Physical Access Control

Information Disclosure in a Community-Oriented RFID Deployment

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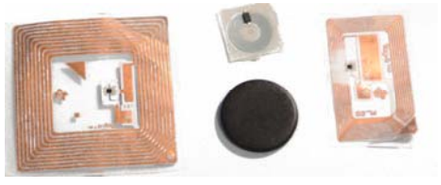
Computer Science & Engineering
University of Washington

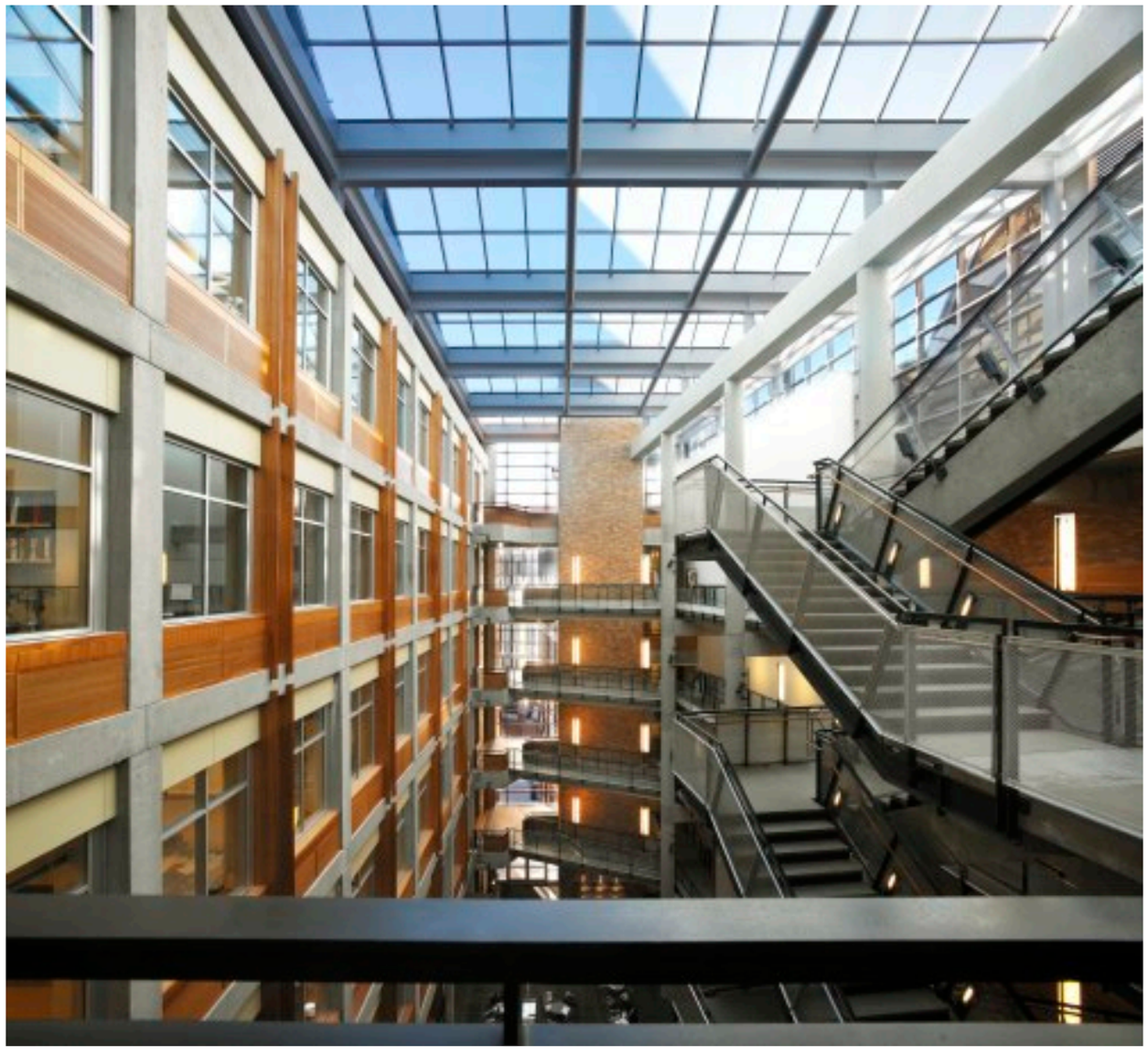
The RFID Ecosystem

- RFID allows tracking of tagged objects
  - tags and readers/antennas
  - readers communicate with a central database

RFID tags



RFID antenna



Paul Allen Center for Computer Science and Engineering, Seattle, WA
image from cs.washington.edu

2

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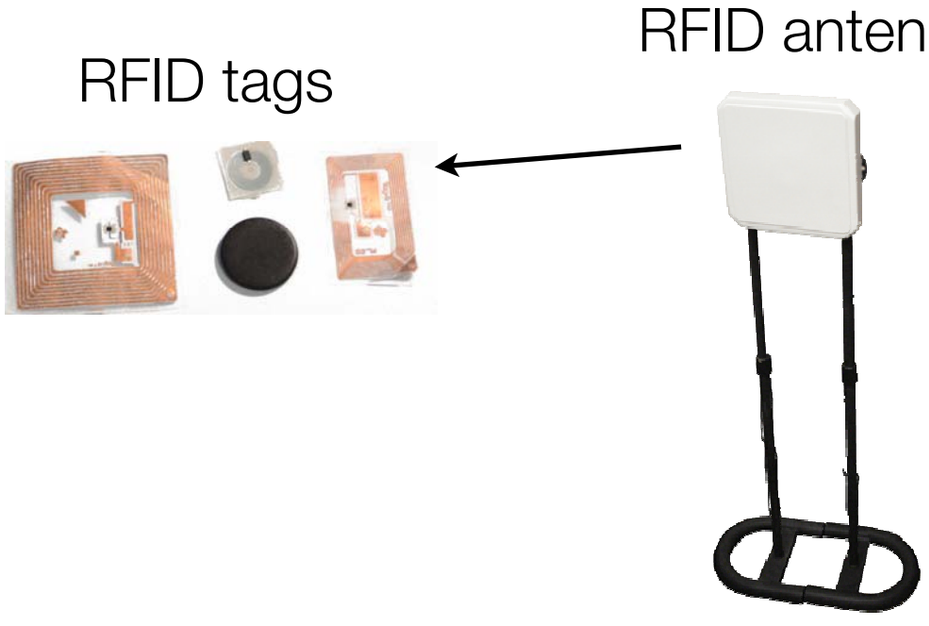

