



# The Portolano Expedition in Invisible Computing -- Labscape

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FDIS '00

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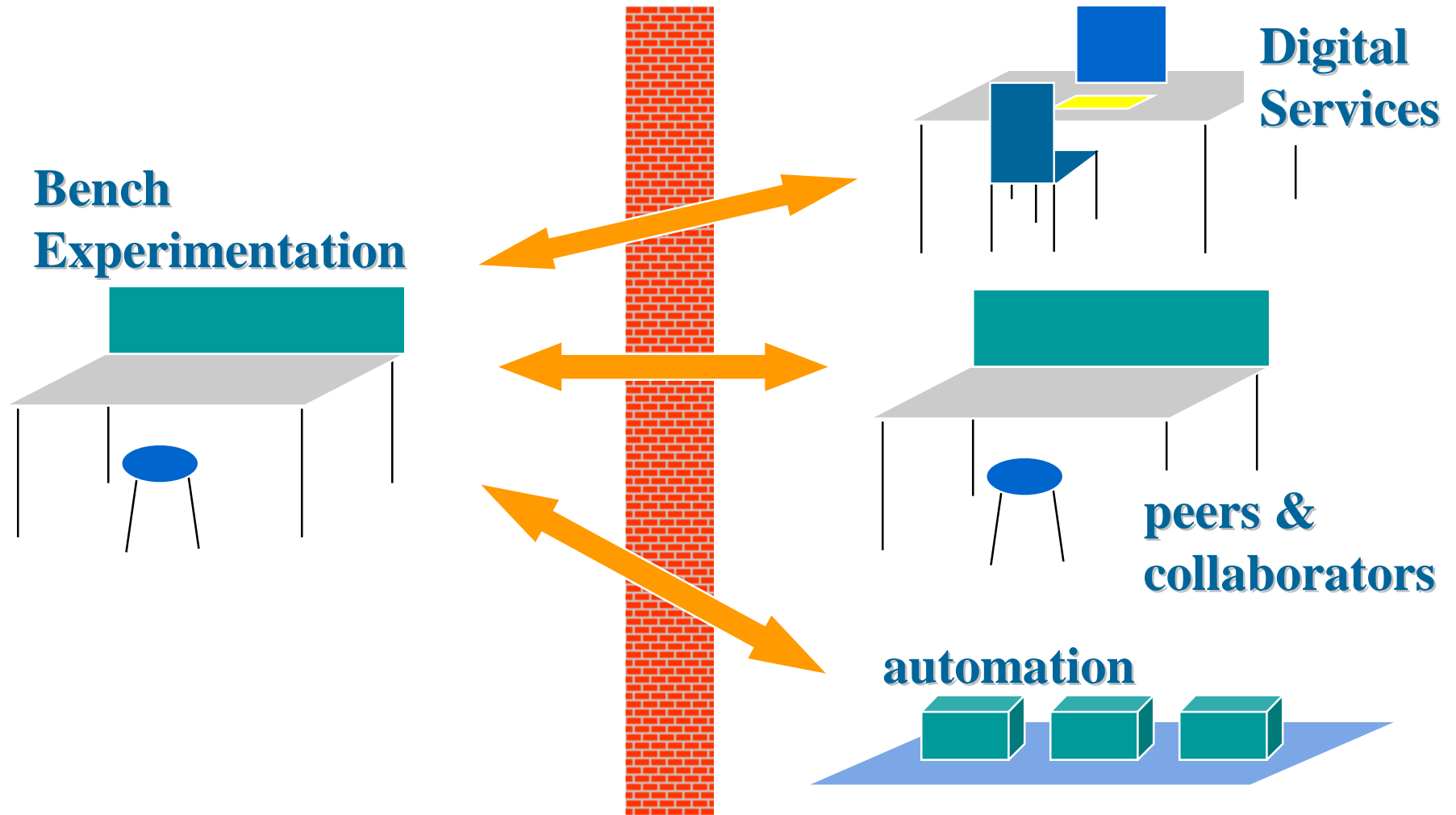
5 June 2000

