



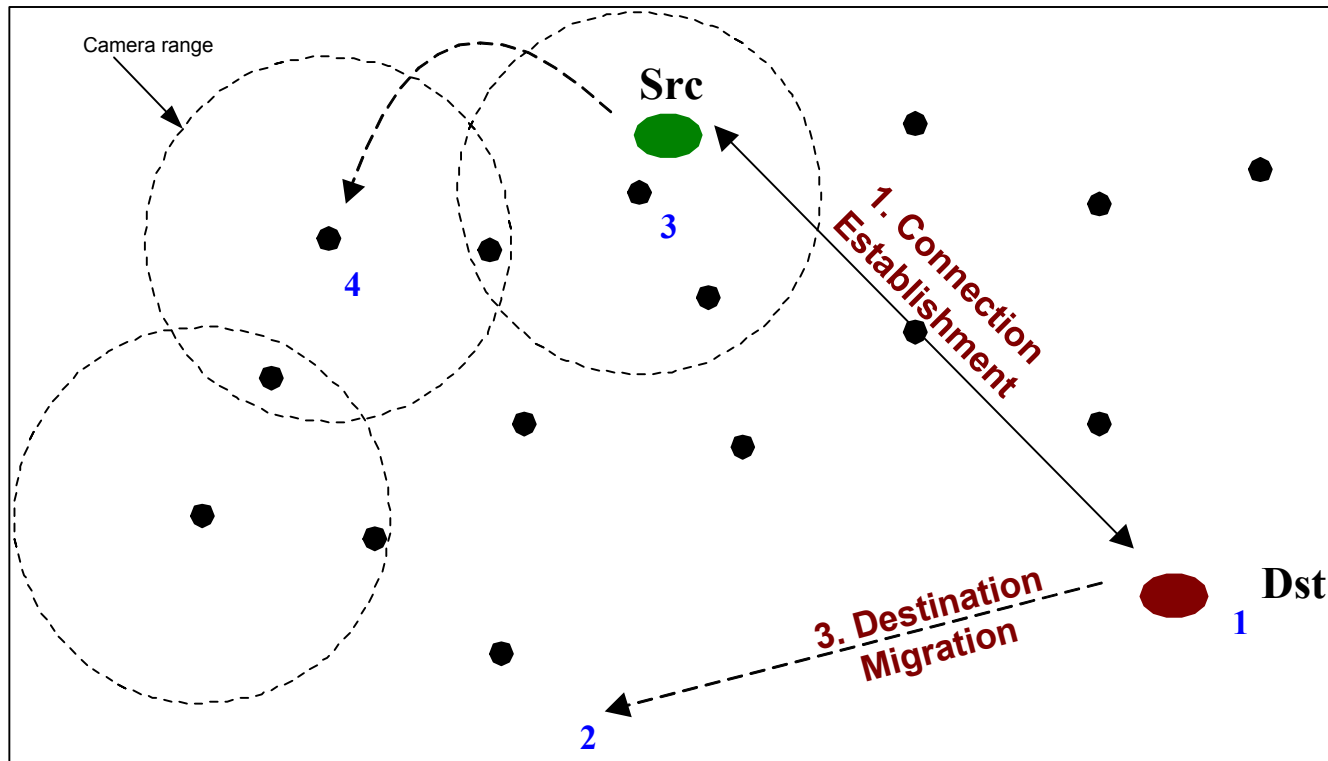
# ATP: Autonomous Transport Protocol

**Tamer Elsayed, Mohamed Hussein, Moustafa Youssef, Tamer Nadeem, Adel Youssef and Liviu Iftode**

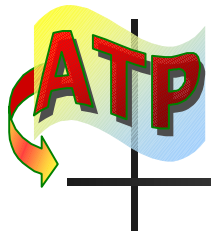
**Department of Computer Science  
University of Maryland, USA**



# Tracking in Sensor Networks



- To conserve energy, target is tracked using only one camera
- Data is transmitted through a streaming application (*Src*) to a mobile command center (*Dst*)
- Active camera changes as target moves (streaming application migrates)
- Cannot tolerate data loss during camera change



# What is ATP ?

---

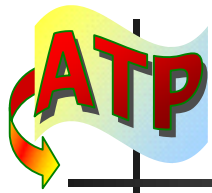
- Autonomous Transport Protocol
- **Why autonomous?**
  - Decoupled from physical network
  - Decoupled from the physical location of application endpoints
- **Provides reliable communication between mobile endpoints**