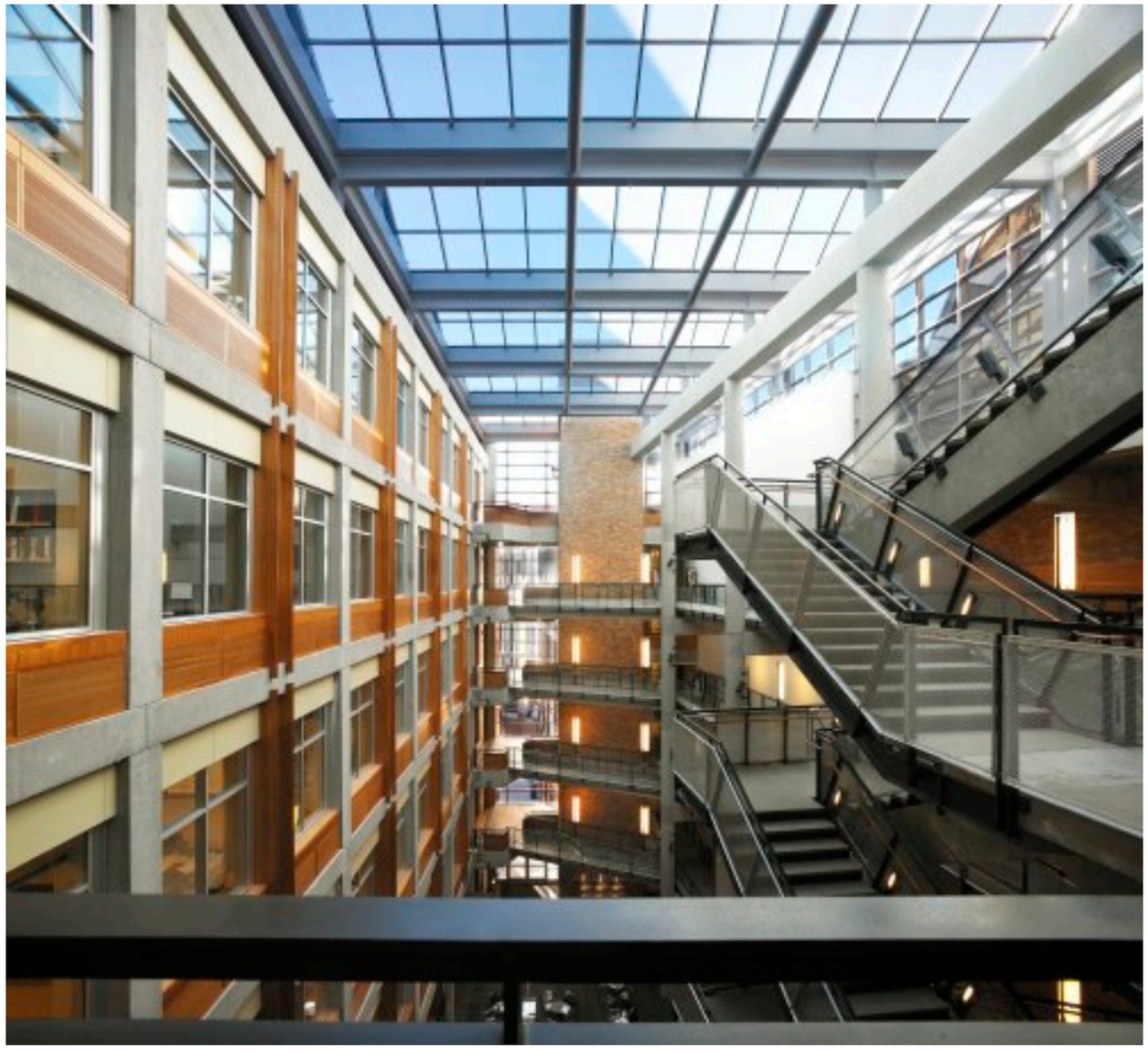

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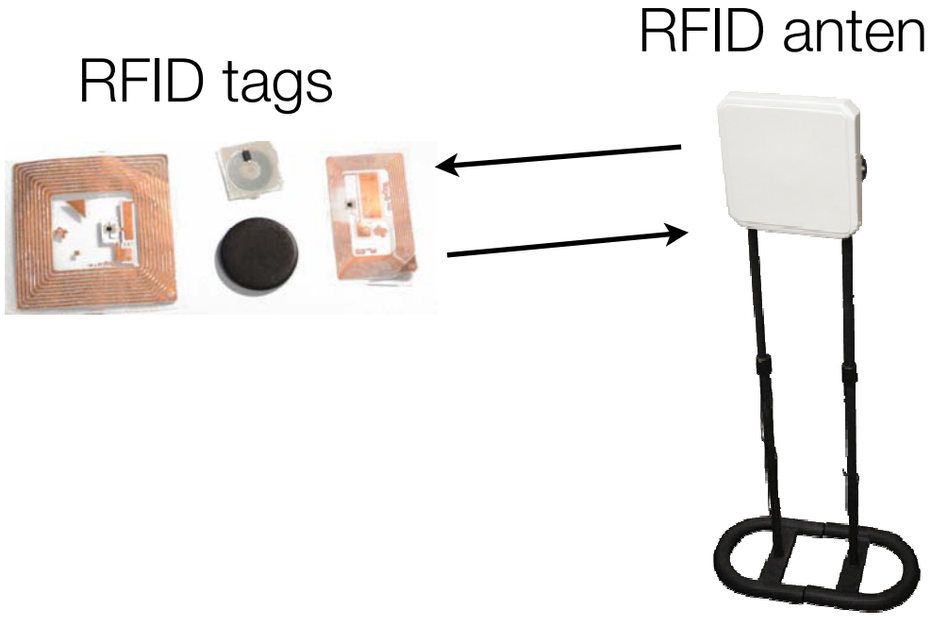

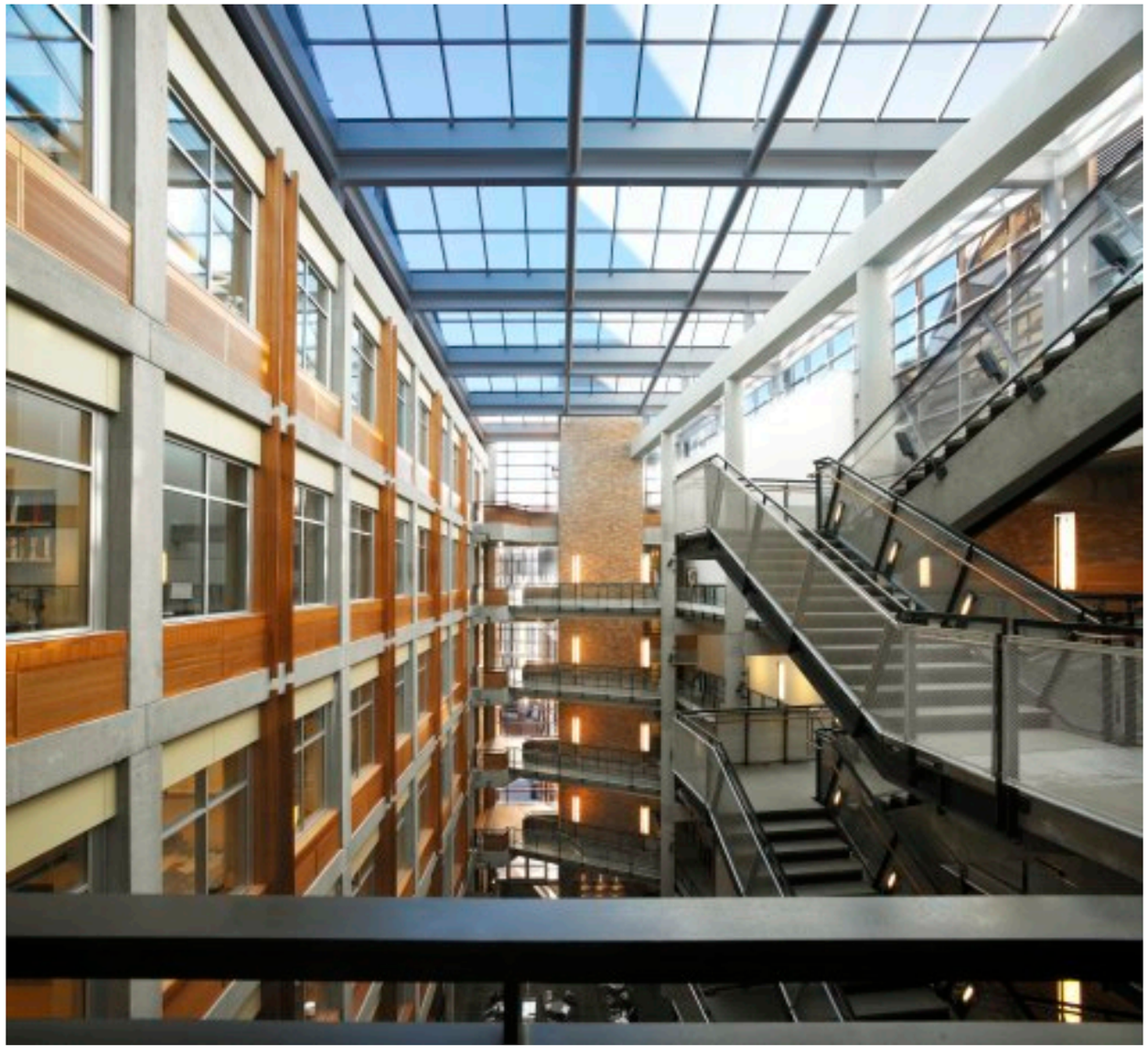

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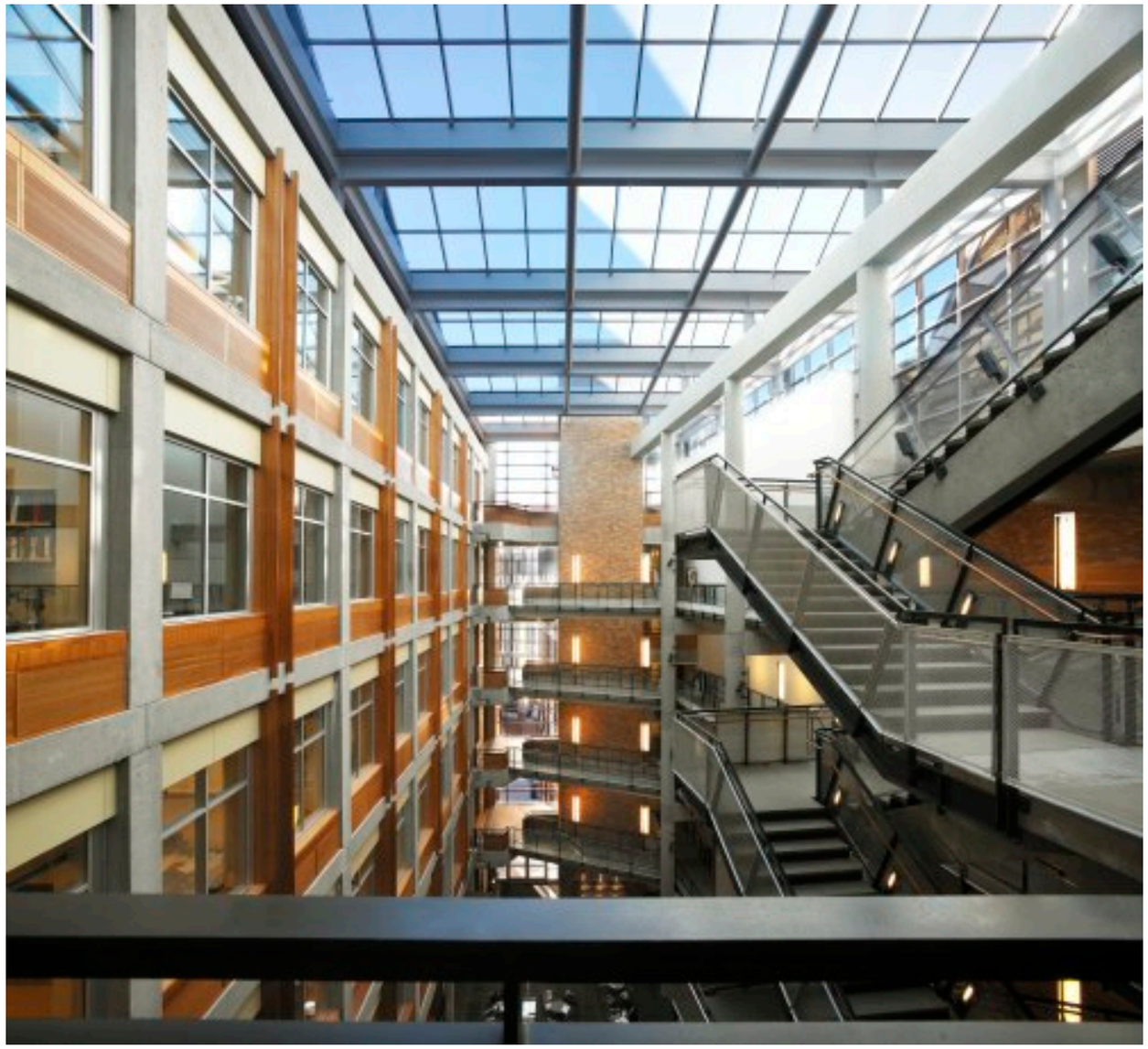
2