# Why Micro-Biology

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- fl Rich mix of metal and physical activity
- fl Goal oriented and sophisticated actors
- fl Constrained but not simplified
- fl Potential for huge impact
- fl Domain experts on board

# Breaking Down Barriers

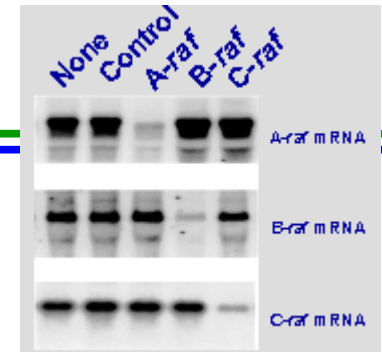


# Example of Drug Discovery

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- f1 Problem: given a set of drug candidates, determine which ones effectively block the expression of a particular gene
  - f1 Expose cells to the drug and various concentrations and under various incubation conditions/times
  - f1 Destroy the cells and separate RNA from the rest of the stuff (variety of methods)
  - f1 Analyze the results to see if the particular gene is active (corresponding RNA exists). The result is an image that shows concentration of the selected RNA for each given sample
- f1 A dilemma: Flexible or High Volume?

# Interview w/ A Biologist



Q What data is currently recorded and how

A A few parameters of the experiment on scratch paper. Transferred to lab notebook every week or two. Onerous task, considered to be overhead.

Q How many parameters are there in performing this experiment?

A Lots.

Q How reproducible are the results.

A Pretty good. Especially if it's the *same researcher*. maybe is same lab.

# Interview Continued

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Q Do you ever wish you had recorded something else in your lab notebook

A No, only when I have to prepare a report or give a presentation about it. Then I need more information. (Working with others)

Q Don't you have trouble coordinating with other scientists?

A No...we each work on a separate disease/gene!

Q What do you need to know about somebody else's experiment:

A Pretty much what is contained in the "materials and methods" section of the paper.

# Observations

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1. Lab-notebook maintenance is not really overhead even for the maintainer. But it is a dead-end. Cannot **mine this data** or help w/ **experiment design**.
2. Lab work is like software development, but without any project management tools or shared data. Very small teams, low bandwidth communication.
3. A ubiquitous computing environment for biologists should merge seamlessly with flexible and adaptable automation.
4. Ubiquitous solutions must be **GENERAL** so that no engineering is required to change things. Generalization **is** the research problem. **Generalization to other domains as well.**
5. There are **gnarly** real world problems...like capturing activities, tracking stuff, etc..