# Features I

---

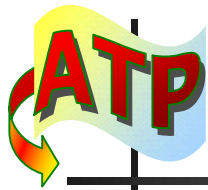
- **Application-specific naming**
  - Connection endpoints are defined as contents in the P2P network
- **Dynamic endpoints relocation on different end hosts without disrupting the connection**
  - ATP is responsible for forwarding segments to the destination and acknowledgments to the source regardless of their current location



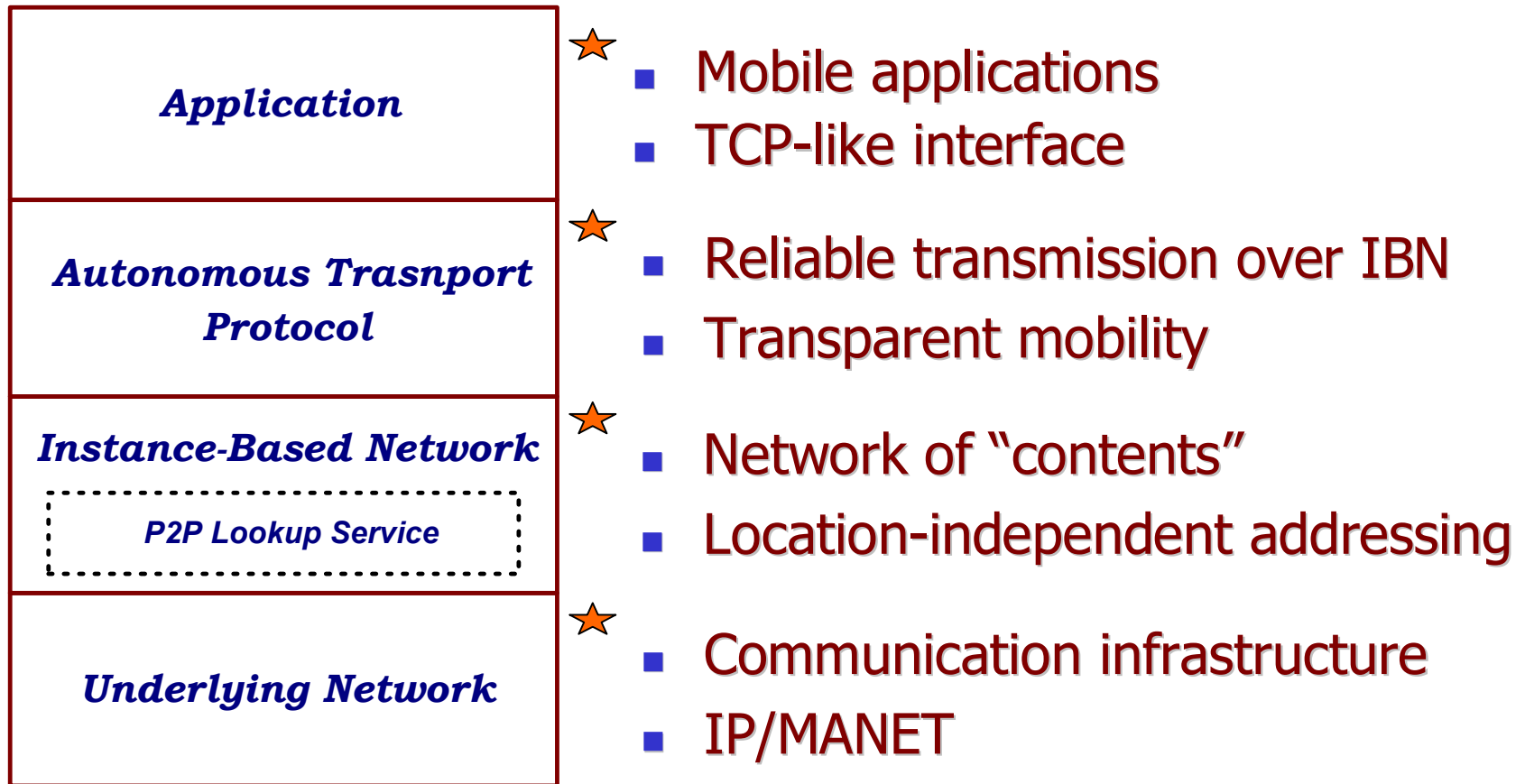
# Features II

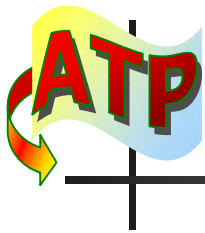
---

- Reliable transmission between users *not* end-hosts
- Established connections maintained independent of intermediate node availability
- TCP-like interface
  - Easy to write new ATP-aware applications
  - Current applications can be made ATP-aware with minor modification