The RFID Ecosystem

- a building-wide RFID infrastructure
  - 300 RFID reader antennas
  - people carry personal tags
  - hundreds of tagged objects
- long-term research test bed



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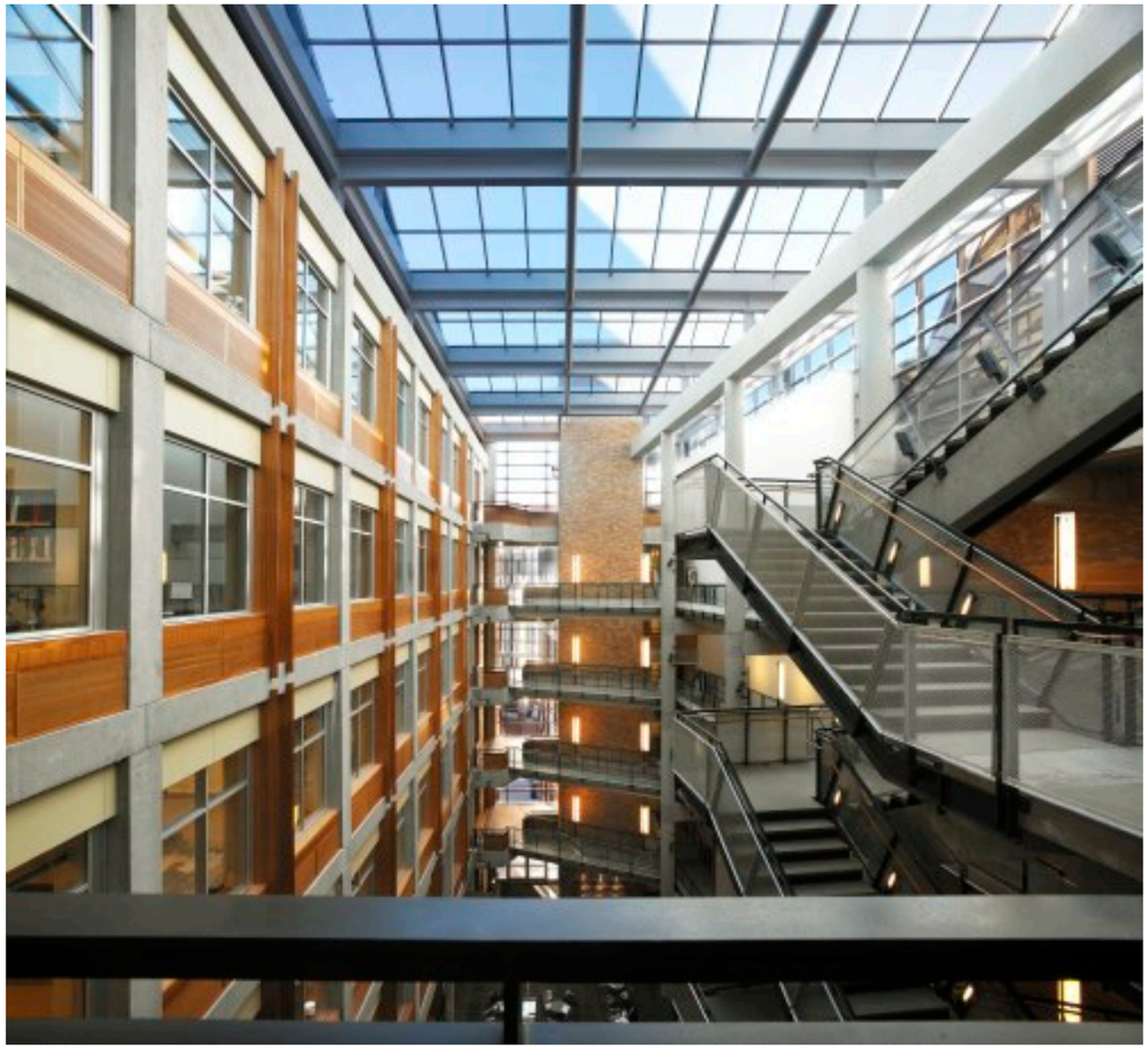
The RFID Ecosystem

- create information-rich environments that empower people
- allows applications such as an object or friend finder, personal reminders, and event notification
- complex social space
- useful applications require information to be disseminated
- information is actionable will likely impact social dynamics



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4

A pervasive dilemma...privacy vs. utility

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divulge no information

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all phenomena recorded, indexed, and shared

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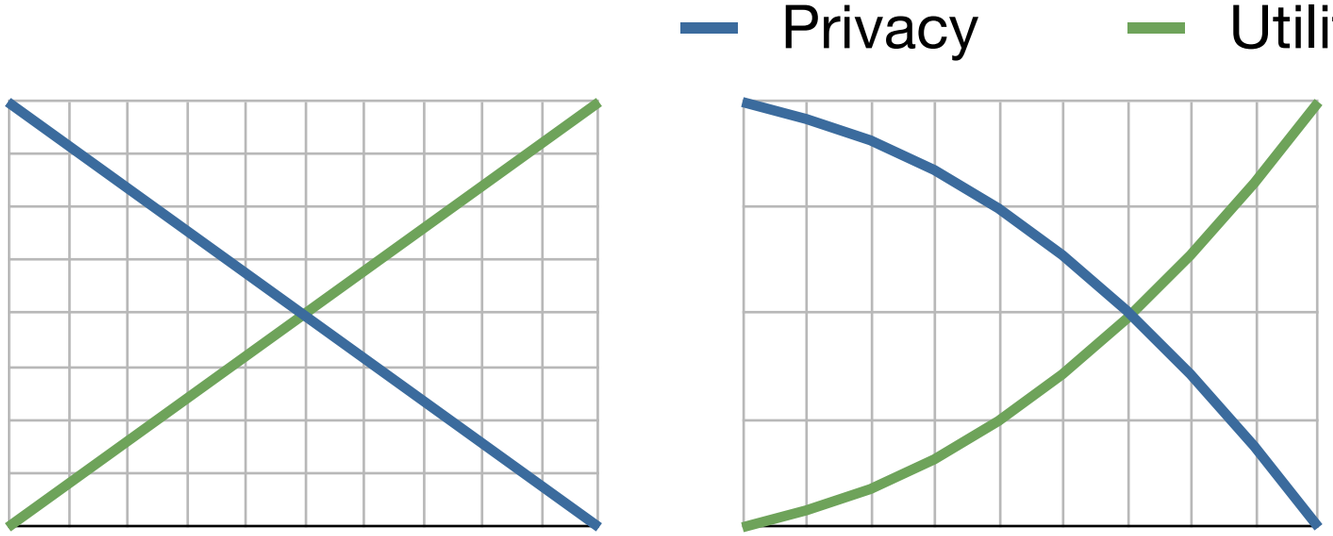

