

Persistent Personal Names for Globally Connected Mobile Devices

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<http://pdos.csail.mit.edu/uia>

Presented by Aiman Erbad

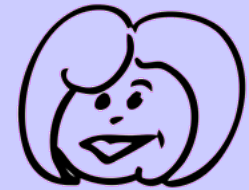
Connectivity Scenario: Stage 1



Bob's Laptop



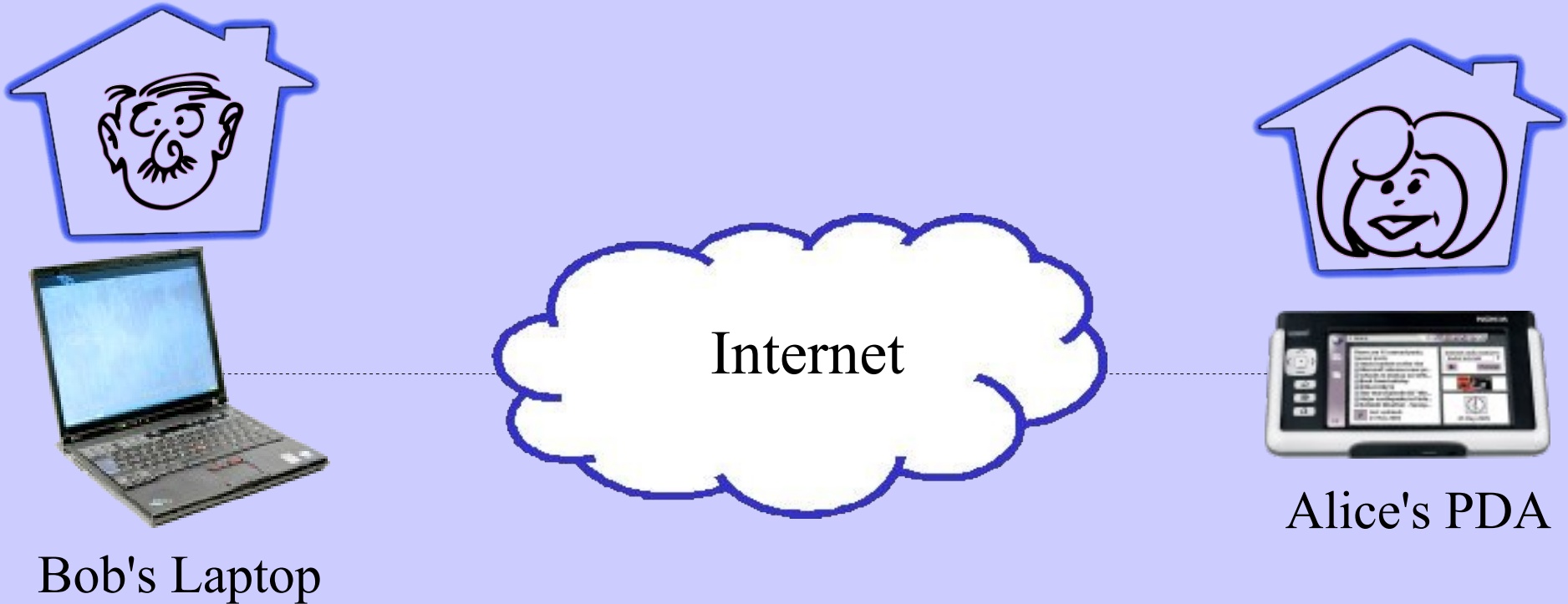
Local Area Network



Alice's PDA

Bob & Alice meet, connect [Bonjour] –
using **local names** (e.g., “Alice-PDA”)

Connectivity Scenario: Stage 2

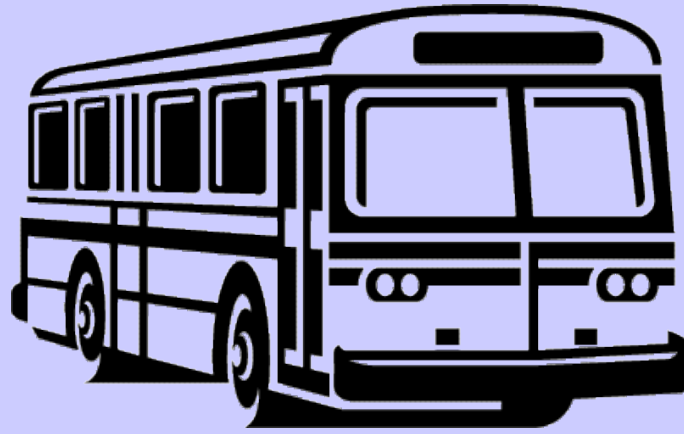


Wish to re-connect remotely –
need **different, global names** & more setup
(e.g., “pda.alice1234.herisp.com”)

