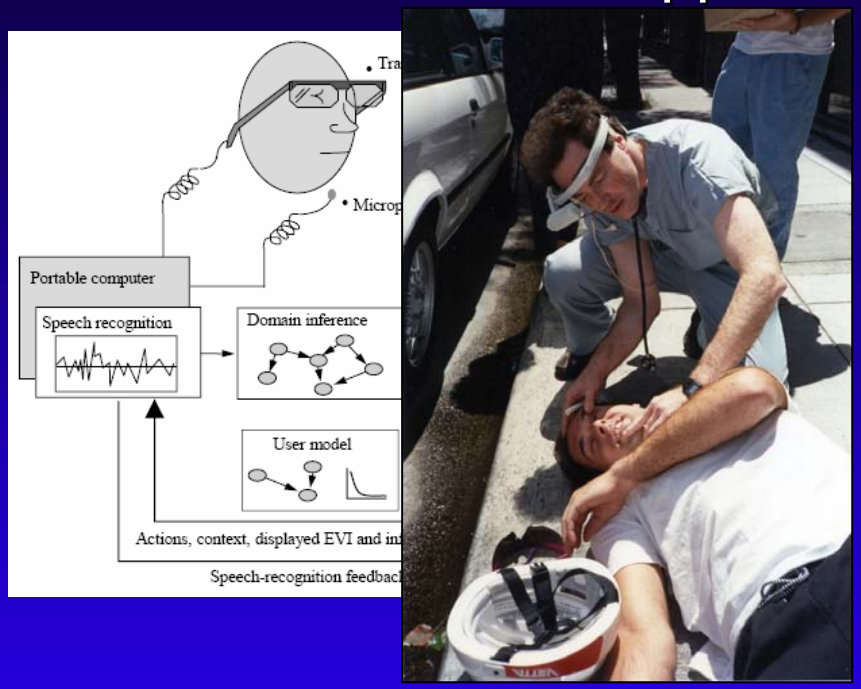


-Memory, search, reminding

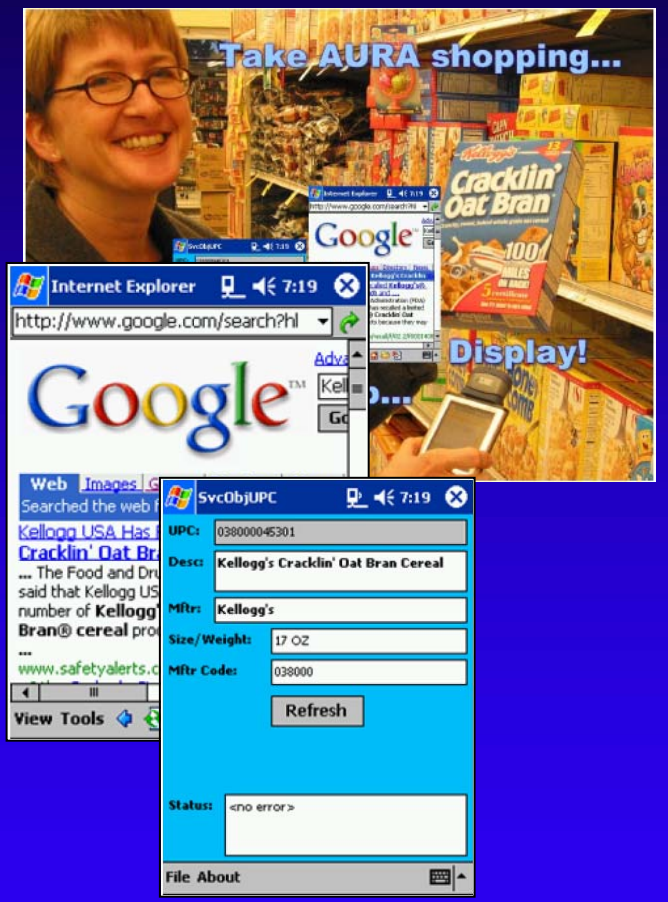


Evolving relationship with computation

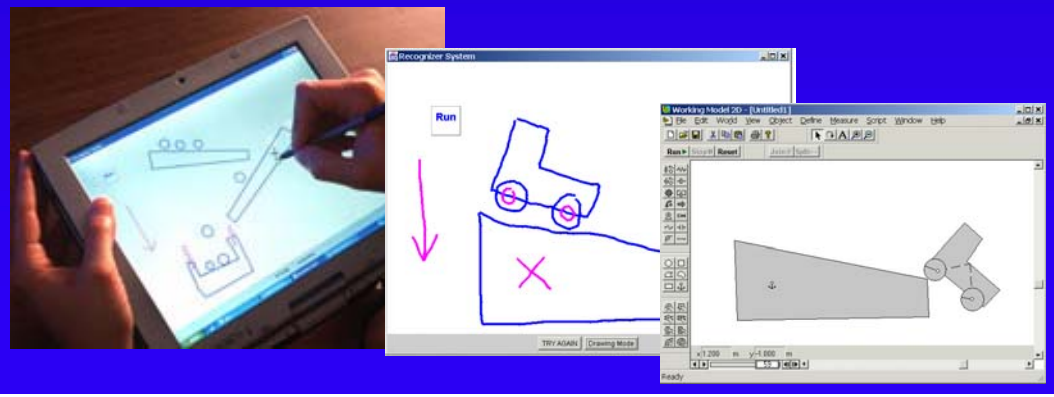
- Handsfree decision support



- Mobile search & retrieval

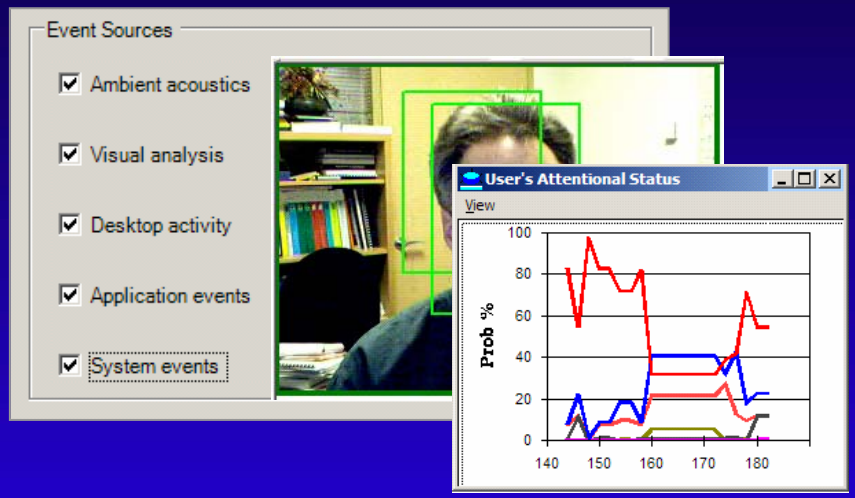


- Natural interaction methods



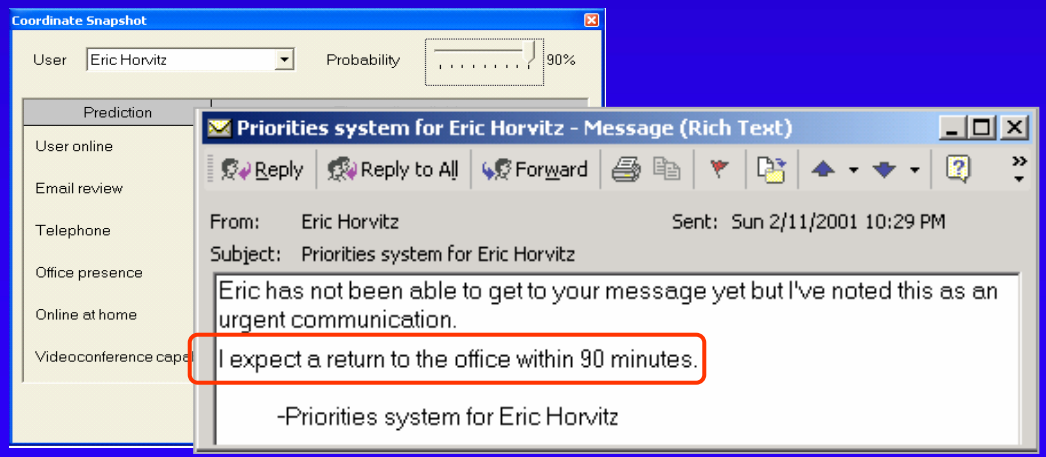
Evolving relationship with computation

- Reasoning about attention



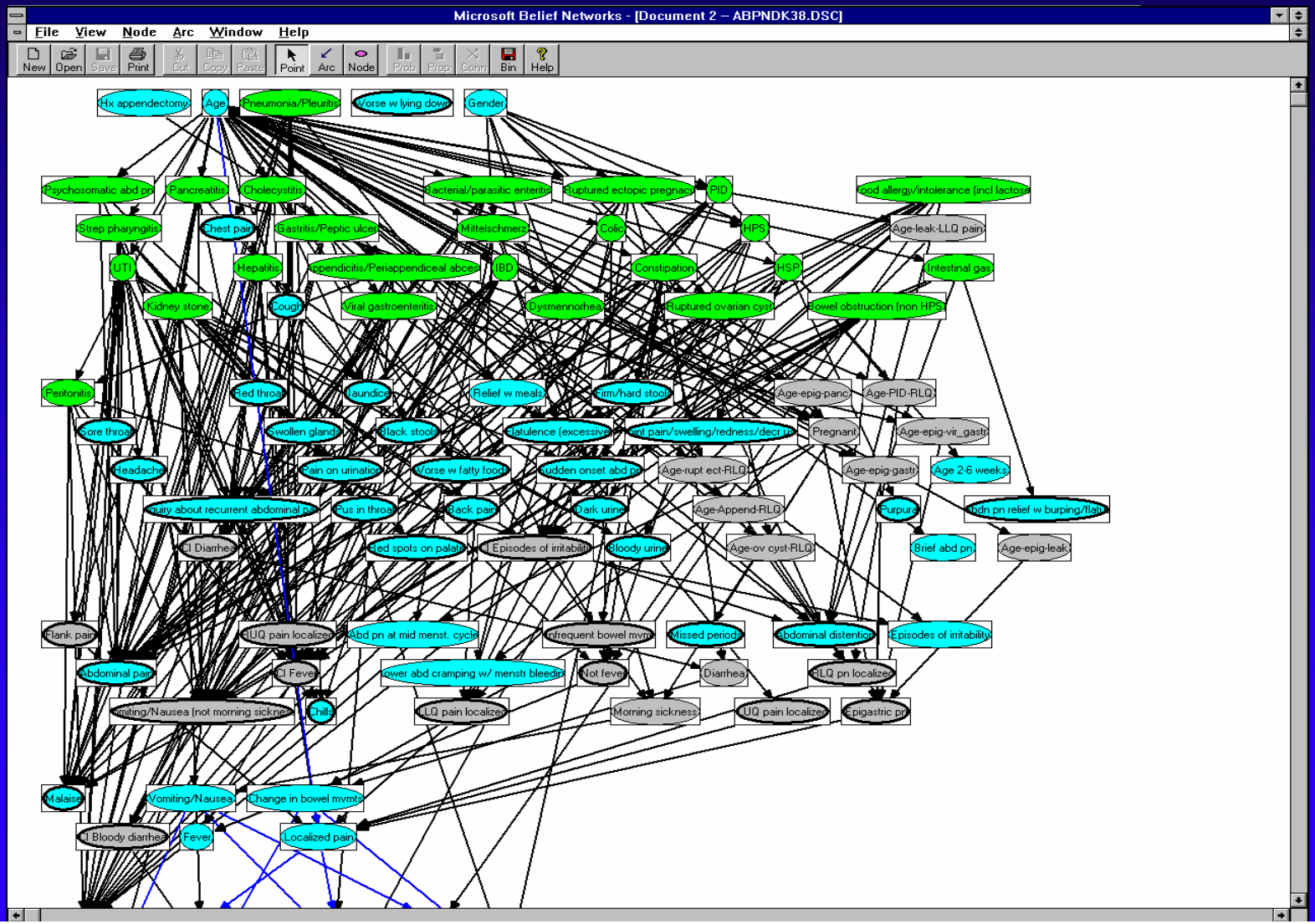
- Facilitating & arranging communications

