

# The 5<sup>th</sup> Dimension

Building Blocks for  
Smart Infrastructures

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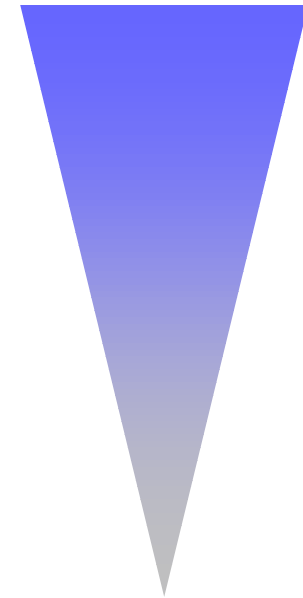
# Motivation

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HUC2k Workshop

- Ubiquitous Computing
  - Smart Environments
  - Information Appliances
  - Low Power Devices
  - Unpowered Artifacts (tagged)

Computing  
Power



# Motivation

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HUC2k Workshop

- Ubiquitous Computing
  - Smart Environments
  - Information Appliances
  - Low Power Devices
  - Unpowered Artifacts (tagged)
- Making Smart Devices First Class Citizens

**Computing Power**

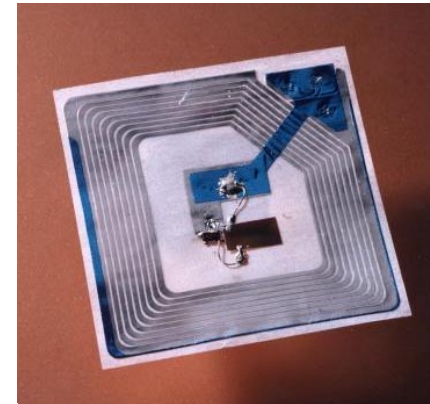


**Leveling the Playing Field**

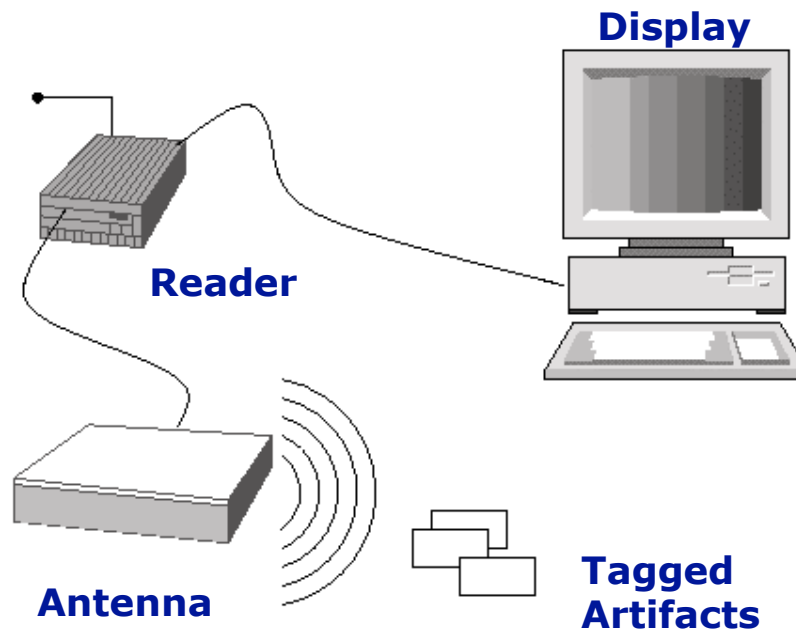
# Linking

HUC2k Workshop

- Connecting
  - Real-World Artifact
  - Virtual Representation



**RFID Tag**



- Active or Passive IDs
- Readers Identify Tags
- Network stores Artifact Data
- Displays Provide Access