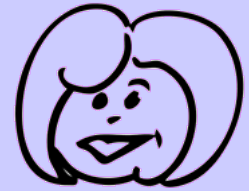
Connectivity Scenario: Stage 3



Bob's Laptop



Disconnected
Local Area Network



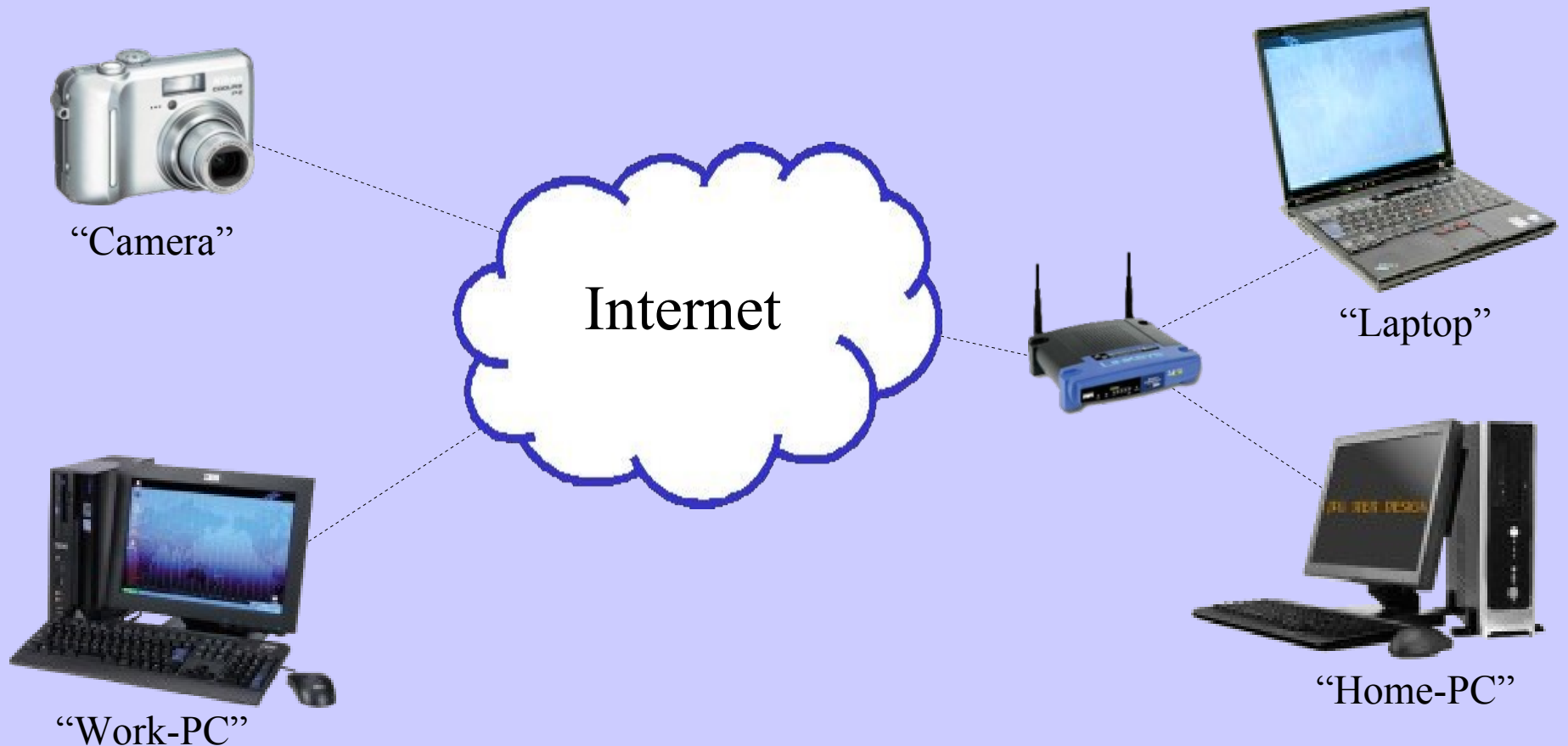
Alice's PDA

Meet again off-Internet – global names stop working!
Require **different, local names** (again)