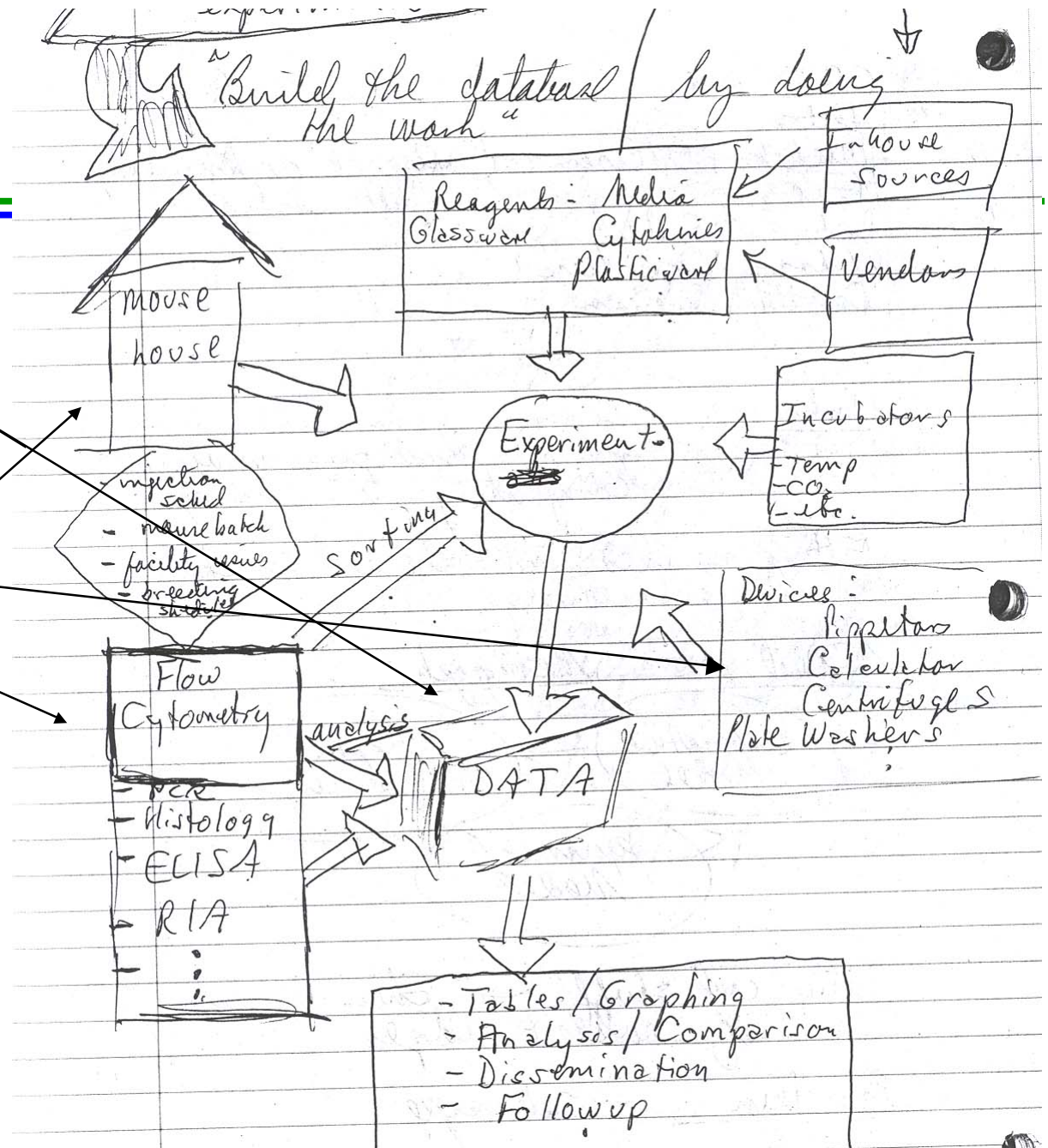
# What Biologists Want

Normally, all we have is the data, off-line and unsearchable