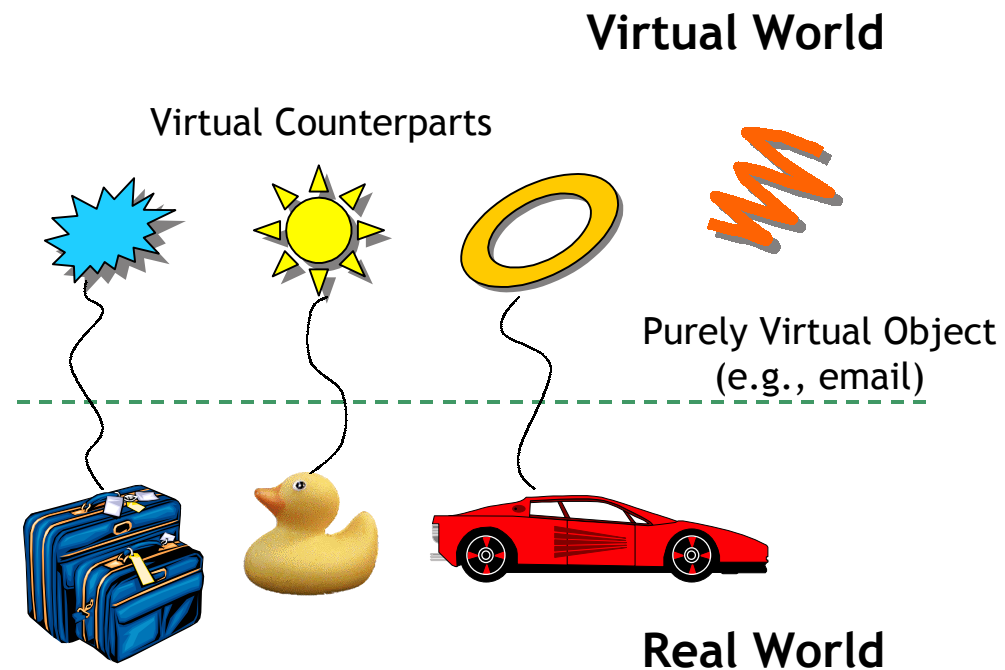
# Virtual Counterparts (VCs)

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- Network Representation of Artifact
  - Data + Code + Execution (Autonomous Agents)
  - Represents & Extends Artifacts

- VCs are:

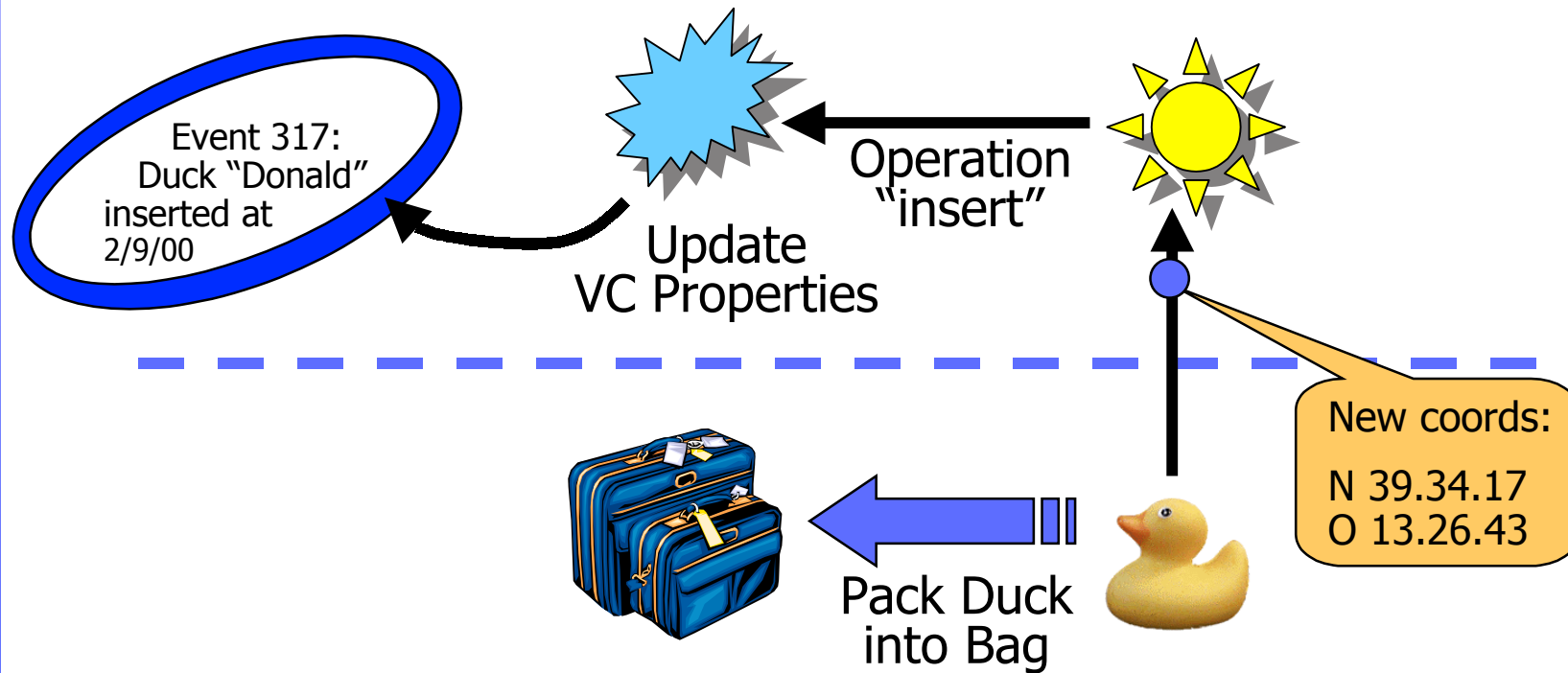
- Autonomous
- Coupled to Artifact
- Mobile