- Presence forecasting



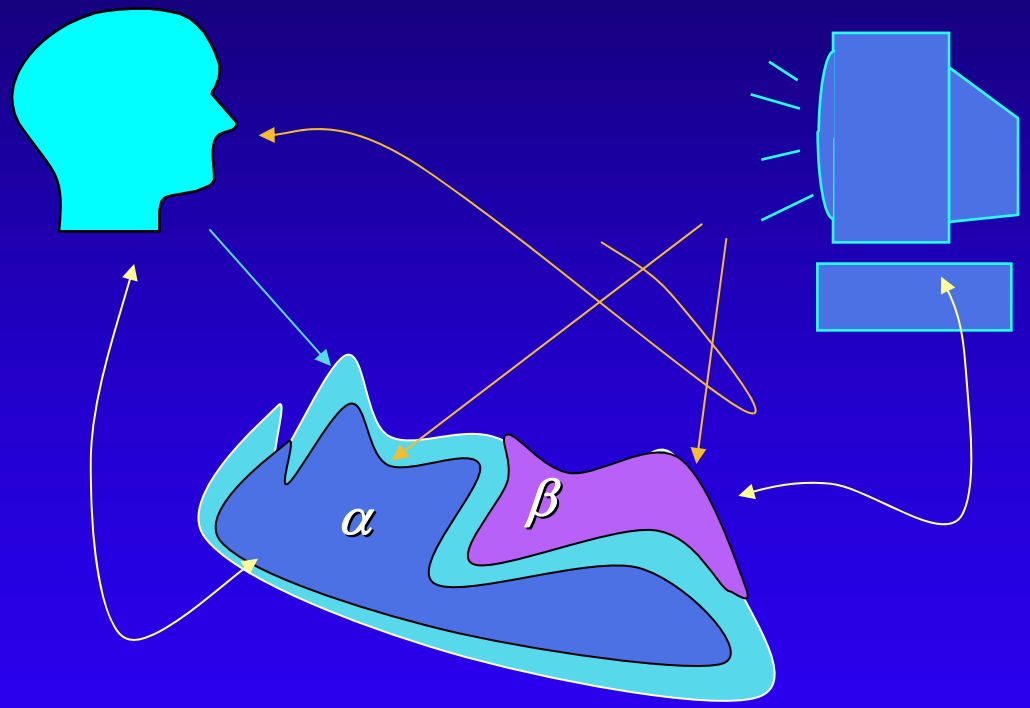
Evolving relationship with computation

- Shift of high-quality expertise and services to consumer



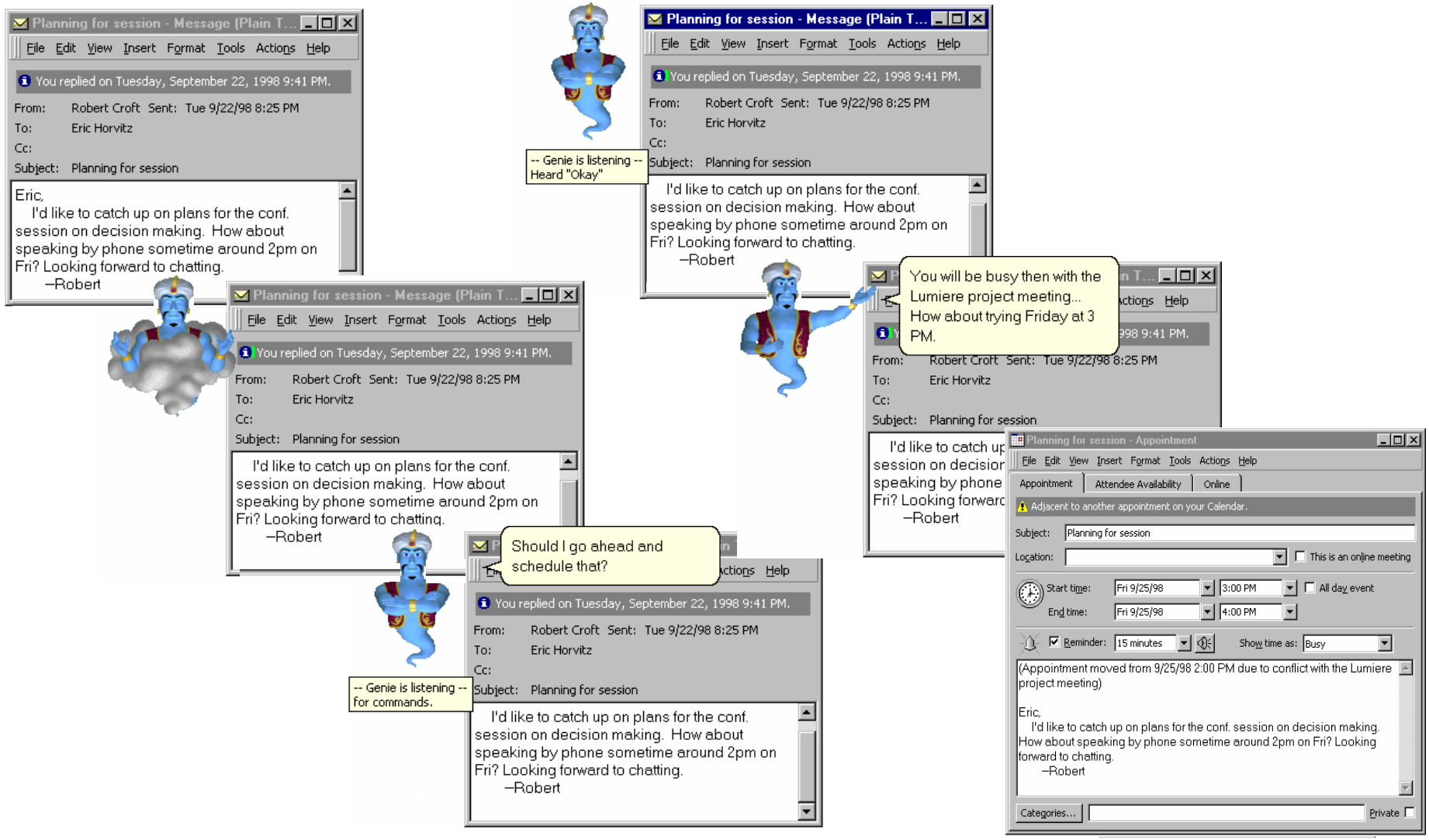
Evolving relationship with computation

- “Mixed-initiative” collaborations



Evolving relationship with computation

- “Mixed-initiative” collaborations



Trends in sensing, reasoning & learning