UIA: Unmanaged Internet Architecture

Global Connectivity via Personal Names

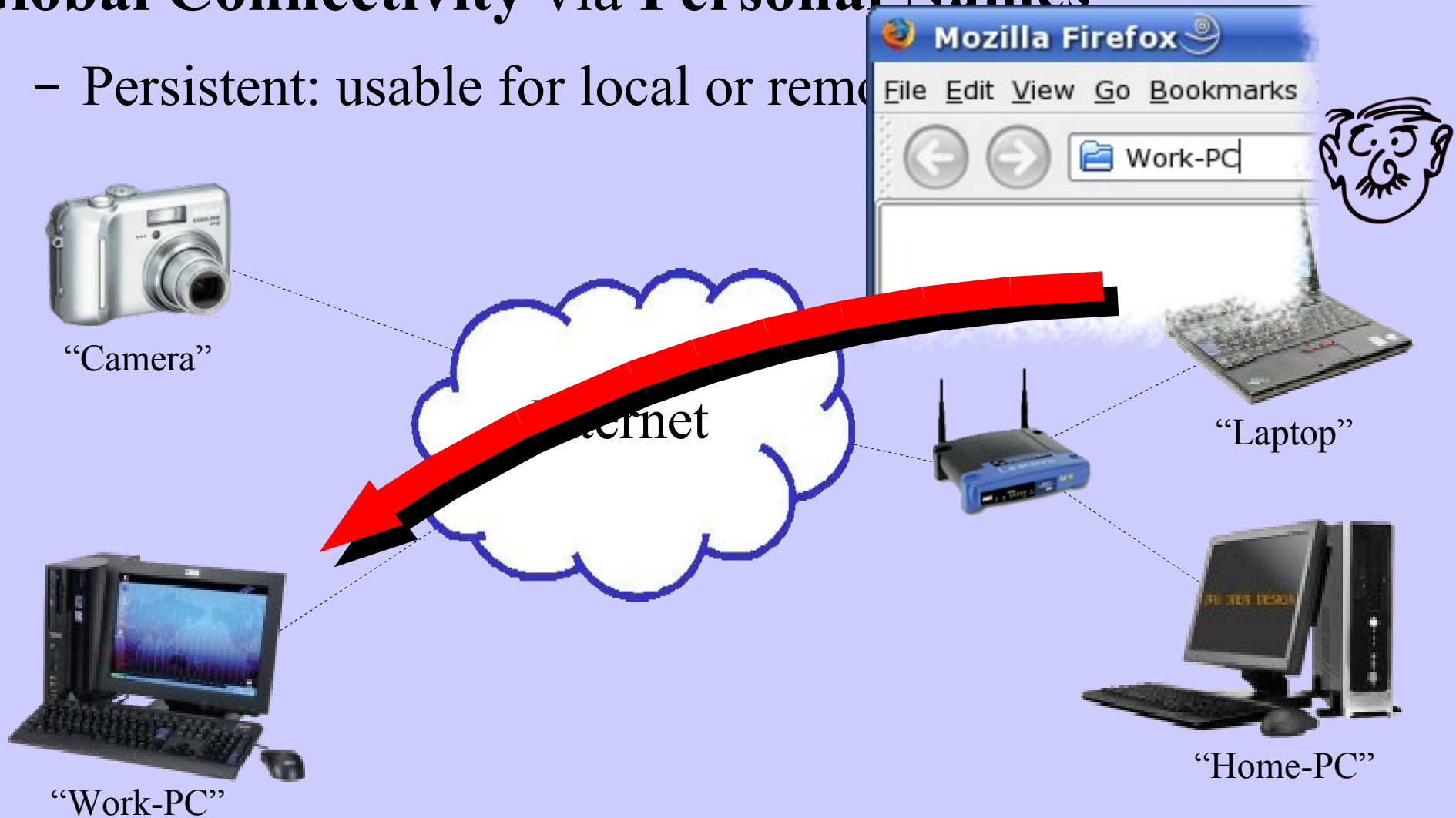
- Like nicknames in cell phone address book



UIA: Unmanaged Internet Architecture

Global Connectivity via Personal Names

- Persistent: usable for local or remote



Challenges

- **Intuitive setup**
 - As easy as plugging local devices together
- **Secure self-managing operation**
 - Don't make users understand key management
- **Namespace synchronization**
 - Changes on one device propagate to others
- **Partitioned Operation**
 - Remains available under limited connectivity
- **Namespace access control and revocation**
 - Handling lost or stolen devices

Contributions

Usability Concepts:

- Local Introduction, Remote Access
- Merging Devices to form Personal Groups
- Linking Groups via Personal User Names

Design Concepts:

- Secure device identities
- Optimistic state replication via change logs
- Overlay routing protocol leveraging social links