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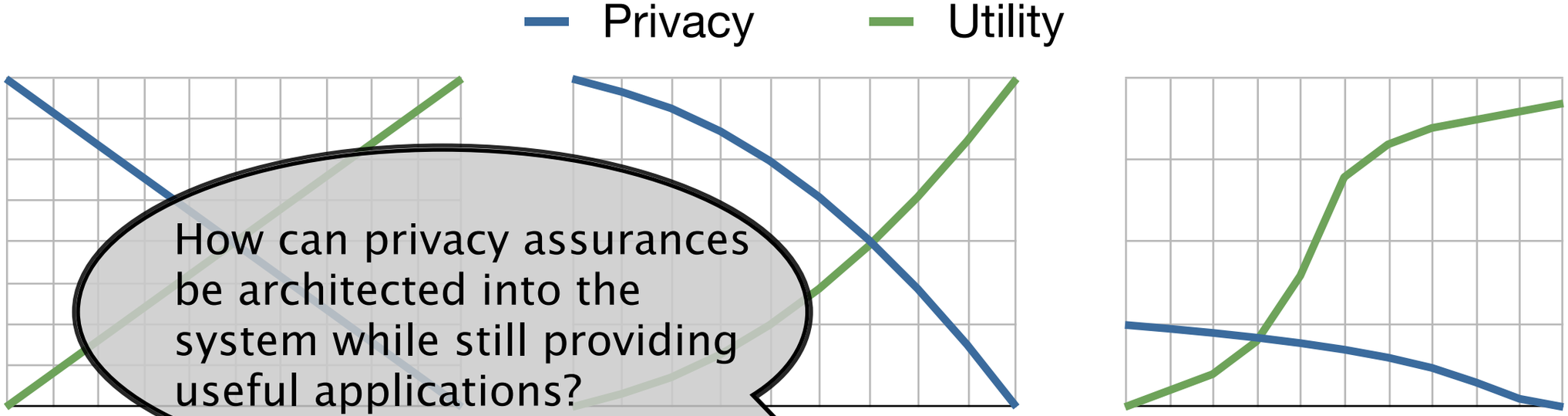

5

Prison building at Presidio Modelo, Isla De la Juventud, Cuba
image from Wikipedia

"The state of conscious and permanent visibility [assures] the automatic functioning of power..."

Michel Foucault, *Discipline and Punish*

Prison building at Presidio Modelo, Isla De la Juventud, Cuba
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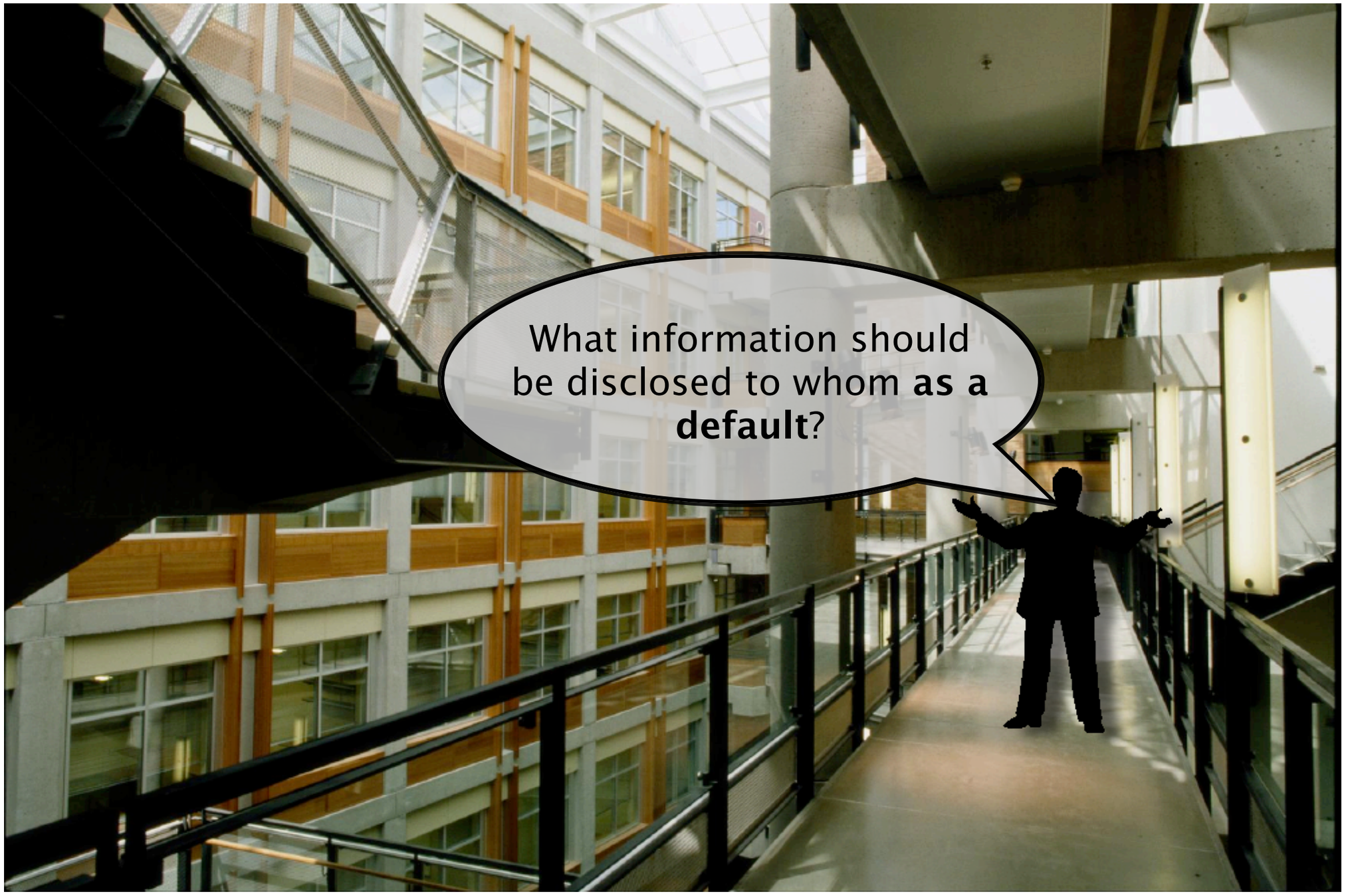

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Surely there's a
safer, yet
useful default...

Physical Access Control (PAC)

- every user has access to a **personal store of data**
    - stores events that occurred when and where they were **physically present**
    - augments users' memory of places, objects, and people **encountered**
- provides **symmetric visibility**
- *principle:* start from human sensory capacity and extend from there