- Large quantities of data via new sensing and online processes

+

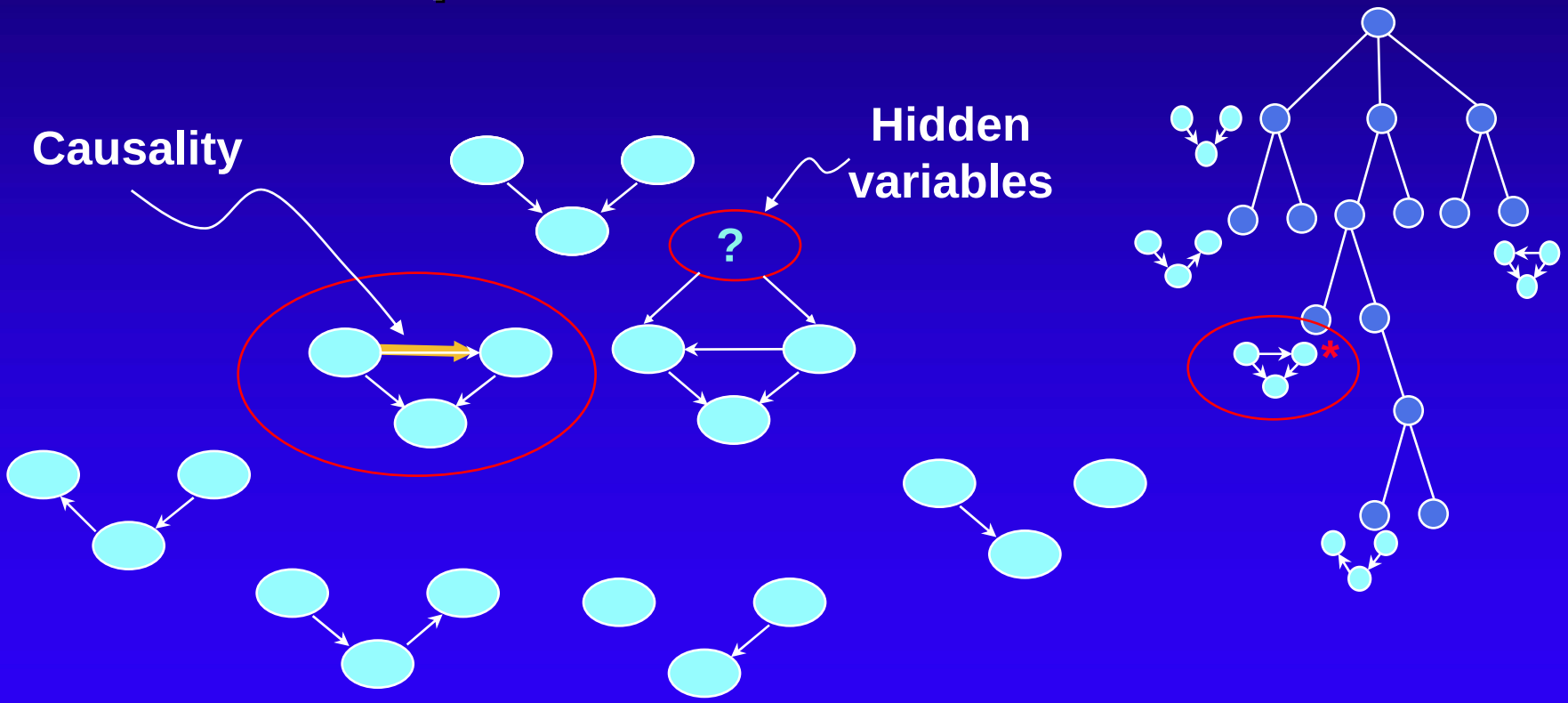
- Advances in tractable machine learning

→ New applications and services

Privacy challenges & opportunities

Advances in Machine Learning

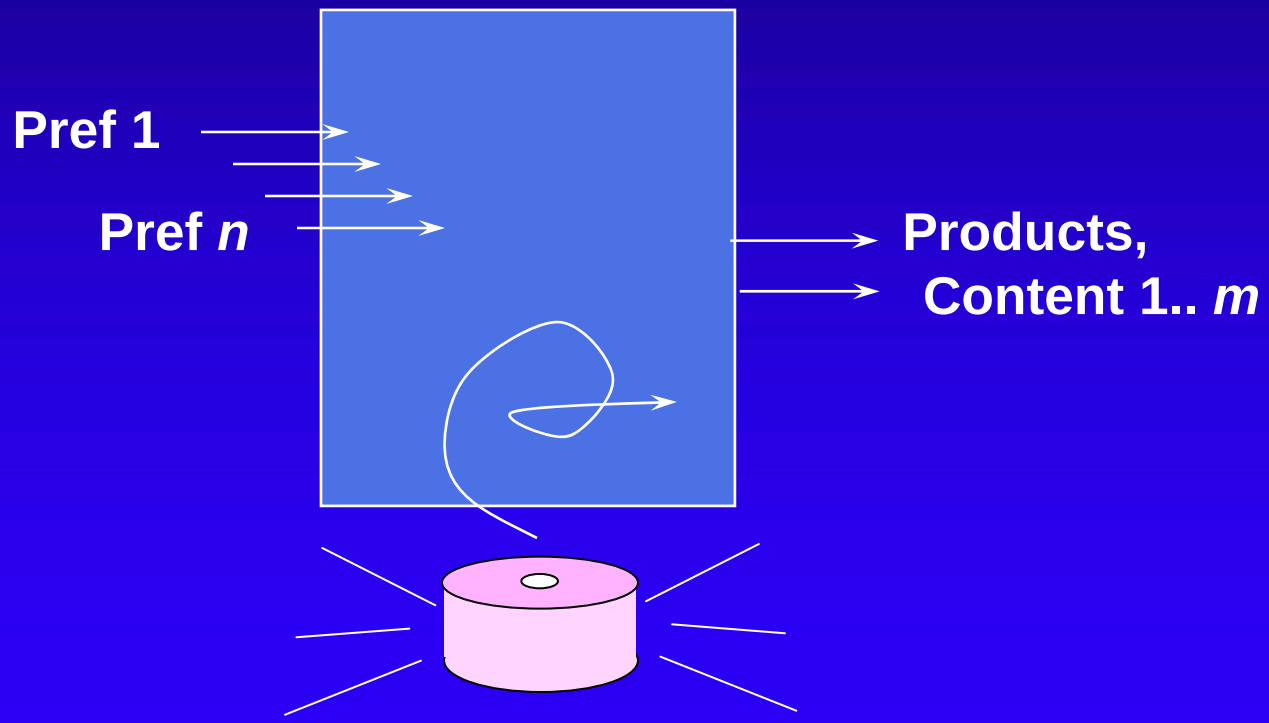
- *e.g.*, Structure search over variables
- Generate and test feasible models
- Build predictive models