# Data + Code

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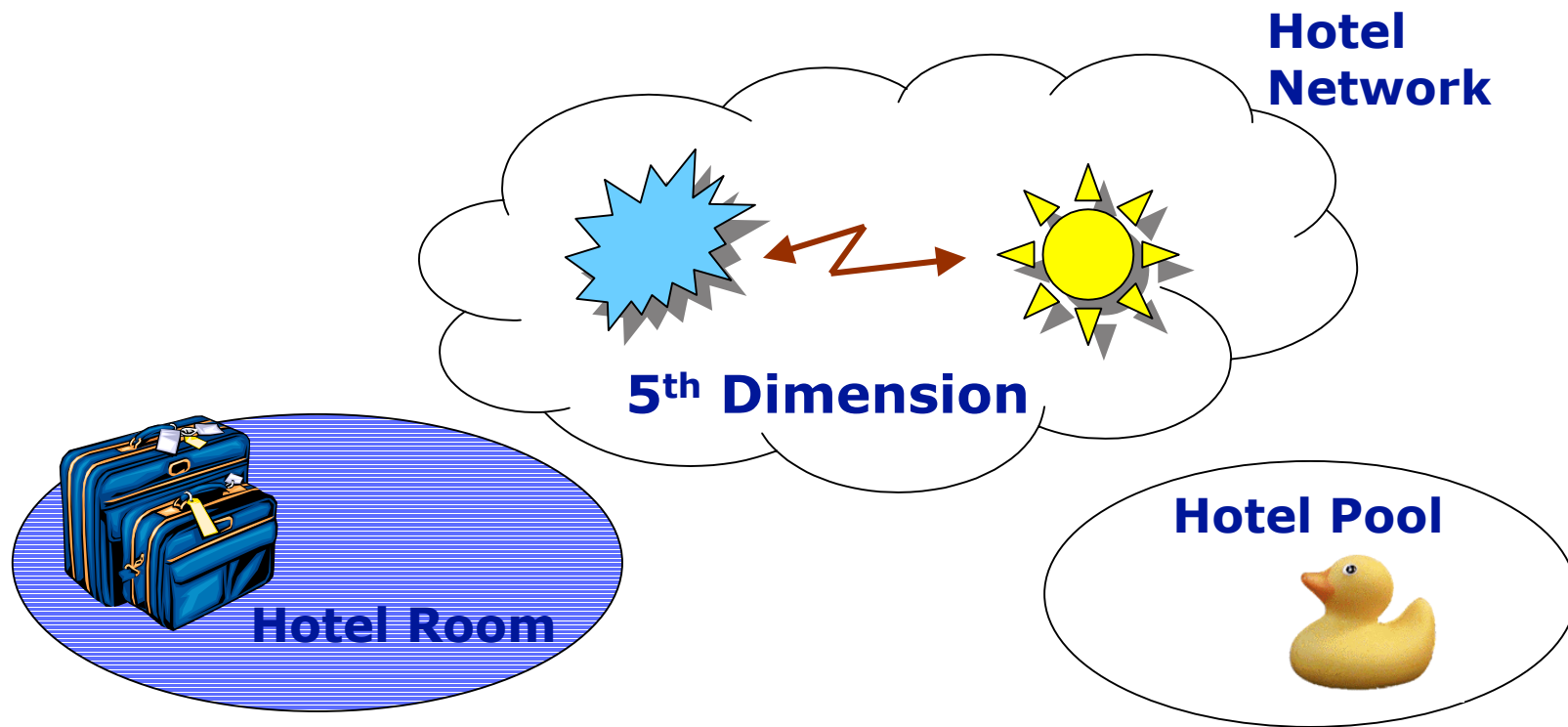
- Extends 4D Interaction Patterns
- Arbitrary Functionalities per Artifact