8

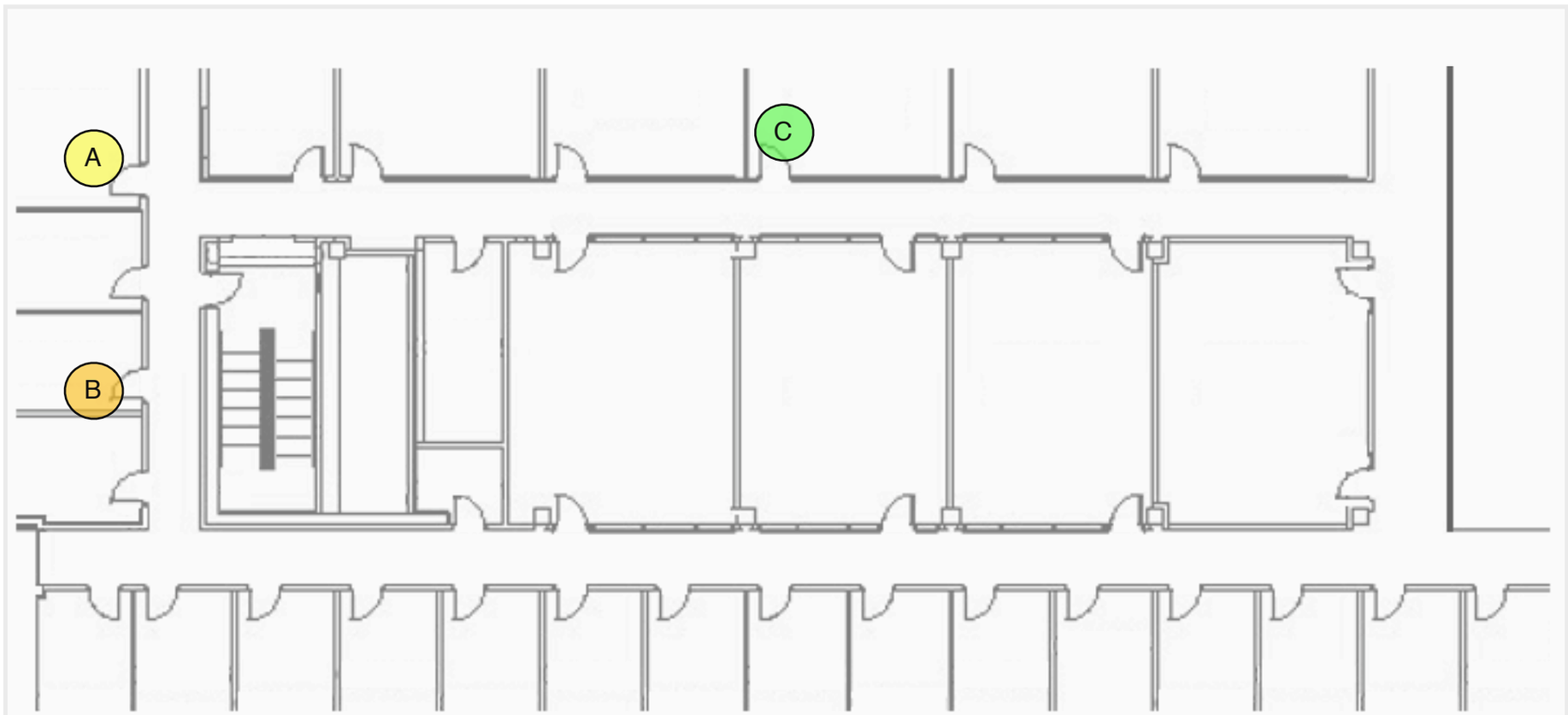
Conceptual Demo

Time: 0

B 's data

A 's data

C 's data

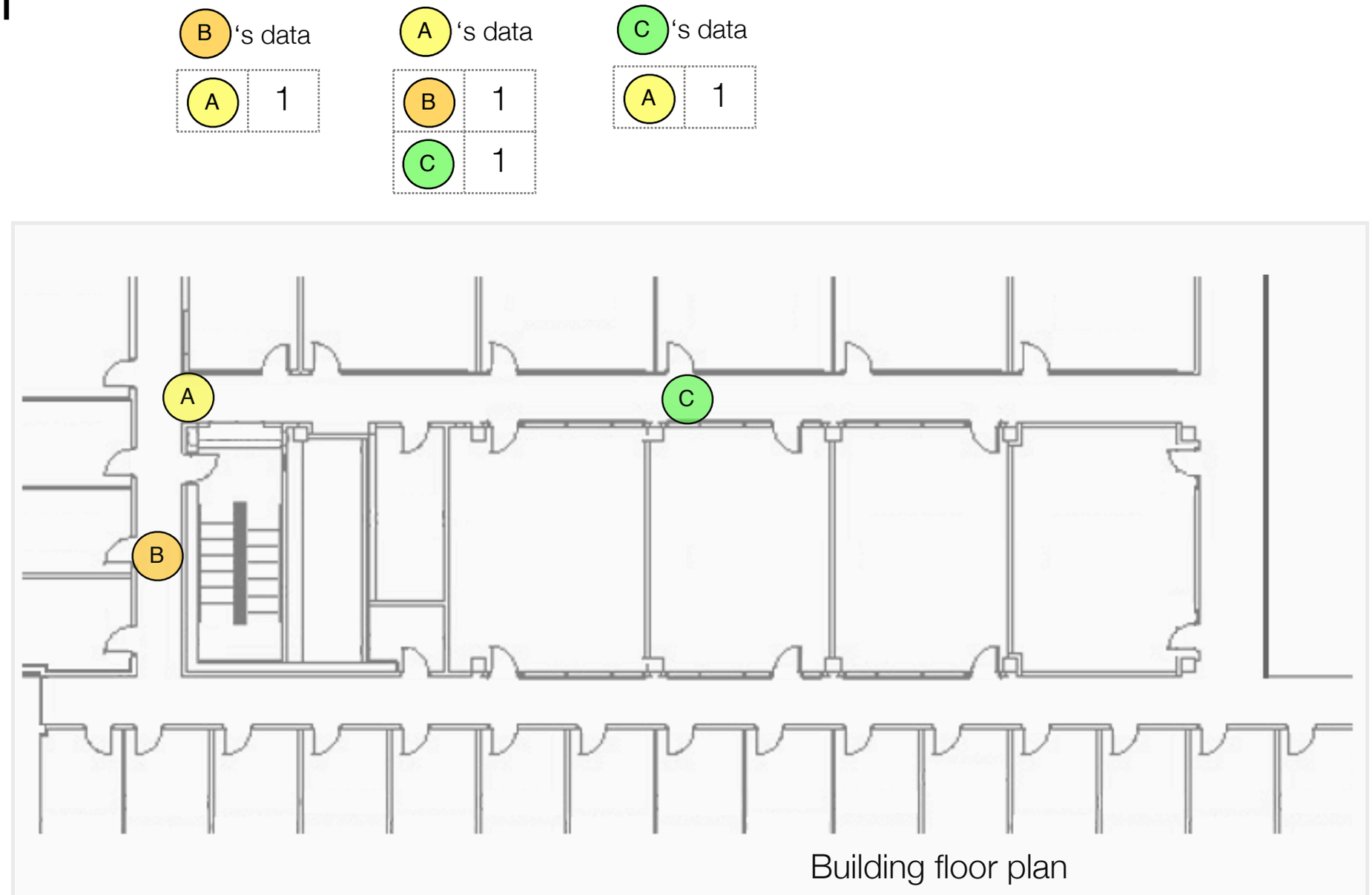


Building floor plan

9

Conceptual Demo

Time: 1



Building floor plan

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Conceptual Demo

Time: 2

B 's data

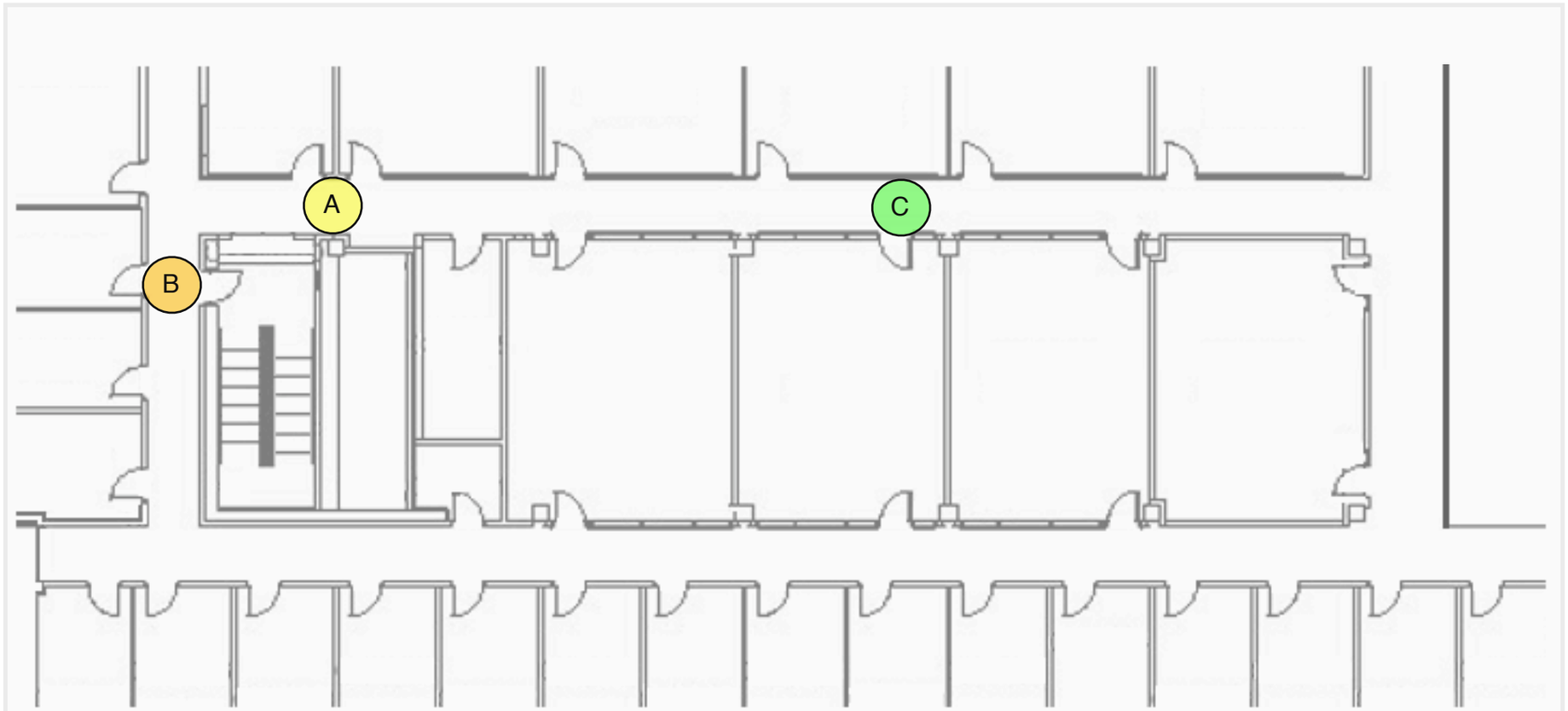
A	1

A 's data

B	1
C	1-2

C 's data

A	1-2



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How does PAC *not* model everyday experience?