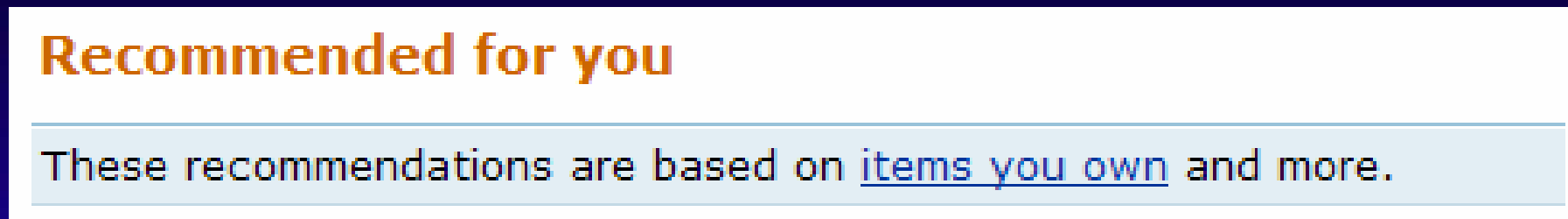
Playing an increasing role in the sciences

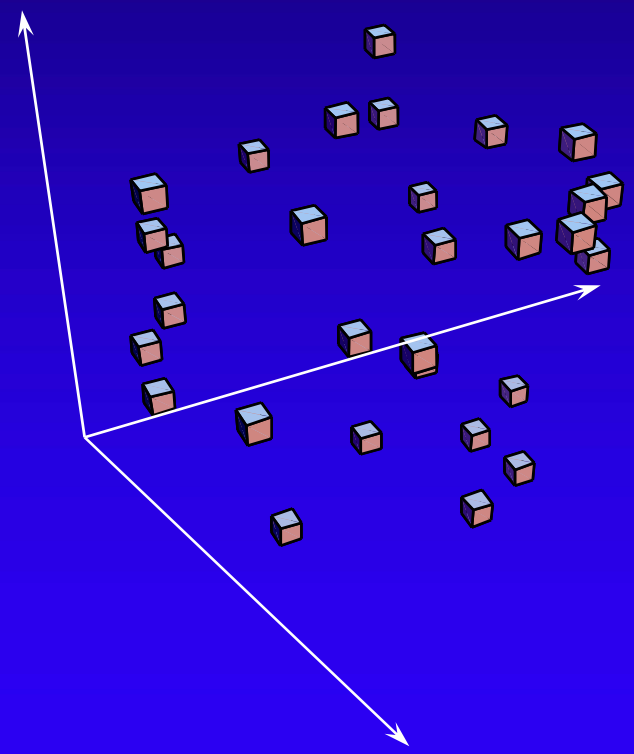
Proliferation of "Preference Machines"

- Example: Collaborative Filtering



Proliferation of Preference Machines

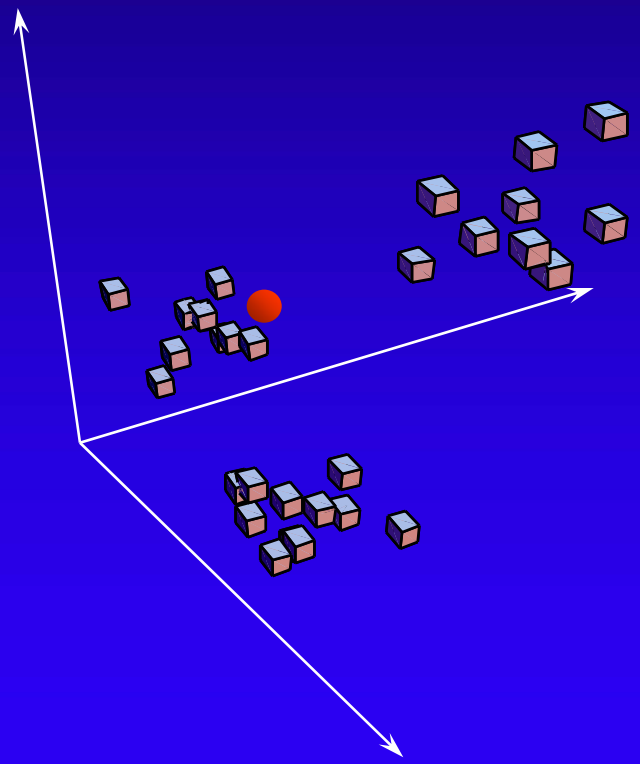




Proliferation of Preference Machines

Recommended for you

These recommendations are based on items you own and more.



Recommended for you

These recommendations are based on items you own and more.

view: **All** | New Releases | Coming Soon — More results

1.

Roman Mysteries 4 (Roman Mysteries)
by Caroline Lawrence
Average Customer Review: ★★★★★
In Stock
Publication Date: April 21, 2005

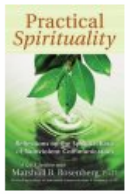
Our Price: $5.99
Used & new from $2.85

Add to cart
Add to Wish List

I Own It Not interested Rate it

Recommended because you purchased Roman Mystery 3 Pirates of Pompeii (Roman Mysteries) and more (edit)

2.



Practical Spirituality: The Spiritual Basis of Nonviolent Communication (Nonviolent Communication Guides)
by Marshall B. Rosenberg
In Stock
Publication Date: April 28, 2005

Our Price: $6.95
Used & new from $2.49

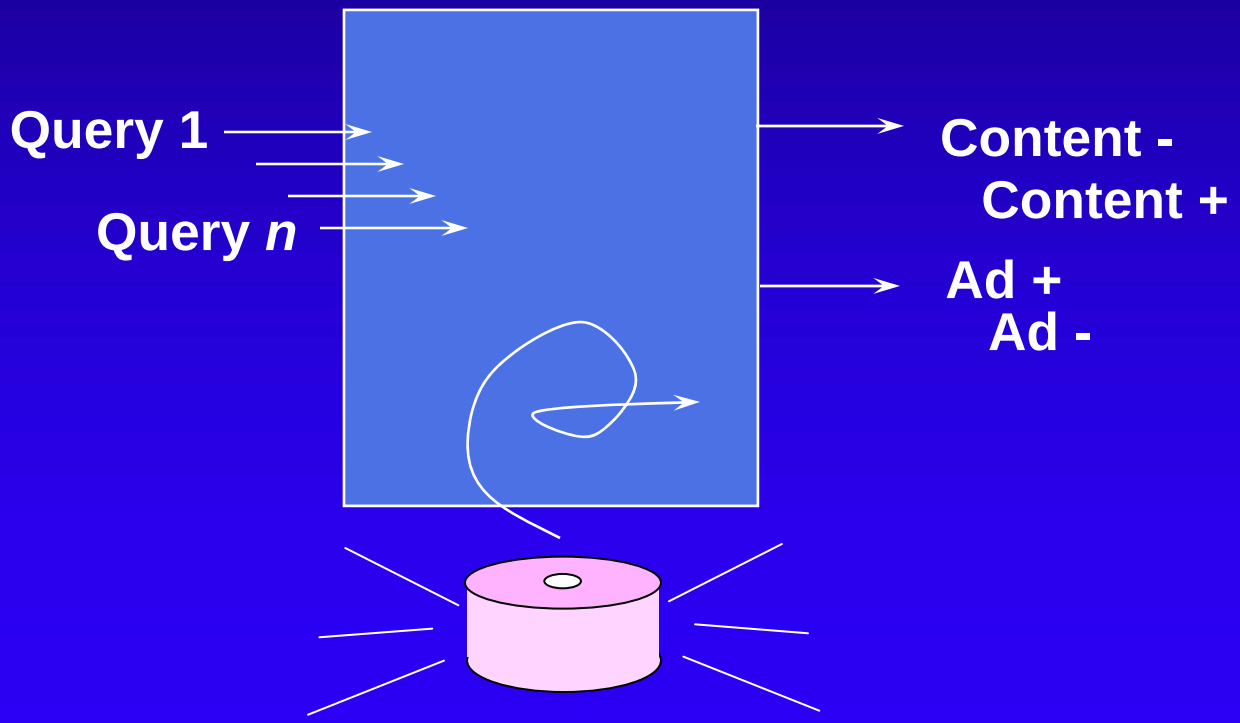
Add to cart
Add to Wish List

I Own It Not interested Rate it

Recommended because you purchased The Surprising Purpose of Anger and more (edit)