Usability Concept 1

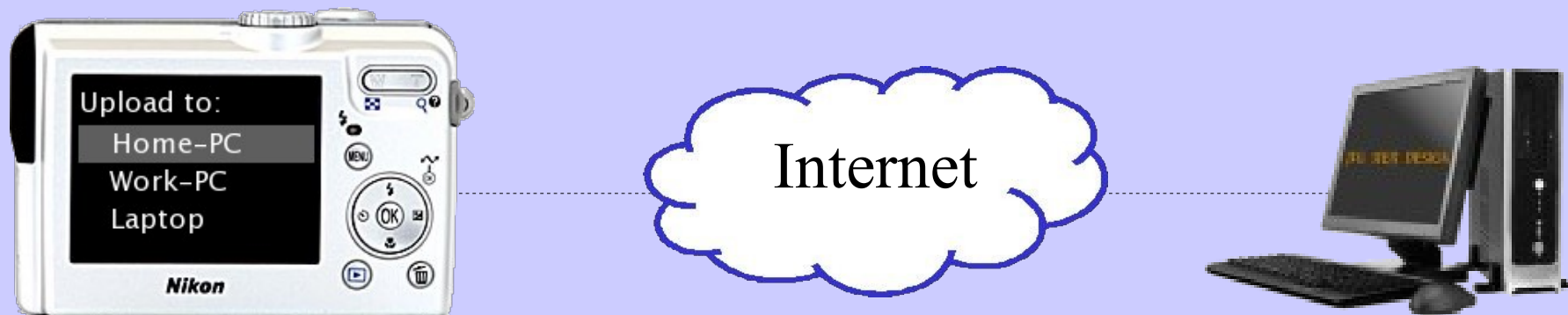
**Local Introduction,
Remote Access**

Local Introduction, Remote Access

1. Bob buys WiFi-enabled digital camera, “introduces” it to desktop PC at home



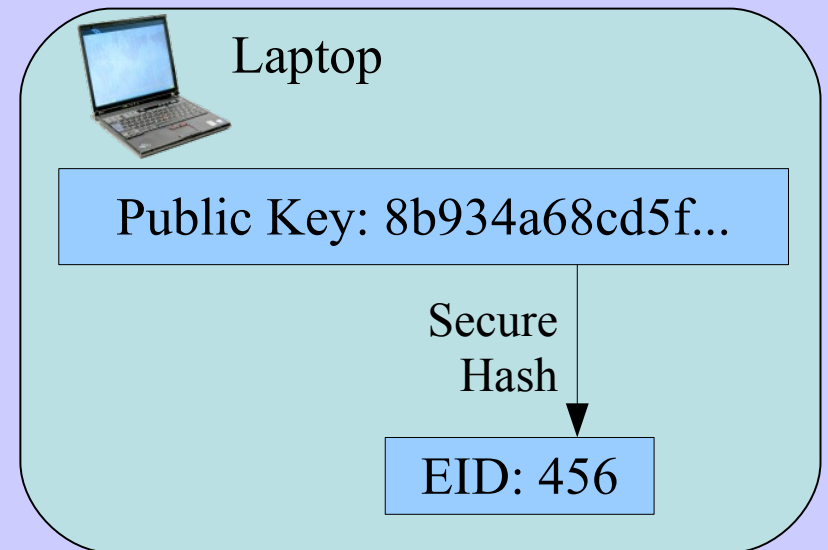
2. Bob takes camera on trip, stops at cyber-cafe, uploads pics to home PC for storage & sharing



Endpoint Identifiers

Each device has an *endpoint identifier* (EID)