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- 360˚ vision

screen capture from “The Big Lebowski”

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from doe.gov

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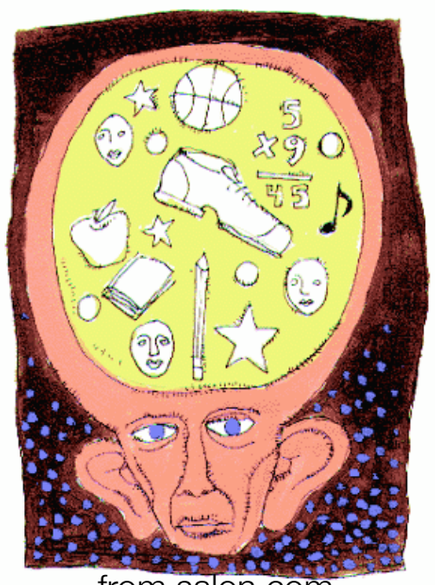

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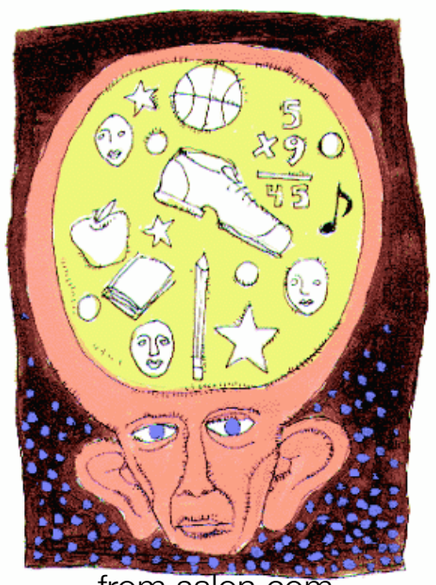
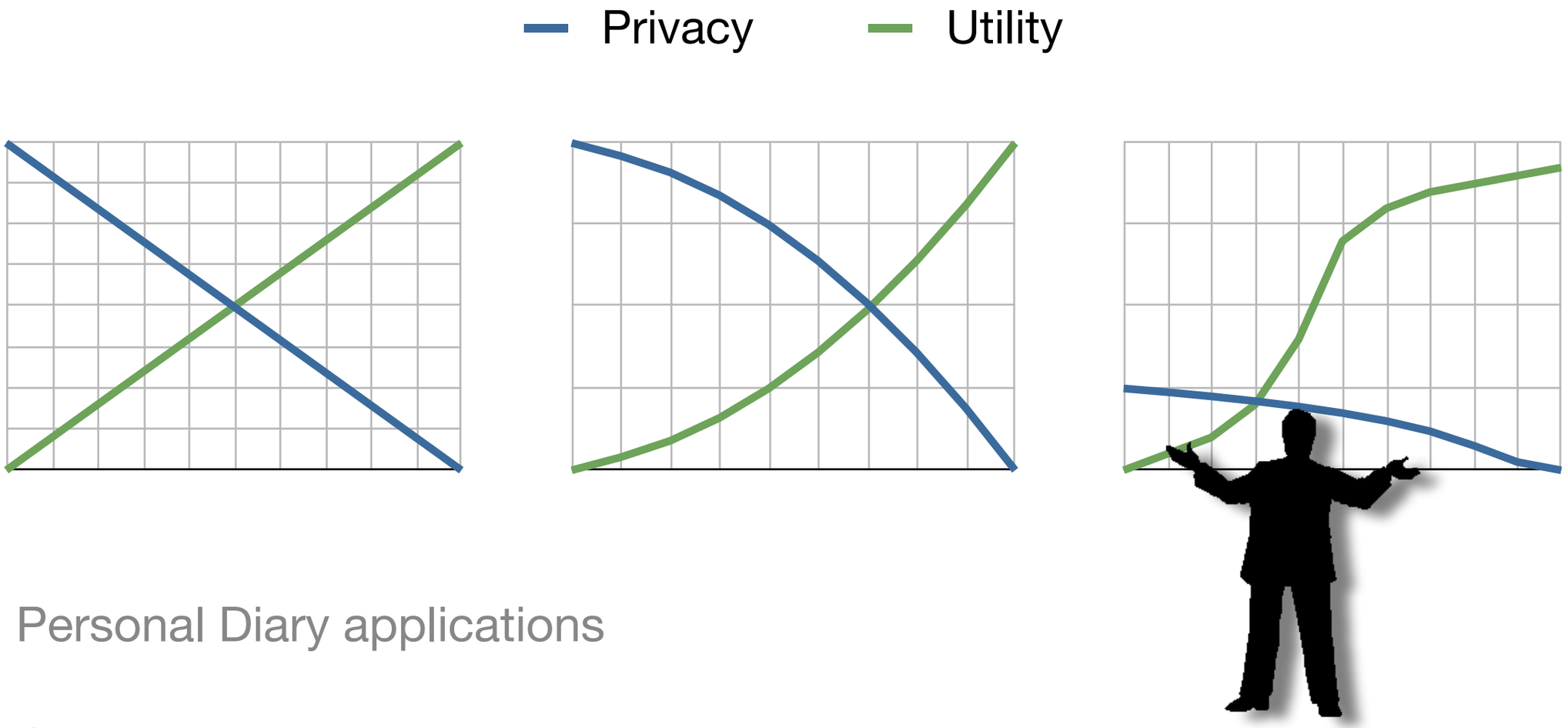


from salon.com

- loss of **plausible deniability**

10

Applications of data collected through PAC



- Personal Diary applications
- Object Finder
- Personal History Analyzer

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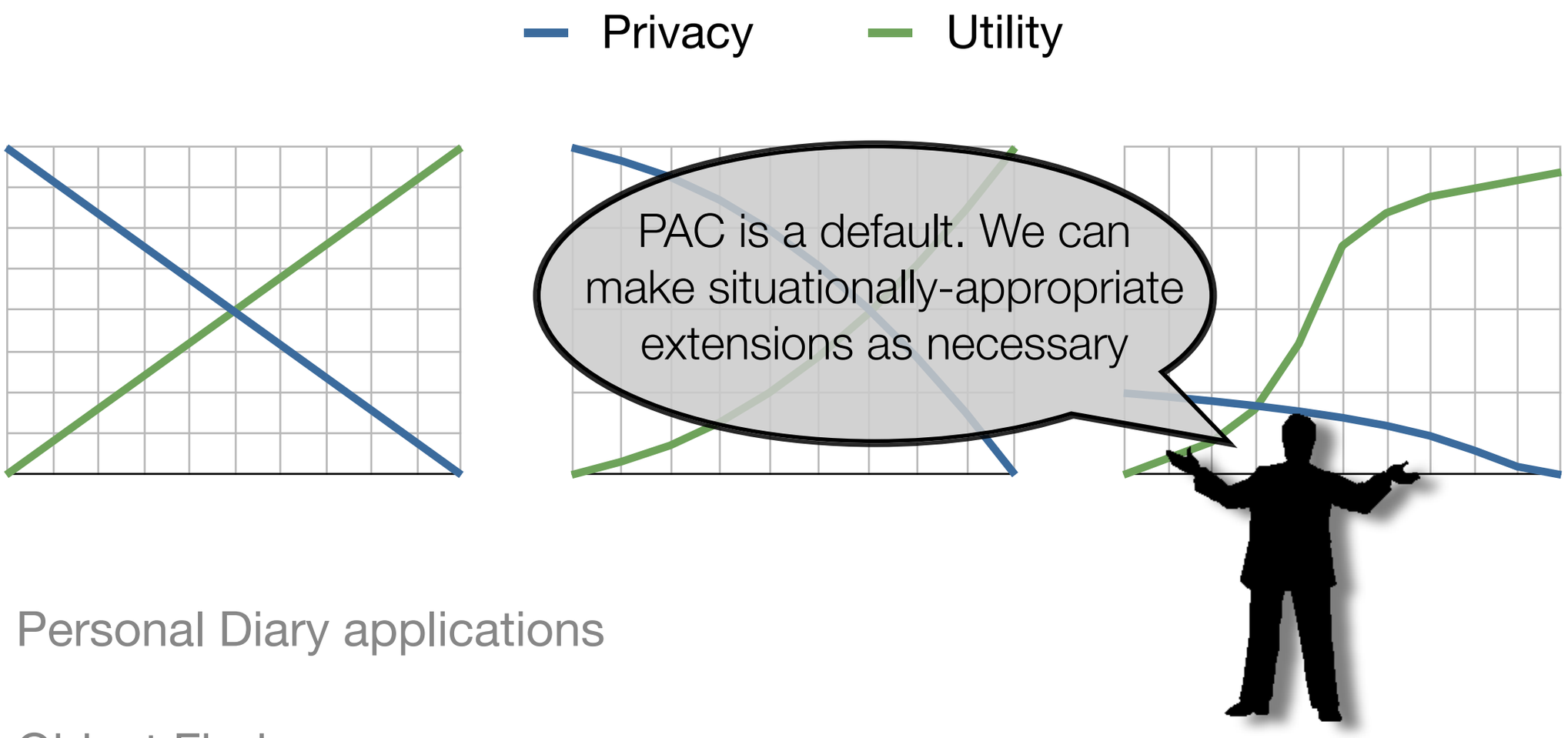

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Modes of information disclosure

Malicious

Personal information is compromised by unauthorized parties

Addressed by secure systems engineering

Institutional

Organizations collect, use, and share personal and behavioral data

Addressed by contracts, federal law, corporate practice...