We want the data AND the meta-data

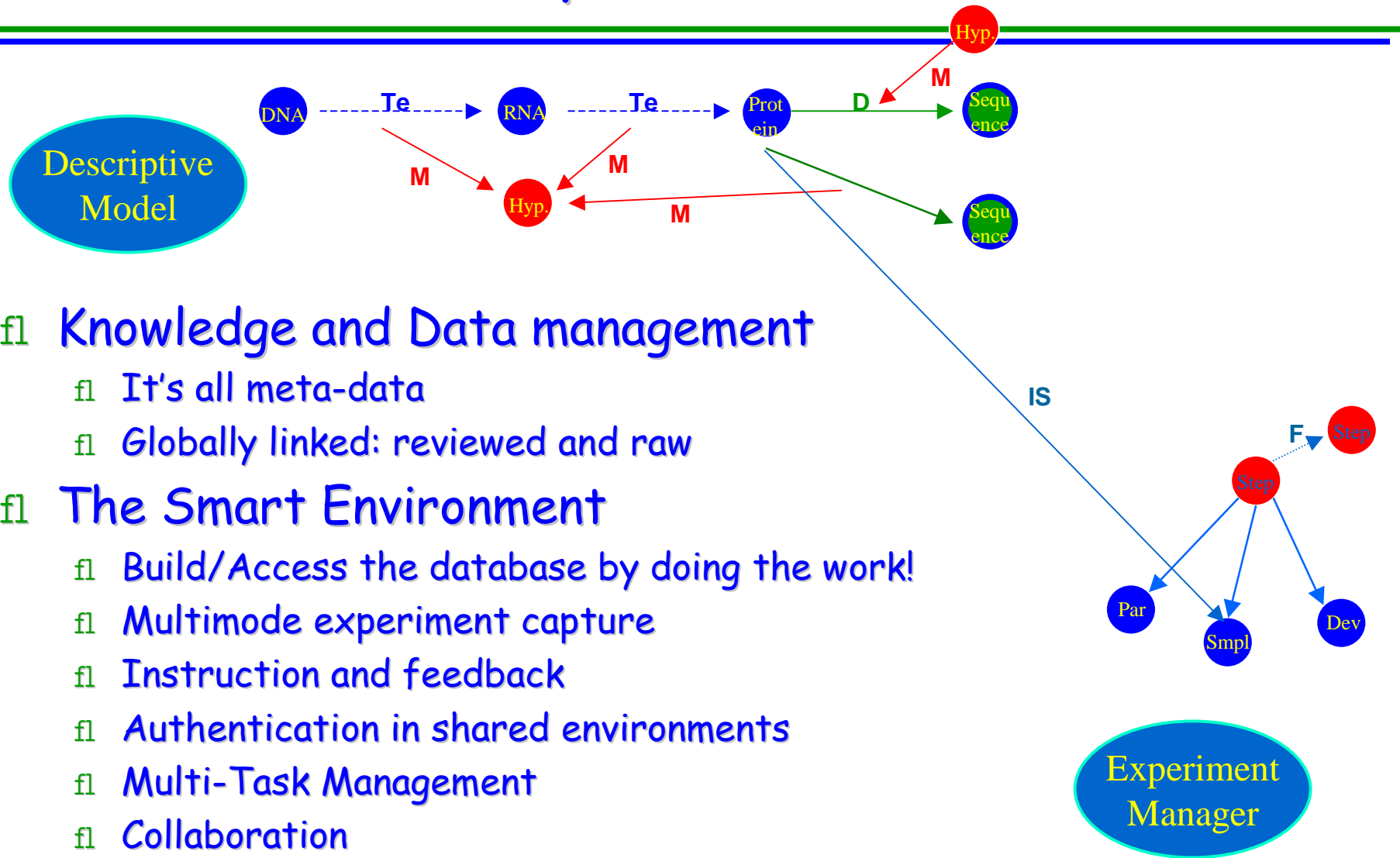
There are no mistakes in the lab if there are no assumptions about what happened!