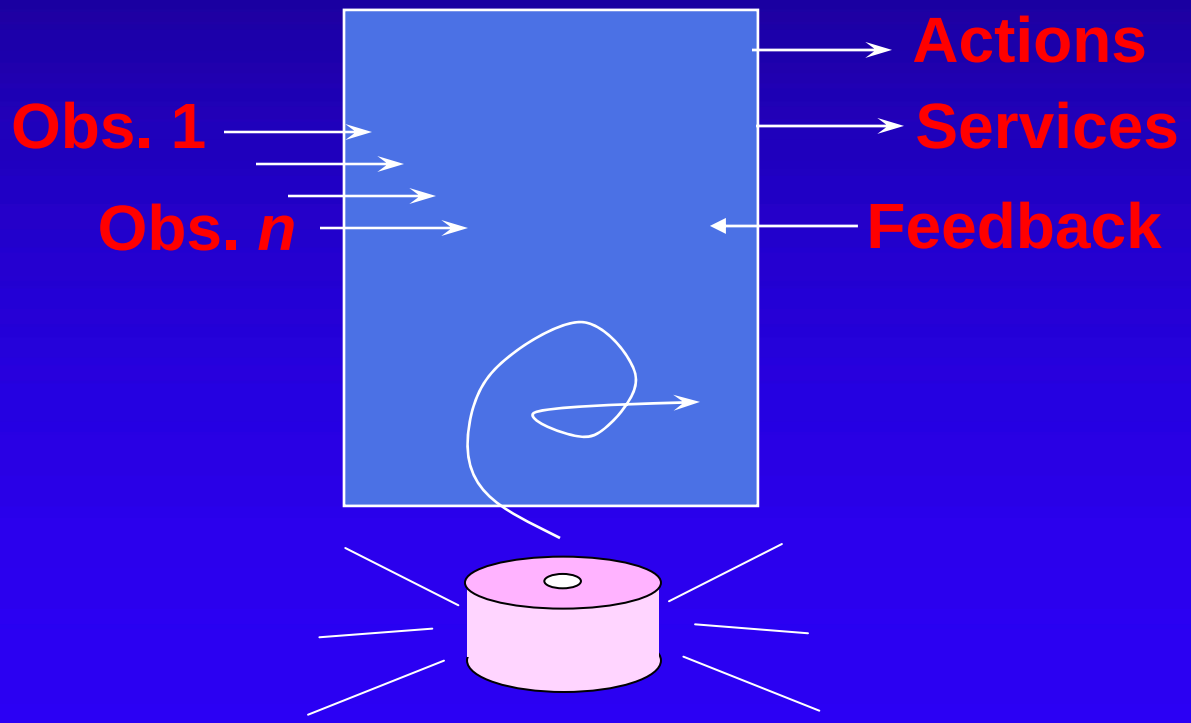
Proliferation of "Intention Machines"

- Example: Web search



Proliferation of "Intention Machines"

- Beyond search… multiple services



Geocentric Services

- Example: Predestination Project

Sensing, Learning, and Privacy

Privacy challenges …and opportunities

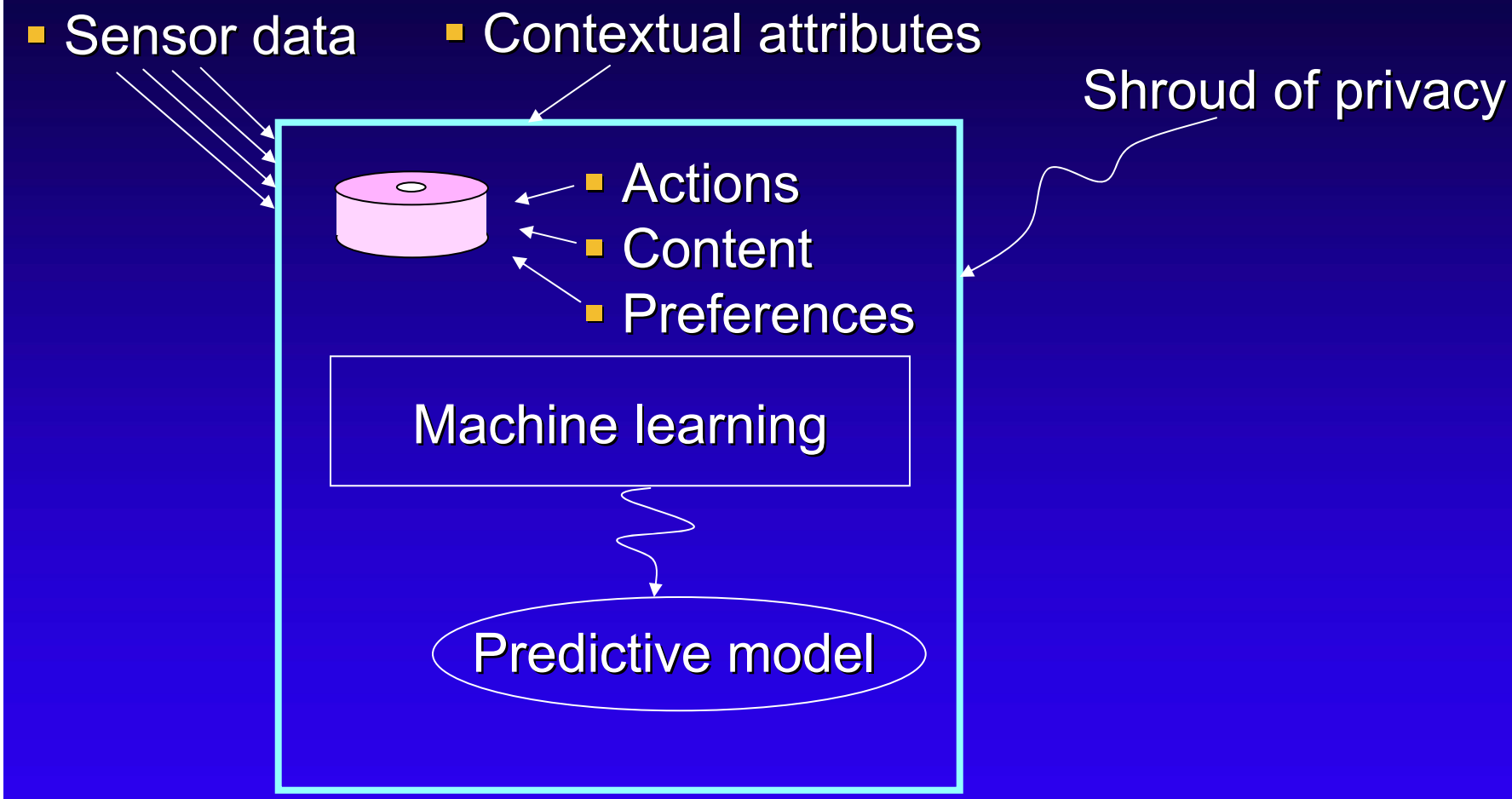
- Protected sensing & personalization
- Learning preferences about privacy
- Proactive inference & modeling
- Enriched parameters & policies for data sharing
- Restricted usage
- Partial revelation