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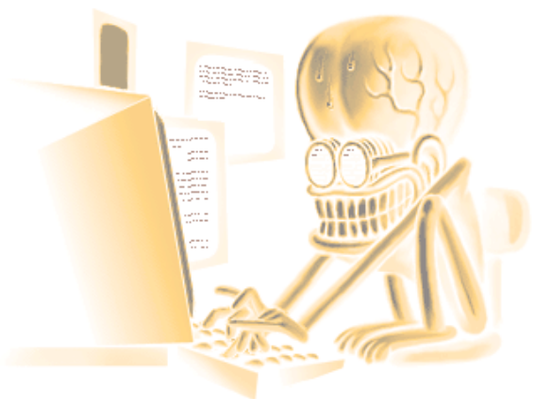


Mediated

Peers and superiors access information through some authorized interface

Mediated by access control policies

12

Implementation of PAC in the RFID Ecosystem

RFID Ecosystem architecture

tag read event (TRE): `{tag identifier; antenna identifier; timestamp }`

14

RFID Ecosystem architecture

tag read event (TRE): `{tag identifier; antenna identifier; timestamp }`

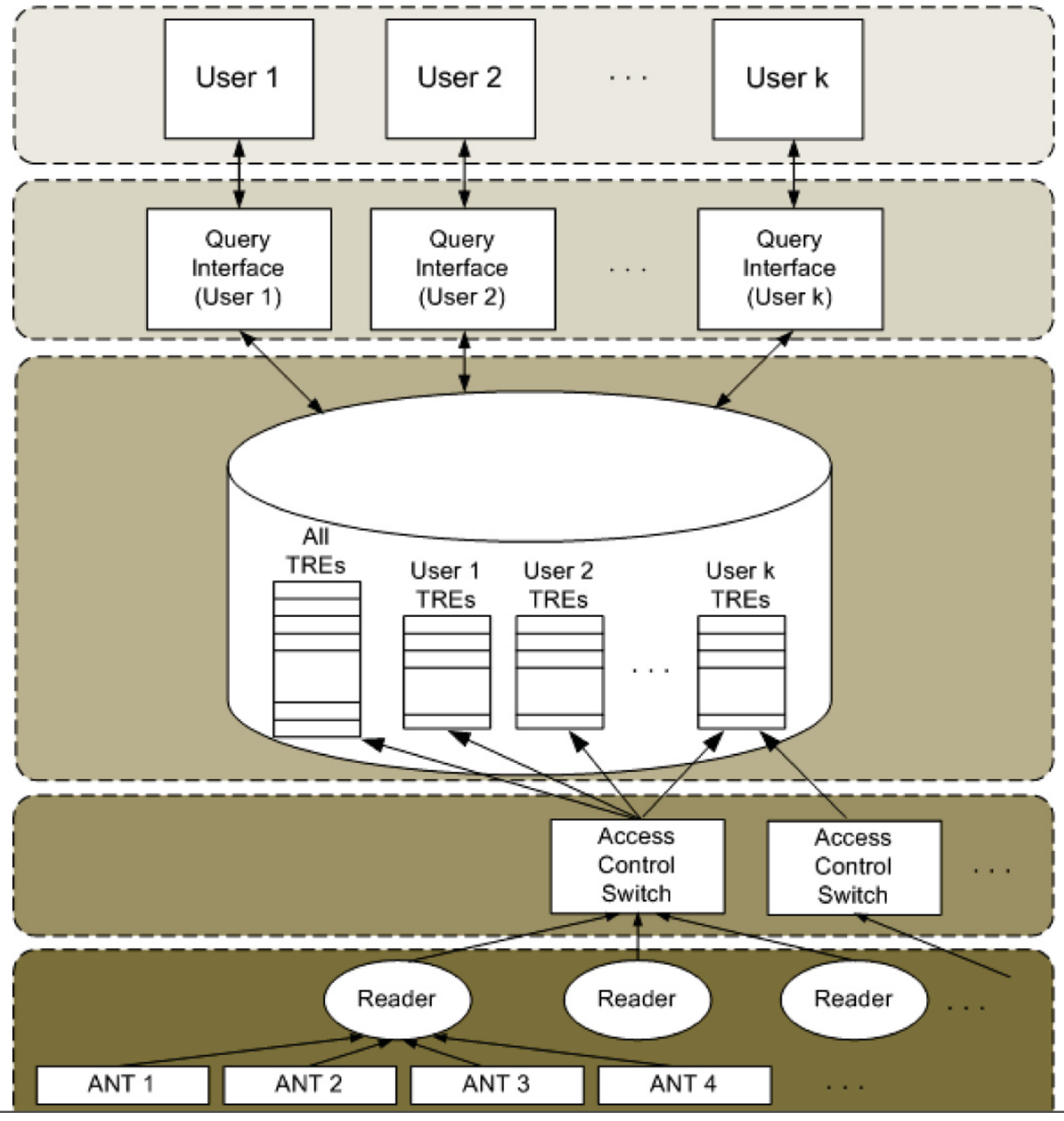
Users

Applications

Centralized database

Access control switch

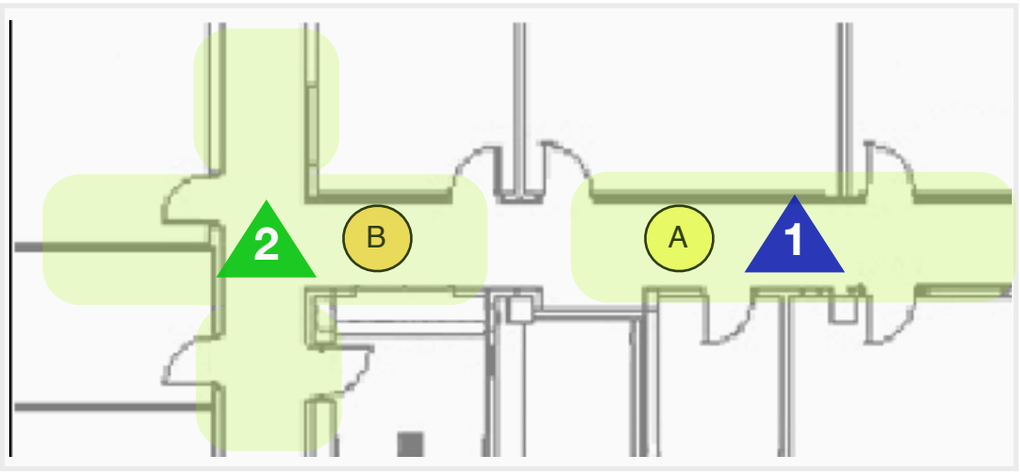
RFID hardware



14

Mutual visibility

determine whether the entities described in two tag reads were **mutually visible** (share an unobstructed line of sight)



{Alice (A); Antenna 1; 08:02:45 }

{Bob (B); Antenna 2; 08:02:50 }

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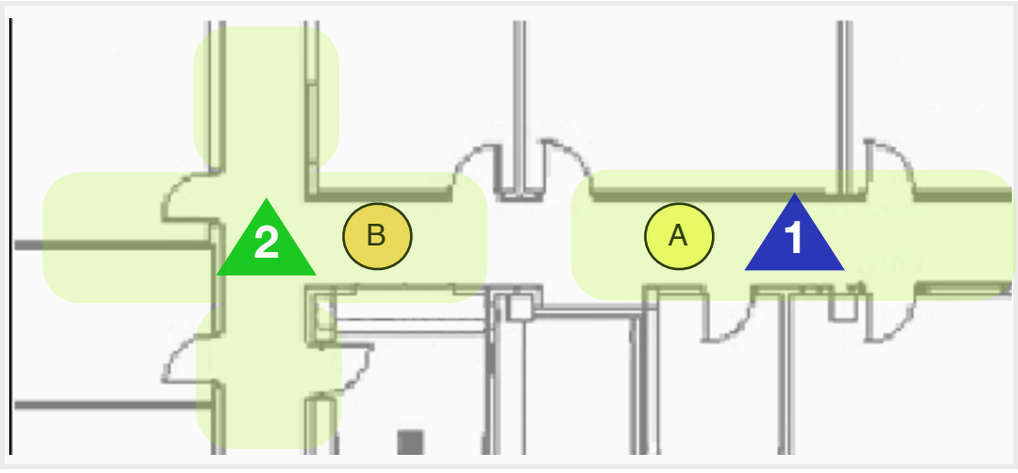

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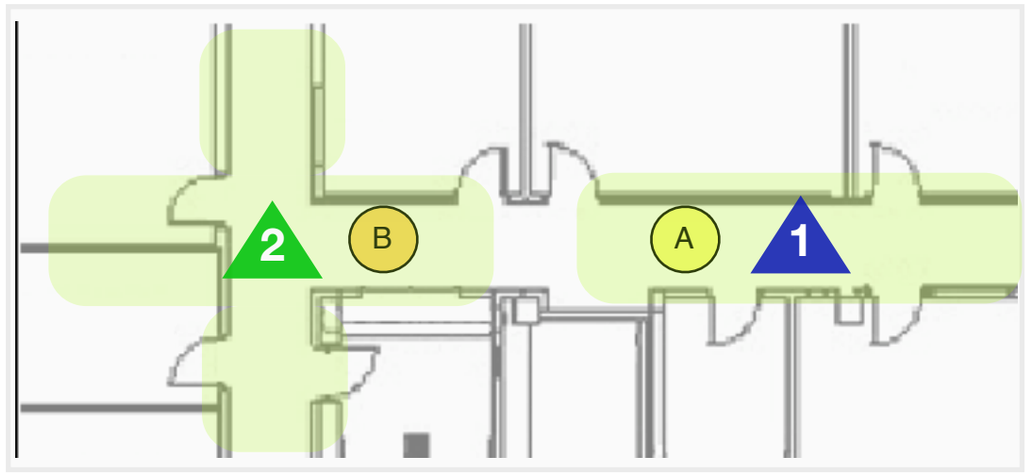
Mutual visibility (continued)