# Autonomous Execution

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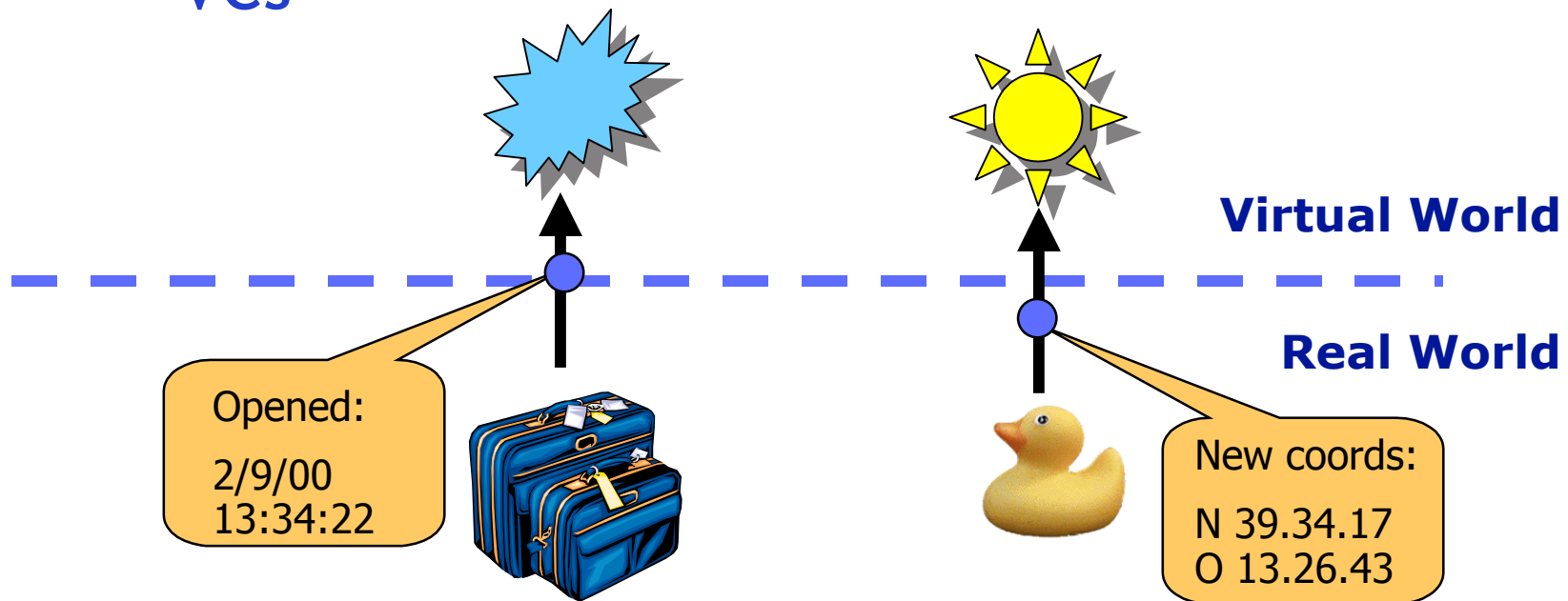
- Decoupled Interactions
- Self-activation



# VC Runtime Environment

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- Event-Driven Infrastructure
  - VCs Register Interest in Events
  - Infrastructure Relays Events to Interested VCs