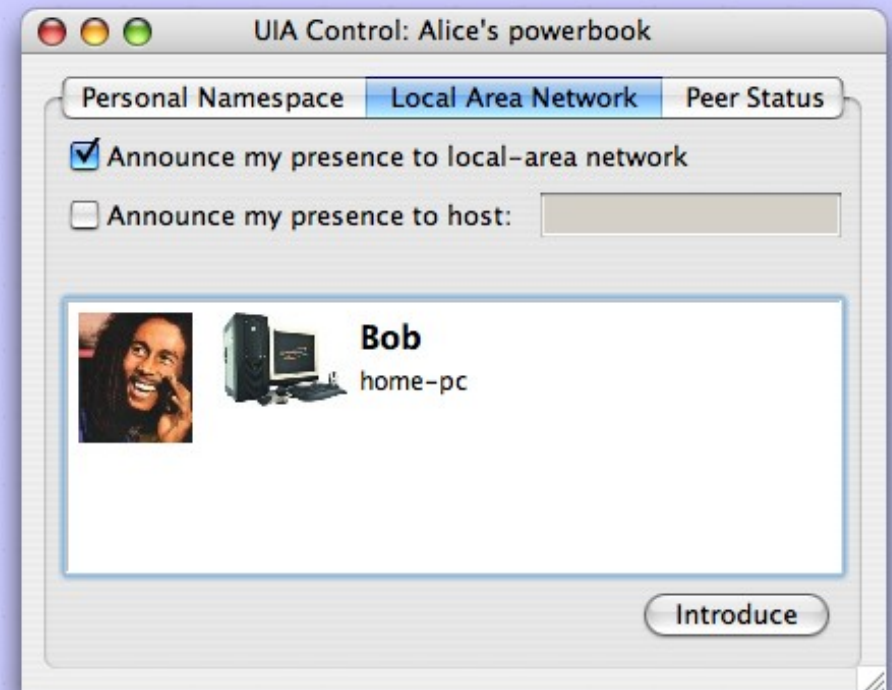
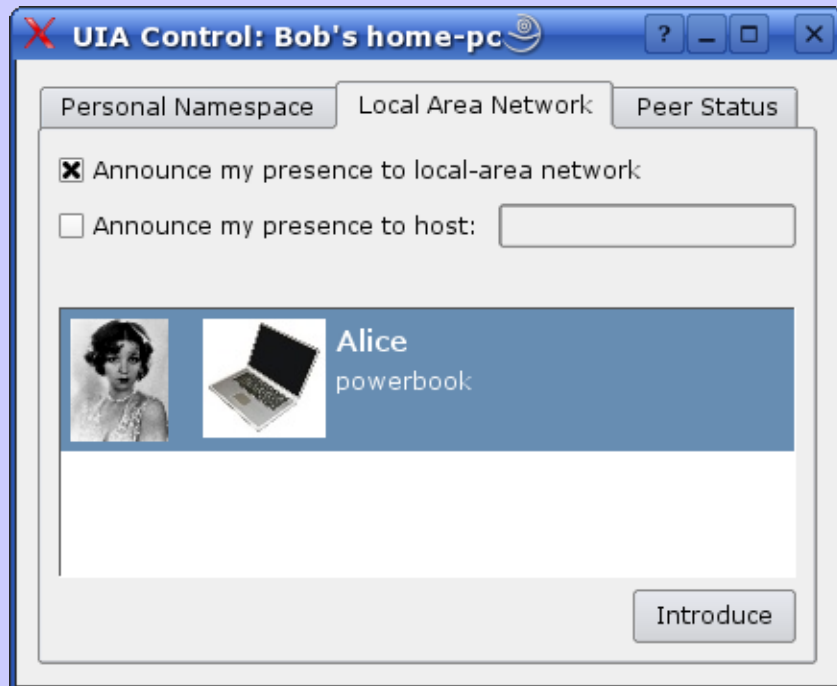
- Formed from hash of device's public key [SFS]
- Self-configured, stable, location-independent [HIP]



Device Introduction

Common case: meet in person on common LAN

- Browse network to find other device [Bonjour]
- Avoid man-in-the-middle attacks [Dohrmann/Ellison]



(screen shots from working UIA prototype)

Usability Concept 2

**Merging Devices
into
Personal Groups**

Merging Devices into Groups

Uses Device Introduction Procedure

Personal Group

Personal Group

Personal Group

“BobPix” → EID 123

“Tabloid” → EID 234

“MyPod” → EID 345

“Blinkpad” → EID 456



“BobPix”
→ EID 123



“Tabloid”
→ EID 234



“MyPod”
→ EID 345



“Blinkpad”
→ EID 456

Implementing Names and Groups

Device keeps a *series*
of change records

- Start with default name



Camera: EID 123

 Series 123

“Coolpix” → EID 123



Laptop: EID 456

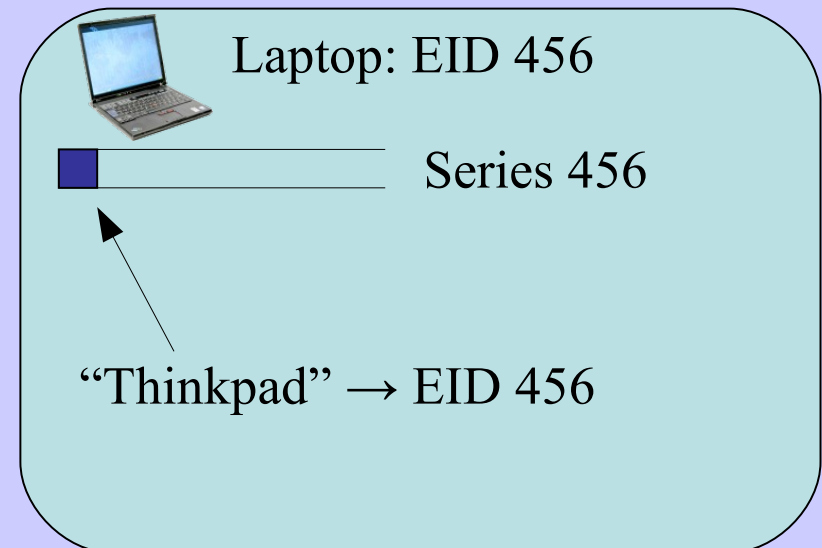
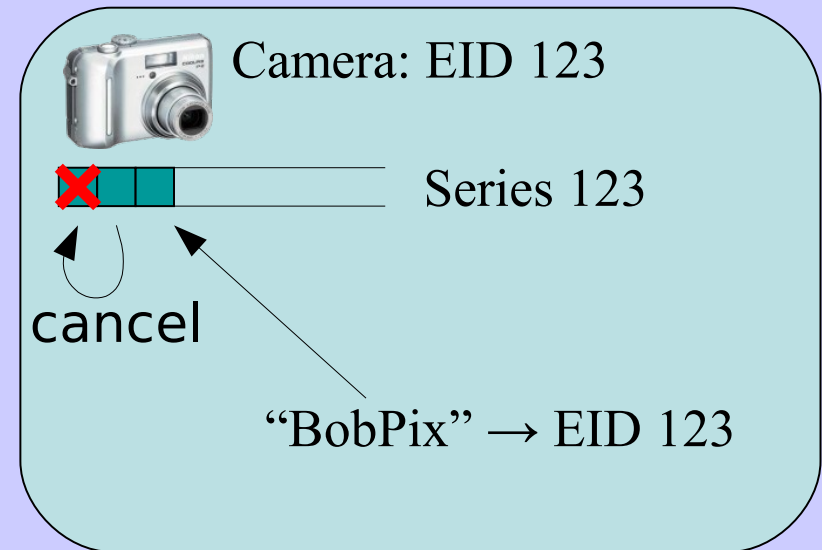
 Series 456