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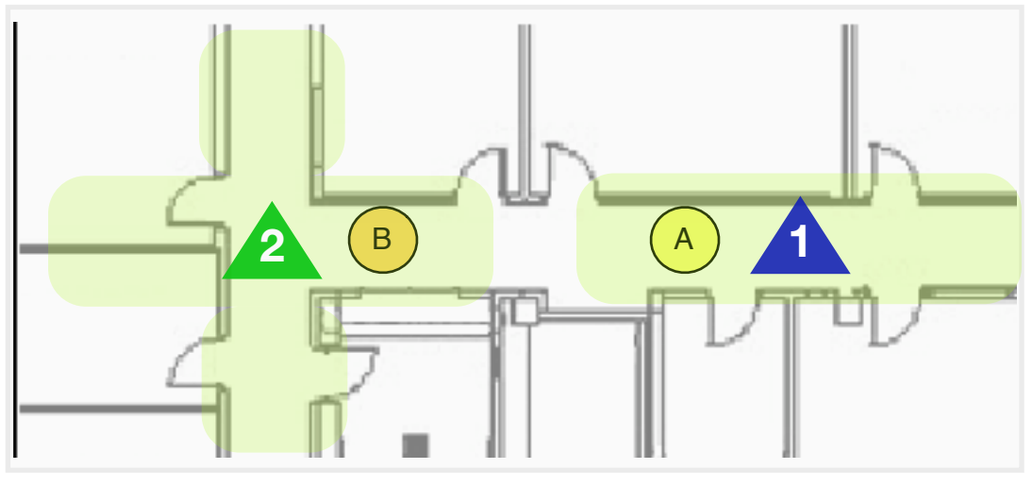
Mutual visibility (continued)

- need to use antenna location as tag location



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Mutual visibility (continued)

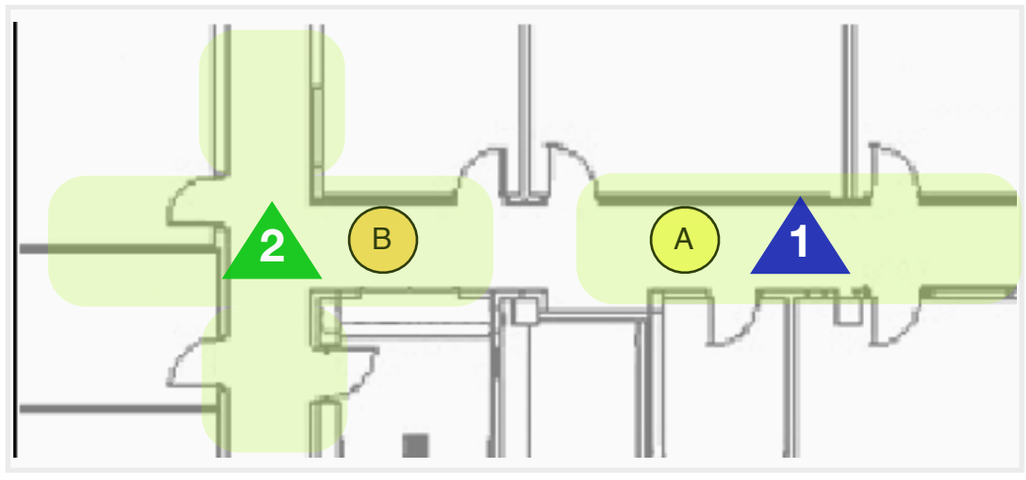
- need to use antenna location as tag location
- two tags read events are said to be mutually visible if they satisfy two constraints:

  1) **temporal constraint:** occur within a time window Δ of each other

  2) **spatial constraint**:

     A) are read by the same antenna or

     B) the involved antennas are considered mutually visible



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Deployment challenges

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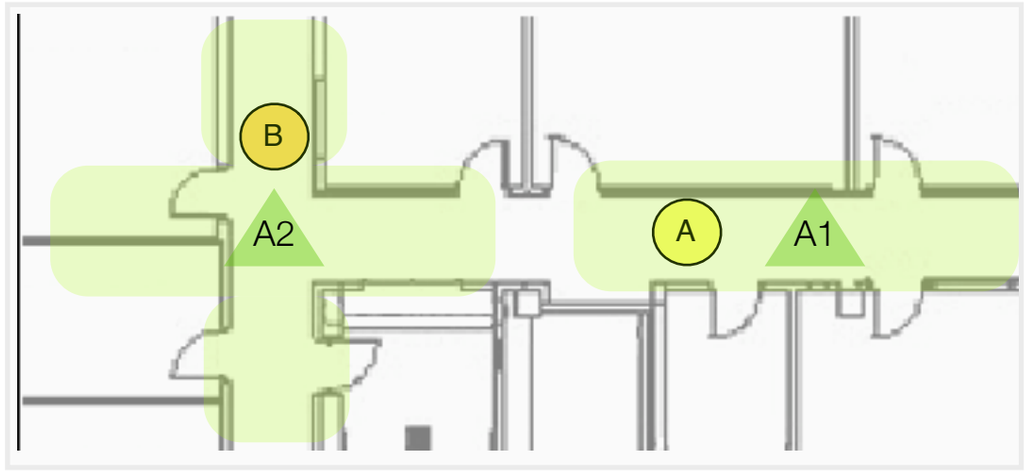
Deployment challenges

- antenna placement

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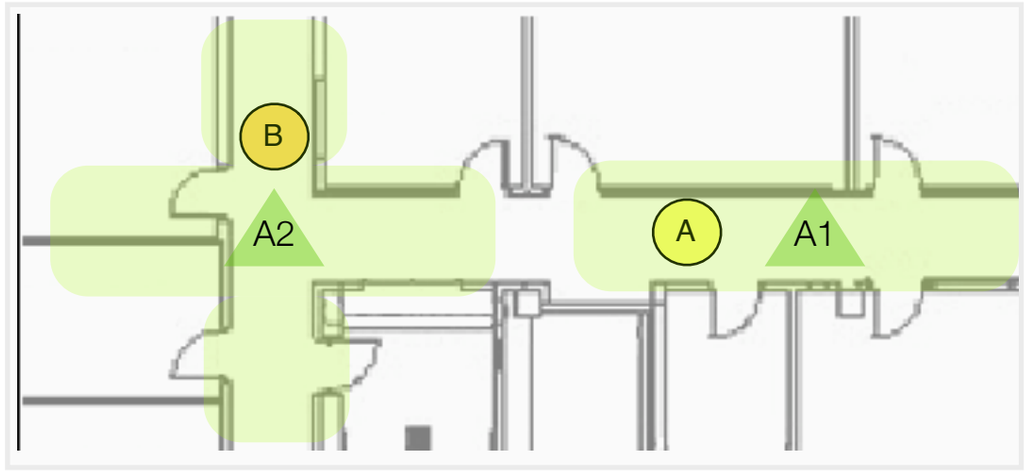


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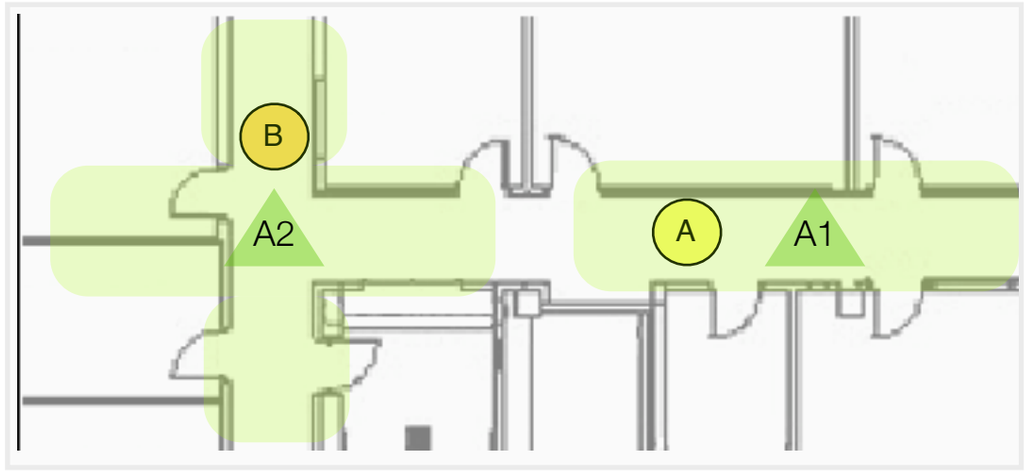


```
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```

- distinguishing tagged objects from tagged people

- “misplaced” user tags

17

Conclusion

- start from a safe principle of symmetric visibility
- define Physical Access Control
- instantiation within an RFID deployment

18

Collaborators:

Evan Welbourne

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Gaetano Borriello

Yoshi Kohno

Dan Suciu

Physical Access Control for Captured RFID Data

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