Sensing, Learning, and Privacy

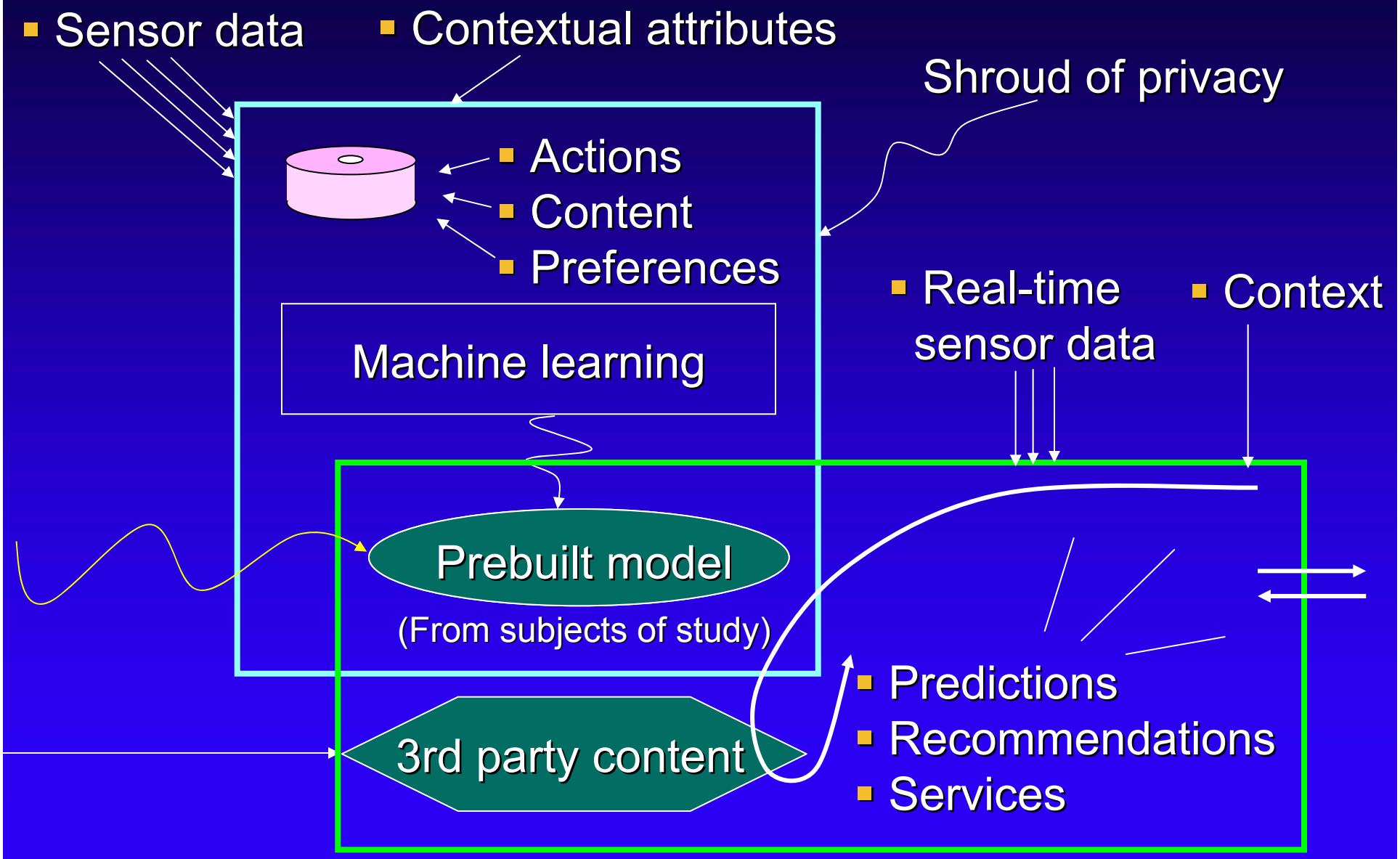
Privacy challenges …and opportunities

- **Protected sensing & personalization**
  - Local sensing, learning, and inferencing within privacy of users' systems
  - Design of services that share nothing or little externally