Build the database by doing the work





# Scope of Issues



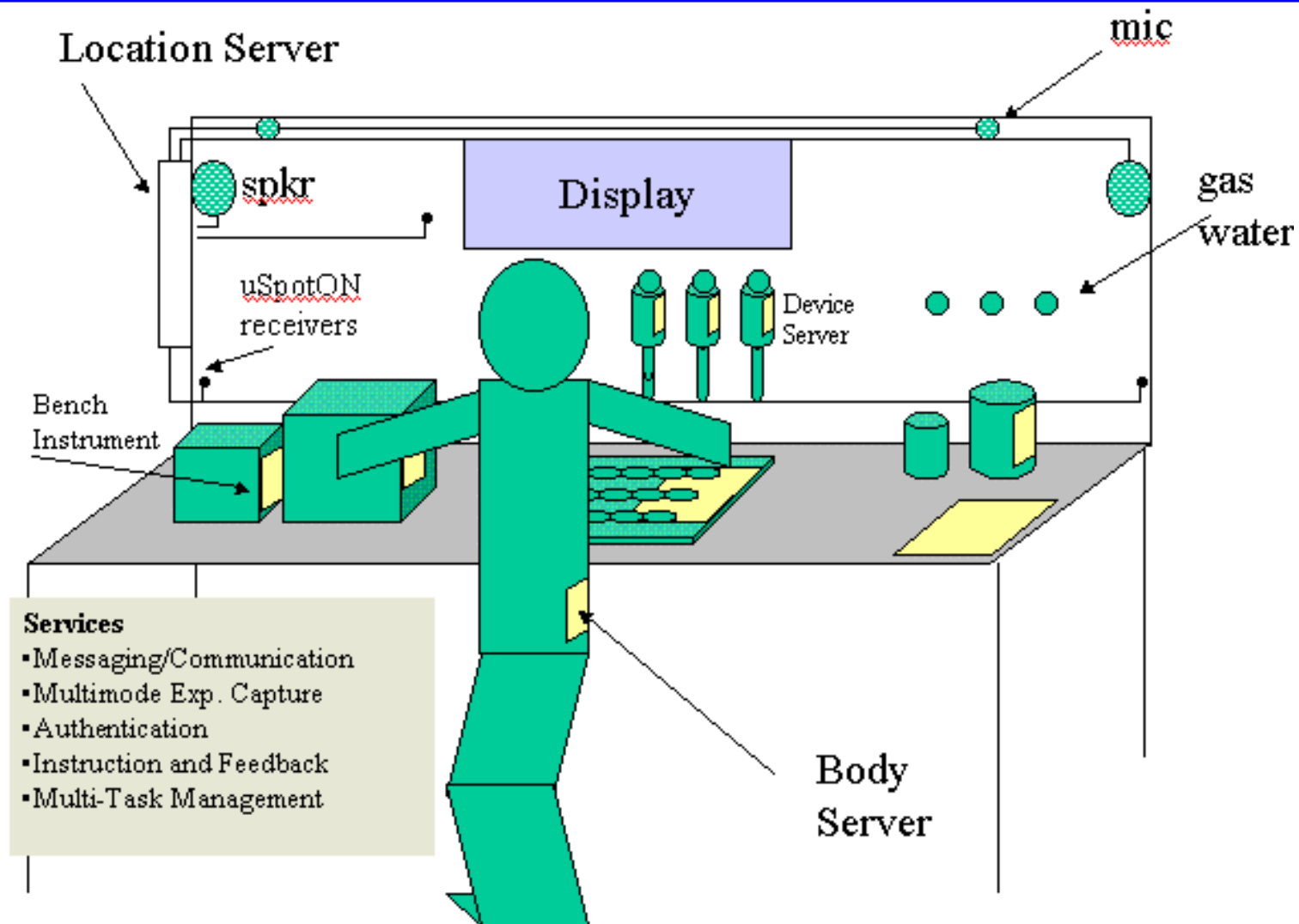
## f1 Knowledge and Data management

- f1 It's all meta-data
- f1 Globally linked: reviewed and raw

## f1 The Smart Environment

- f1 Build/Access the database by doing the work!
- f1 Multimode experiment capture
- f1 Instruction and feedback
- f1 Authentication in shared environments
- f1 Multi-Task Management
- f1 Collaboration

# Portolano Technologies



# Deeply Tied to Other Protolano Projects

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## f1 Body Com

- f1 Ties events and tools to people
- f1 An important back-channel for the wired infrastructure.
- f1 Great for security in shared spaces
- f1 Lab bench tools and resources become personal devices. Your data stays with you.

## f1 Location Tracking

- f1 Spot-on for room-scale location tracking and orientation
- f1 Phase comparator for fine grained location tracking (bench scale)
- f1 New faculty member Dieter Fox has AI techniques for probabilistic sensor fusion to solve location tracking problems. Extracting A LOT of information from crude measurements.

## f1 Hendrix

- f1 Hands free continuous contact to your info/media stream.
- f1 Arbitration for I/O resources with others

# Primary Collaborators

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- fl Cell System Initiative (UW School of Medicine)
- fl Isis Pharmaceuticals
- fl Immunex Corporation

# Things to Consider

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- f1 Paradigm shift in the laboratory
  - f1 micro-fluidics, elimination of manual steps in the experimental process
  - f1 flexible automation (indistinguishable from invisible computing?)
  - f1 Single cell experiments becoming more important. What does this mean for manual procedures in the lab?
- f1 Are the data capture barriers insurmountable?
  - f1 Maybe the manual stuff is just “practice” for the high throughput stuff.
  - f1 Start with speech and some location tracking
- f1 Be Scientific
  - f1 Do some experiments!

# Impact

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- f1 Make biology fun - attract top people
- f1 Get better results faster
- f1 Apply computation
  - f1 data mining
  - f1 modeling