“Thinkpad” → EID 456

Implementing Names and Groups

Device keeps a *series* of change records

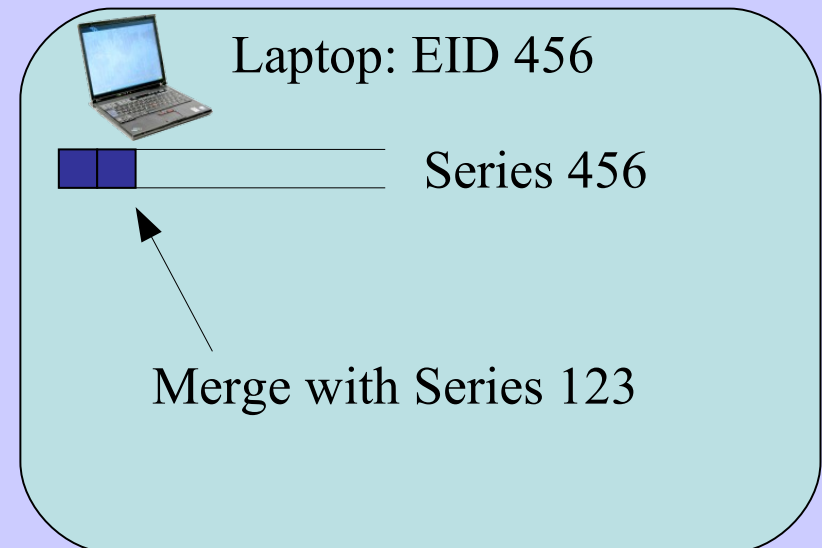
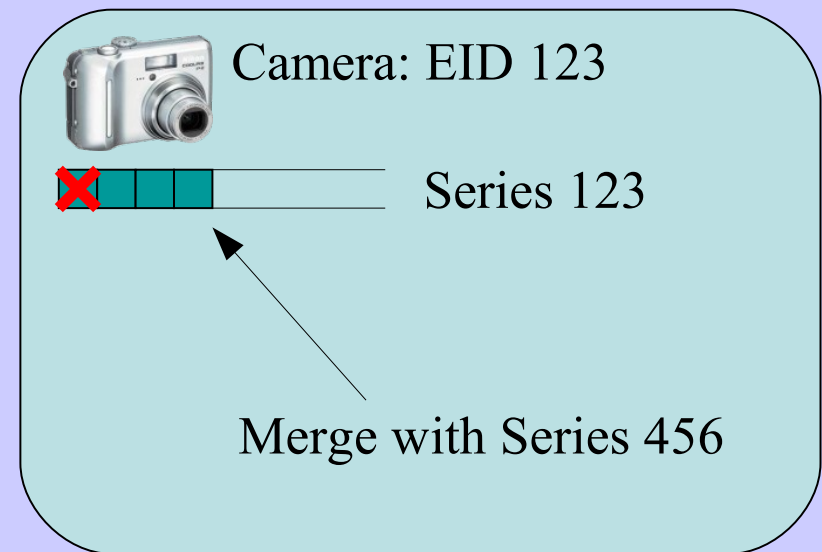
- Start with default name
- To rename: cancel old, write new name record