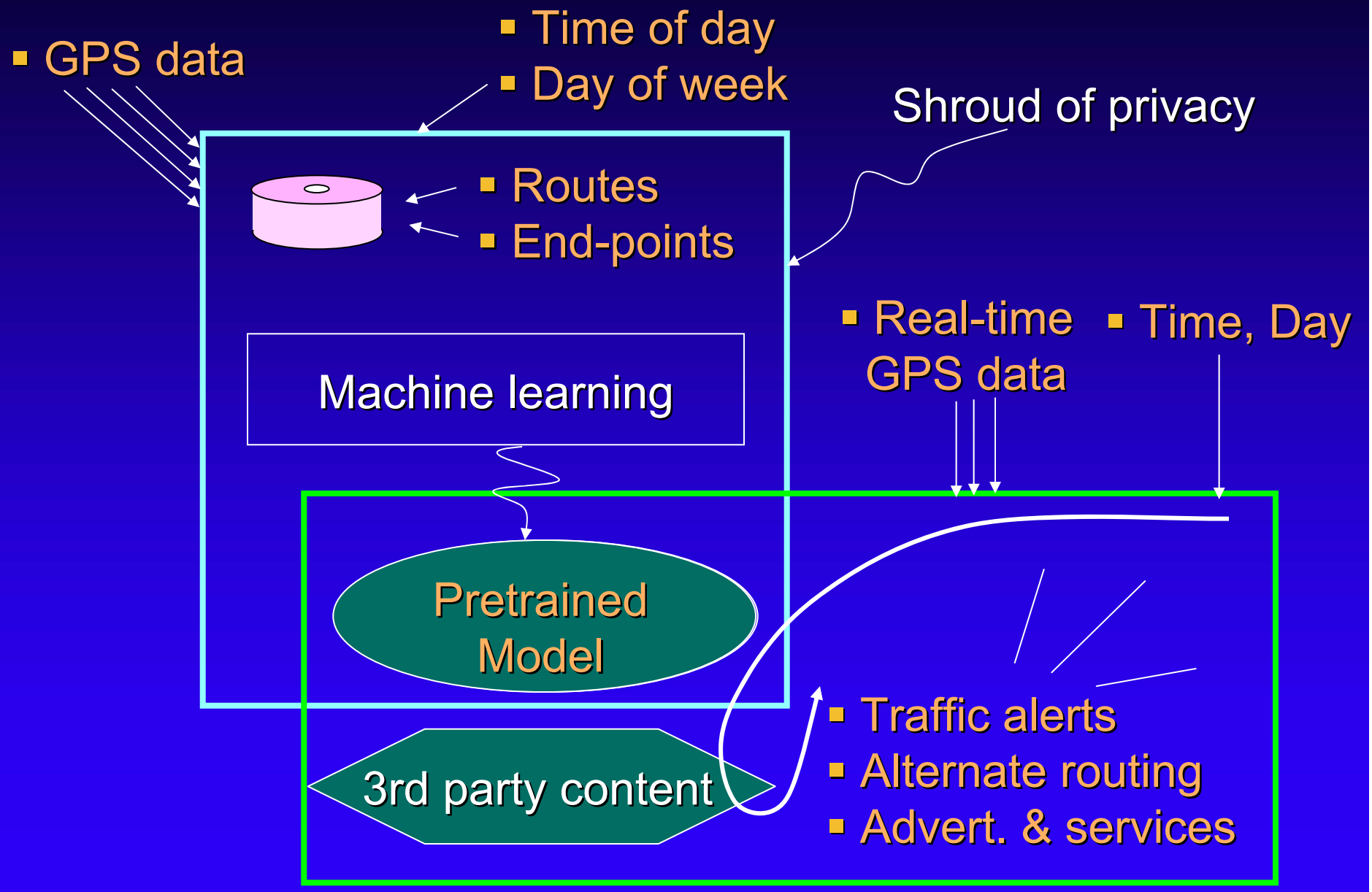
Protected Sensing & Personalization



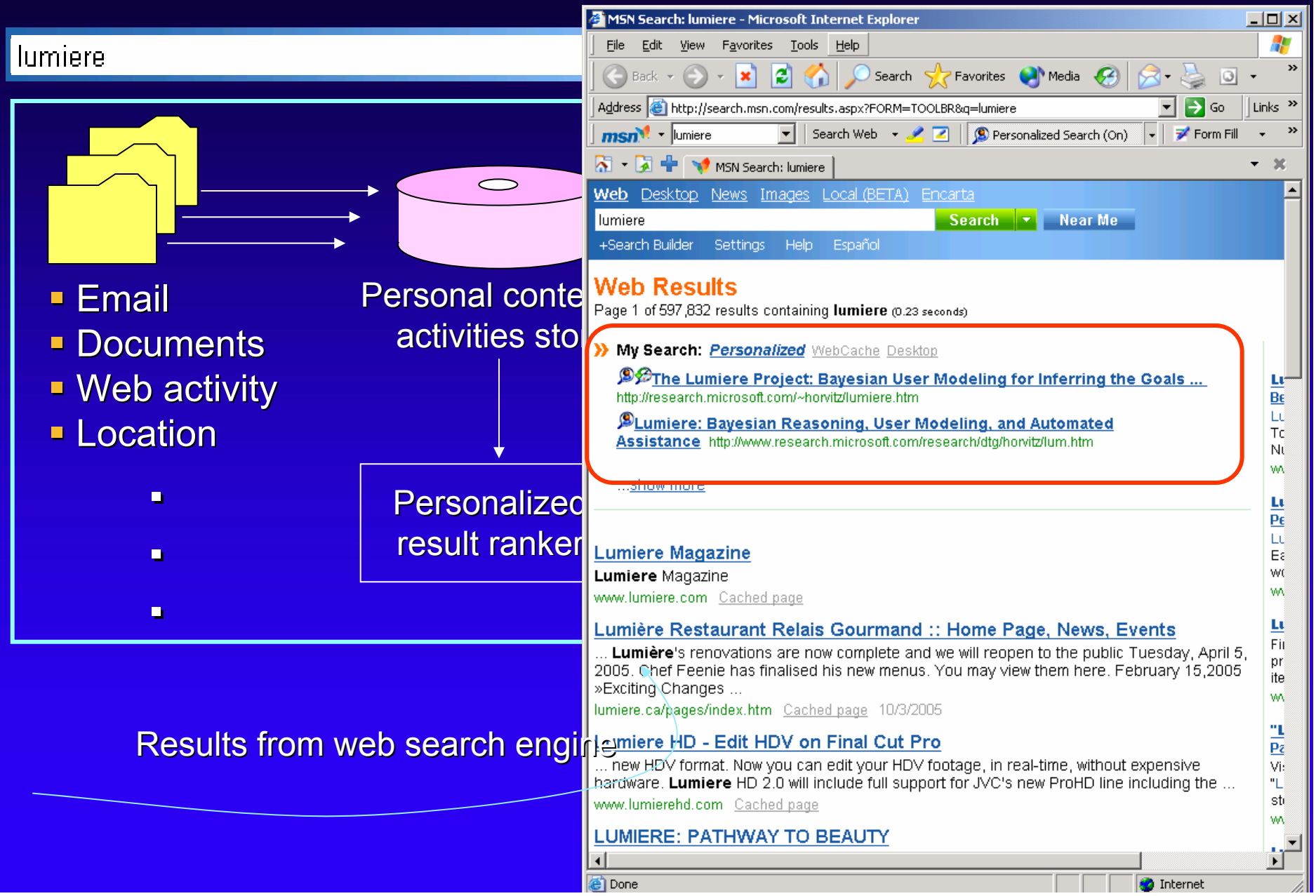
Protected Sensing & Personalization



Example: Geocentric Services



Example: Personalized Web Search

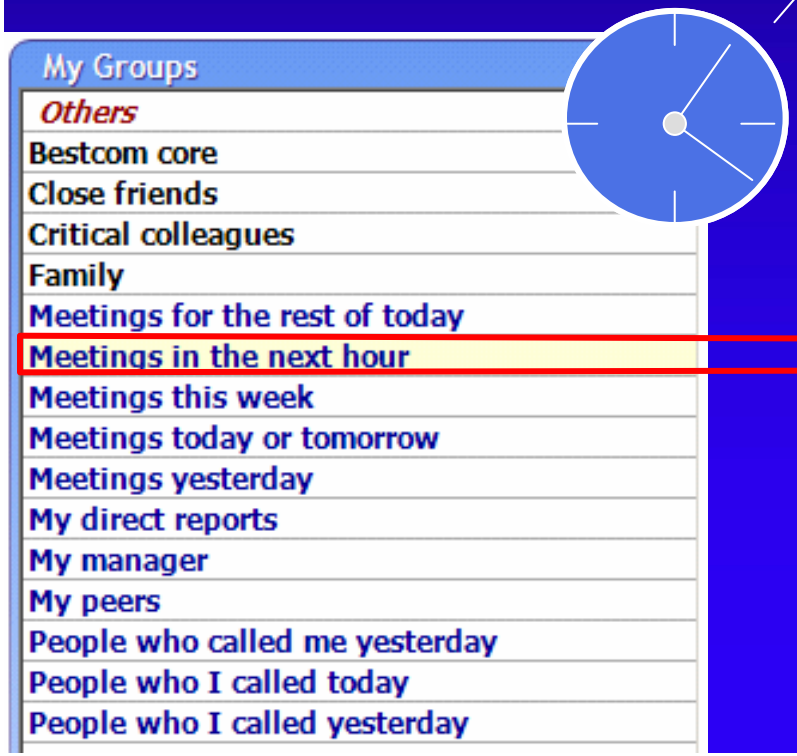


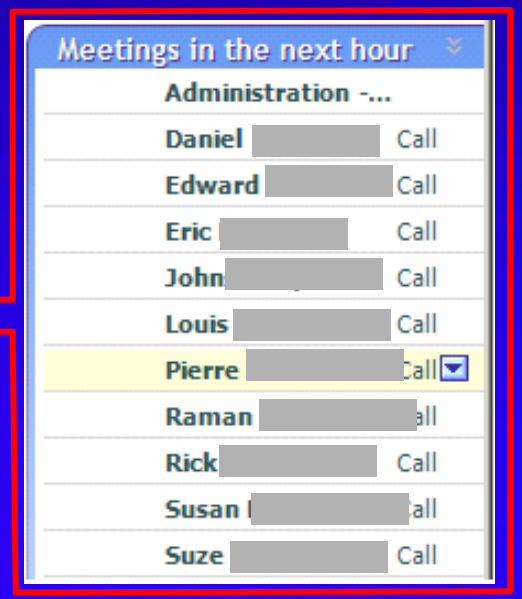
Enriched Policies for Sharing Data & Inferences

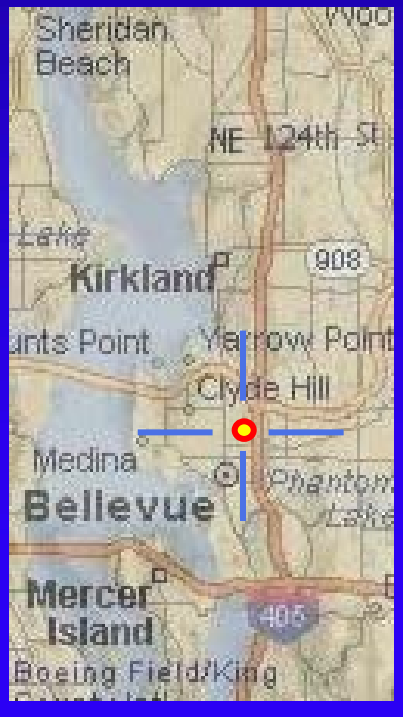
- *E.g.*, Policies set by identity, time, and activity

"If I'm scheduled to see you within an hour…"

- You can access my exact location
- Your calls will be routed to my cell phone
- *Otherwise no location and no call routing.*