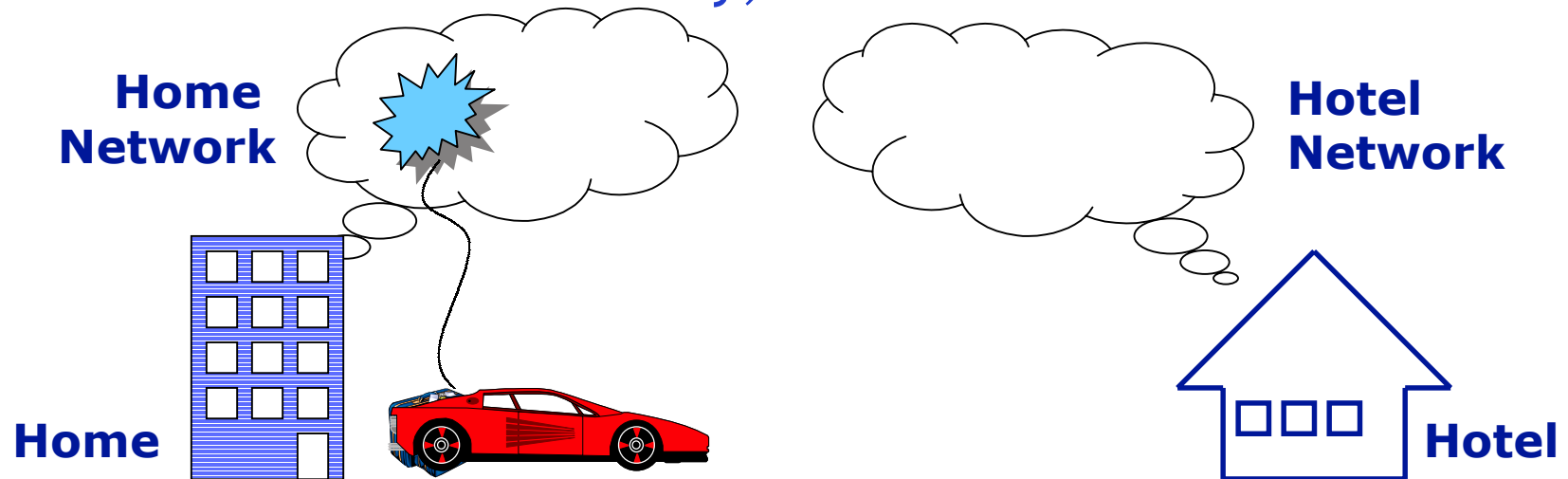




# Disconnected Operation

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- Virtual Worlds Non-Continuous
  - Different Localities, Operators, Vendors, Trust Levels
- VC Mobility
  - VCs follow across World Boundaries
  - Ensures Connectivity, Minimizes Traffic







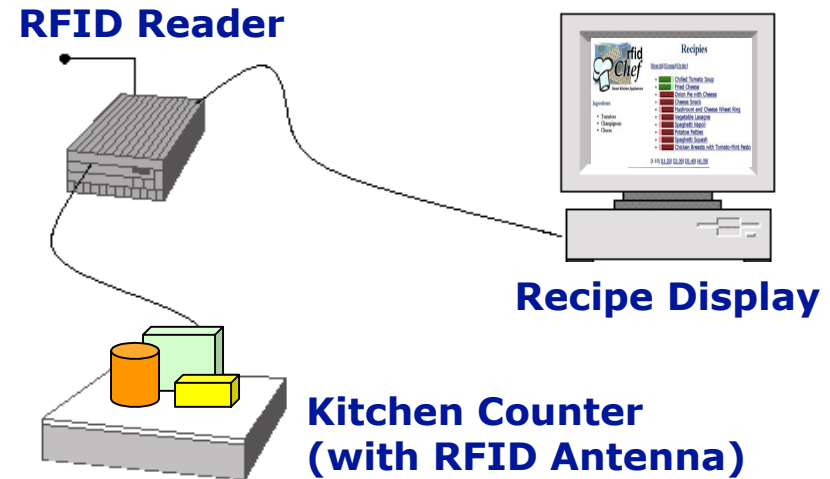




# RFID Chef

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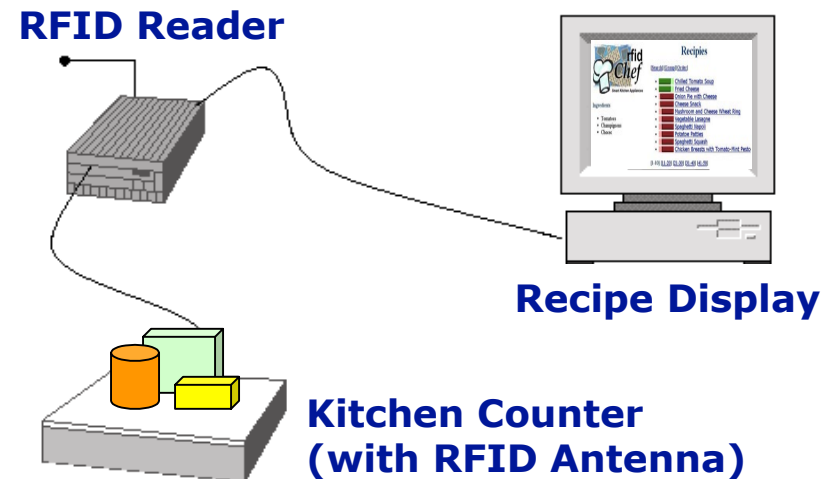
- Virtual Cookbook
  - Suggests Recipes based on available Items
  - Reader in Countertop



# RFID Chef

HUC2k Workshop

- Virtual Cookbook
  - Suggests Recipes based on available Items
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- Basic Event Infrastructure
  - *Event* „RFID nnn appears or disappears“
  - *Collisions* make objects become *invisible* for a short time
  - Requires some *corrections* of the sensor information

# Issues

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- **Ontology?**
  - Do we need Hierarchies? Object Fusion?
- **Objects or Data (XML)?**
  - Simplicity or Expressiveness?
- **Code Mobility**
  - Aren't all Networks Interconnected?
- **What's in an Infrastructure?**
  - Basic Services?