Implementing Names and Groups

Device keeps a *series* of change records

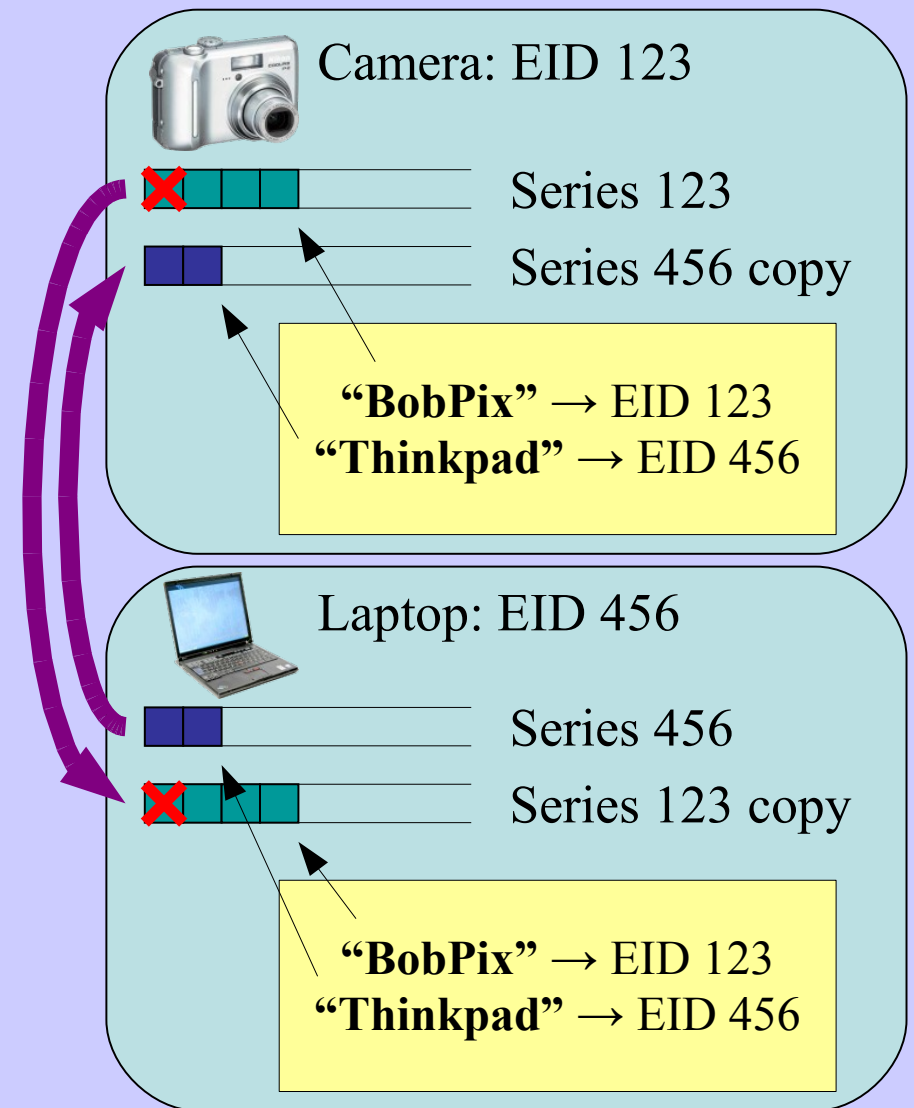
- Start with default name
- To rename: cancel old, write new name record
- To merge:
 1. Write merge records



Implementing Names and Groups

Device keeps a *series* of change records

- Start with default name
- To rename: cancel old, write new name record
- To merge:
 1. Write merge records
 2. Gossip series contents

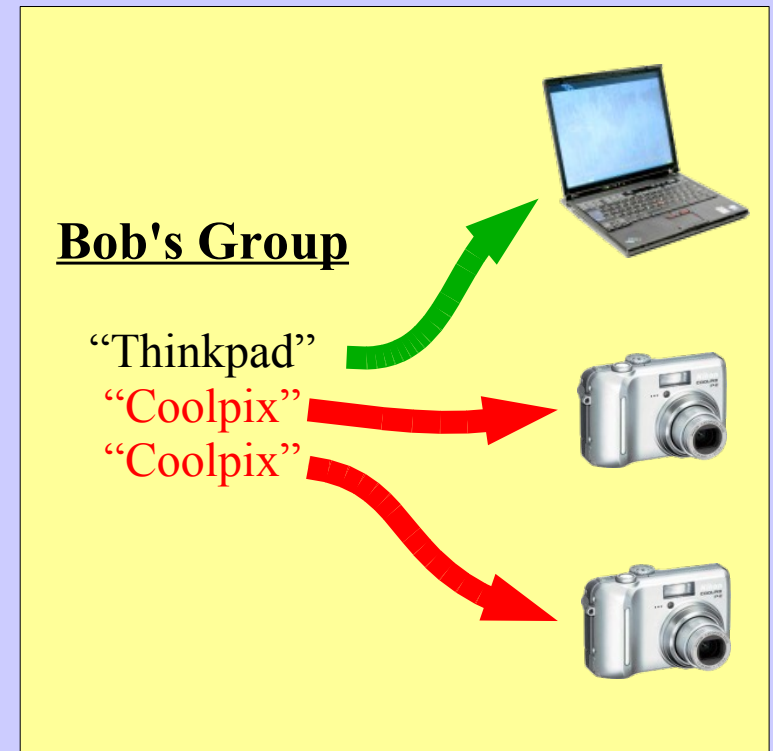


Handling Name Conflicts

What if user merges two devices w/ same name?