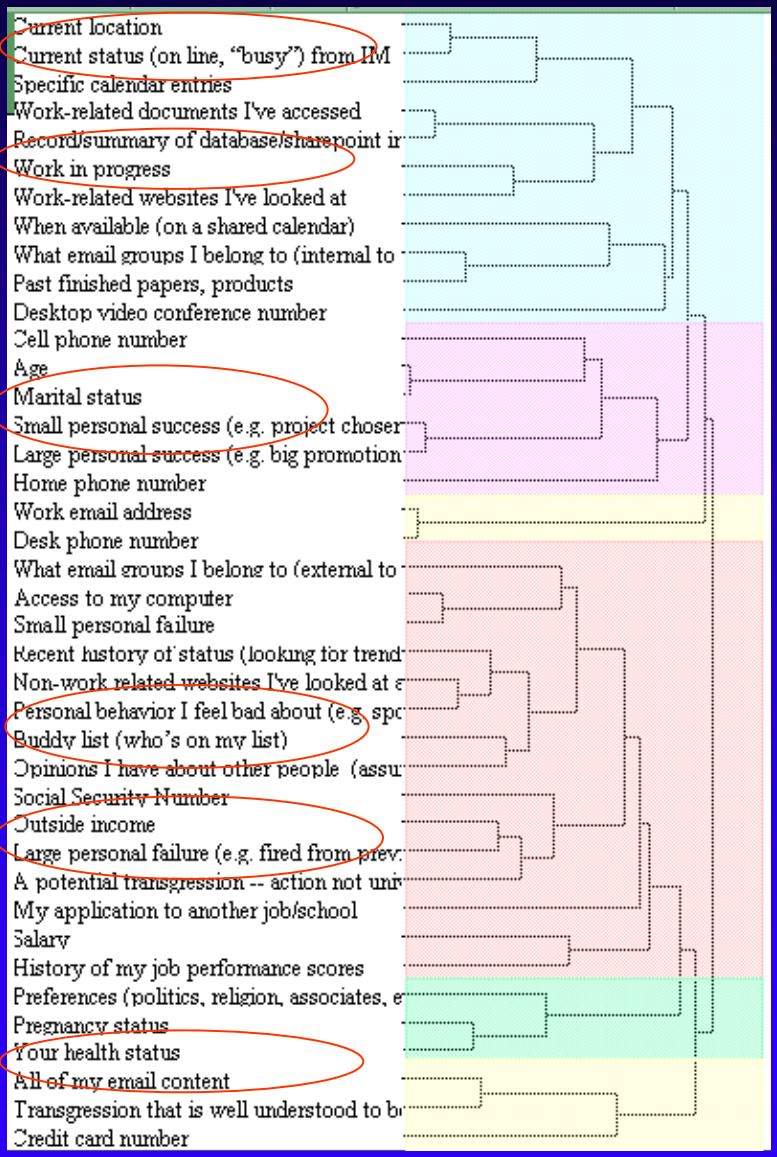




Learning Preferences about Sharing What with Whom

- Variances, differences, similarities

	Salesperson (live or web-based)	Your personal website/blog	Potential or confirmed competitor	Company newsletter	People in an upcoming meeting	People you want to impress (e.g. hire, date)	Corporate lawyer	People in a project for whom it is relevant	People who work for me	Other team members	People in extended family	Young child of yours	Trusted colleague/team member	Sibling	My manager	Adult child of yours	Parent/grandparent	Best friend outside of work	Spouse	Average	Standard Deviation
Transgression that is well understood to be wrong (e.g. accessing pornographical images on a work computer)	1.07	1.50	1.04	1.16	1.17	1.10	1.32	1.23	1.26	1.20	1.34	1.63	1.57	1.61	1.60	1.79	1.82	2.17	2.55	**1.48**	*0.40*
All of my email content	1.07	1.17	1.11	1.20	1.30	1.24	1.64	1.50	1.47	1.43	1.66	1.94	1.73	1.68	2.00	1.57	1.89	2.00	3.10	**1.62**	*0.47*
Credit card number	1.57	1.06	1.00	1.00	1.10	1.10	1.40	1.17	1.40	1.27	1.59	1.59	1.43	1.75	1.47	2.43	2.32	1.83	4.38	**1.62**	*0.78*
Social Security Number	1.30	1.06	1.14	1.08	1.17	1.38	1.80	1.31	1.60	1.47	2.07	2.18	1.80	2.61	2.67	3.14	3.41	2.17	4.45	**1.99**	*0.92*
A potential transgression -- action not universally understood as wrong, more in a gray area (e.g. using your work computer for church activities)	1.10	1.61	1.14	1.36	1.33	1.41	1.68	1.67	1.65	1.80	1.97	2.12	2.30	2.46	2.40	2.93	2.68	2.90	3.69	**2.01**	*0.70*
Outside income	1.48	1.37	1.19	1.21	1.34	1.46	1.79	1.43	1.63	1.52	2.25	2.25	1.76	2.59	1.83	3.14	3.26	2.97	4.36	**2.04**	*0.86*
Salary	1.41	1.28	1.18	1.16	1.17	1.46	2.16	1.17	1.39	1.48	2.07	2.06	2.14	2.52	4.00	2.62	3.11	2.66	4.39	**2.08**	*0.96*
Large personal failure (e.g. fired from previous job)	1.30	1.50	1.25	1.24	1.48	1.46	1.88	1.62	1.58	1.80	2.21	2.59	2.33	2.79	2.47	3.00	3.29	3.33	4.21	**2.17**	*0.85*
Personal behavior I feel bad about (e.g. spoke sharply to a colleague)	1.17	1.56	1.36	1.56	1.70	1.62	2.00	2.00	2.05	2.27	2.28	2.35	2.73	2.68	2.77	2.79	2.89	3.13	3.79	**2.25**	*0.68*
Buddy list (who's on my list)	1.32	1.25	1.55	1.61	1.62	1.70	1.72	1.67	1.93	2.05	2.57	3.21	2.19	3.05	2.33	3.22	3.19	3.10	3.50	**2.25**	*0.75*
Non-work related websites I've looked at at	1.24	1.67	1.57	1.56	1.80	1.83	1.92	1.93	1.79	2.20	2.64	2.76	2.60	2.70	2.60	3.08	2.74	3.17	3.71	**2.29**	*0.66*
Recent history of status (looking for trends)	1.57	1.41	1.62	1.85	2.05	2.05	1.90	2.14	2.13	2.27	2.32	2.87	2.59	2.60	2.73	2.80	2.62	2.68	3.38	**2.29**	*0.51*
History of my job performance scores	1.17	1.29	1.39	1.68	1.53	2.03	2.24	1.80	1.74	1.83	2.28	2.59	2.40	2.96	4.17	3.00	3.07	2.97	4.10	**2.33**	*0.87*
Opinions I have about other people (assume in digital form)	1.43	1.67	1.46	1.56	1.73	1.79	1.56	1.90	1.89	2.03	2.79	2.53	2.50	3.11	2.37	3.43	3.29	3.50	3.97	**2.34**	*0.79*
My application to another job/school	1.33	1.61	1.25	1.44	1.43	1.76	1.52	1.63	1.58	1.67	2.93	2.71	2.30	3.50	1.97	3.71	3.79	3.80	4.62	**2.34**	*1.06*
Access to my computer with personal assurance that they won't look at anything	1.20	1.19	1.29	1.32	1.57	1.69	1.88	1.93	2.53	2.40	2.54	2.71	3.23	2.81	3.37	3.15	3.22	3.14	3.82	**2.37**	*0.84*
Small personal failure (e.g. project missteps that led to failure)	1.30	1.50	1.29	1.48	1.73	2.00	2.08	2.07	2.47	2.43	2.59	2.76	3.03	3.07	3.33	3.21	3.36	3.47	4.03	**2.48**	*0.82*
What email groups I belong to (external to	1.50	1.71	1.59	1.92	2.21	2.21	2.08	2.32	2.29	2.28	2.70	3.00	2.62	3.11	2.62	3.27	3.42	3.59	4.11	**2.56**	*0.71*
Record/summary of database/sharepoint int	1.29	1.29	1.76	1.91	2.73	2.60	2.59	3.00	3.17	3.31	2.59	2.87	3.85	2.90	3.96	2.90	2.95	2.91	3.77	**2.76**	*0.76*
Preferences (politics, religion, associates, etc.) (assume in digital form)	1.70	2.33	1.79	1.72	1.77	2.38	1.84	2.10	2.32	2.33	3.66	3.65	2.90	4.00	2.57	4.07	4.11	4.27	4.52	**2.84**	*1.00*
Work-related documents I've accessed	1.29	1.18	1.79	2.04	2.83	2.76	2.92	3.03	3.42	3.53	2.56	2.94	4.20	2.71	4.23	2.91	3.00	3.08	3.76	**2.85**	*0.84*
Your health status	1.50	1.78	1.96	2.12	2.17	2.24	2.36	2.30	2.50	2.57	3.41	3.47	3.23	3.57	3.10	3.93	3.93	4.03	4.55	**2.88**	*0.88*
Specific calendar entries	1.52	1.78	2.00	2.17	3.07	2.59	2.54	3.17	3.16	3.17	3.08	3.40	3.48	3.36	3.62	3.38	3.40	3.56	4.18	**2.98**	*0.70*
Pregnancy status	1.87	2.11	2.00	2.07	2.27	2.29	2.40	2.33	2.22	2.73	3.73	4.13	3.53	3.79	3.40	3.83	4.00	4.20	4.64	**3.03**	*0.92*
Work in progress	1.32	1.67	1.67	2.16	3.21	3.07	2.96	3.76	3.67	3.72	2.89	3.50	4.21	2.92	4.31	3.17	3.08	3.14	3.78	**3.06**	*0.84*
Desktop video conference number	1.29	1.83	2.50	3.17	3.83	3.20	3.50	4.33	3.33	3.83	3.00	2.75	3.71	3.20	4.29	2.00	3.33	3.17	3.83	**3.16**	*0.81*
Work-related websites I've looked at	1.41	1.72	2.00	2.52	3.20	3.03	3.16	3.60	3.26	3.70	3.39	3.53	4.13	3.33	4.23	3.62	3.37	3.48	4.00	**3.19**	*0.77*
Current location	1.63	1.94	2.11	2.25	3.07	3.07	2.76	3.73	3.26	3.37	3.41	4.06	3.77	3.75	3.70	3.64	3.79	3.83	4.31	**3.23**	*0.76*
Current status (on line, "busy") from IM	1.78	1.82	2.33	2.24	3.18	3.05	2.58	3.45	3.47	3.45	3.77	4.07	3.55	4.05	3.50	3.78	3.86	3.91	4.19	**3.27**	*0.76*
Past finished papers, products	1.55	2.61	2.43	3.24	3.63	3.59	3.64	3.93	3.79	4.13	3.25	3.47	4.43	3.26	4.60	3.31	3.48	3.48	4.00	**3.46**	*0.71*
What email groups I belong to (internal to t	1.45	1.81	2.43	3.32	3.69	3.52	3.76	3.97	4.11	4.33	3.19	3.38	4.63	3.52	4.63	3.58	3.64	3.78	4.08	**3.52**	*0.84*
Small personal success (e.g. project chosen to demo)	1.87	2.50	2.89	3.16	3.23	3.45	3.24	3.47	3.65	3.53	3.72	4.12	4.00	4.07	4.30	4.29	4.25	4.30	4.76	**3.62**	*0.71*
When available (on a shared calendar)	1.67	2.00	2.30	2.61	4.10	3.39	3.29	4.24	4.21	4.07	3.69	4.13	4.38	4.12	4.38	4.00	4.04	4.22	4.59	**3.65**	*0.88*
Home phone number	1.55	1.47	2.07	2.25	2.76	3.32	3.17	3.31	3.44	3.59	4.75	5.00	4.45	4.96	4.59	5.00	4.96	4.93	5.00	**3.71**	*1.25*



Summary

- Efforts in artificial intelligence leading to valuable new services and applications
- Innovations in privacy will be enabling
- AI methods for learning & reasoning promises to play a key role in these innovations