⇒ merge succeeds, but
creates name conflict
(can't use name)

Resolve by renaming
(on either device)

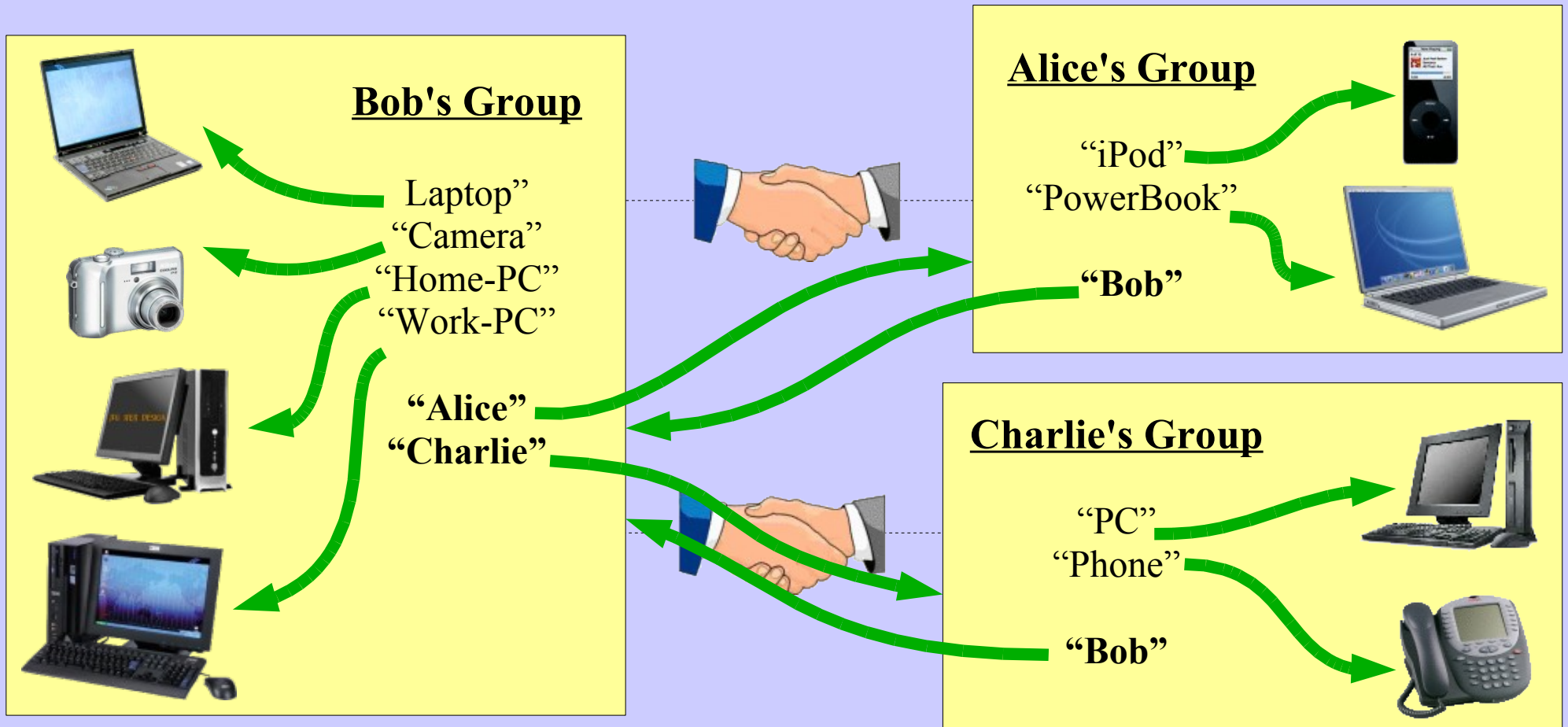


Usability Concept 3

Linking Groups via Personal User Names

Personal User Names

- Assign short personal names to friends for easy communication and sharing



Legacy Application Support

- Disguises
 - UIA names as DNS names
 - EIDs as IP addr

Summary

UIA simplifies global device connectivity through **persistent personal names**

Based on three key usability concepts:

- **Local Introduction, Remote Access**
- **Merging Devices to form Personal Groups**
- **Linking Groups via Personal User Names**

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