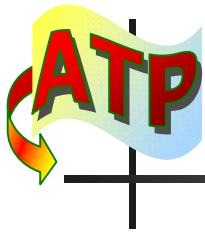
# System Architecture





# Content-Based Network (CBN)

- **Network of endpoint entities “*Contents*”**
  - **Active Contents**
    - communicates together by messages
    - performs a lookup for other contents
    - e.g. application service, network connection agent, ..
  - **Passive Contents**
    - stored in the network
    - e.g. document, ..
- **Location-independent addressing**
  - Extends P2P lookup services (e.g. CAN, Chord,..)
  - Maps a content to a specific node



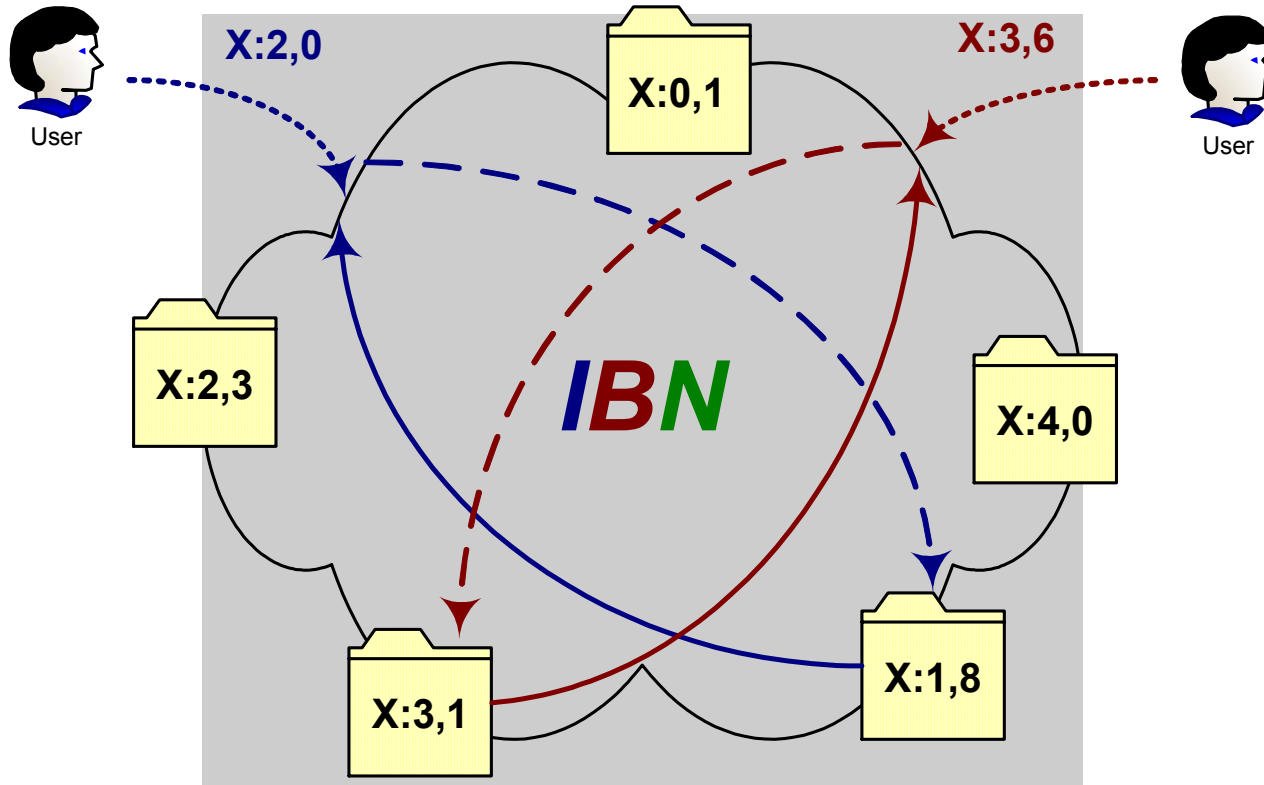
# IBN=CBN++

- Allows different instances of same content
- Instance Publishing
  - Self (active) / Free (passive)
  - Reliable
  - Leased
- Instance Routing
  - Decoupled from instance physical location
  - Routes to specific or closest instance
- Replicates contents for fault-tolerance
- Caches info for future queries

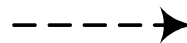




# IBN Routing Example



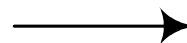
Published file



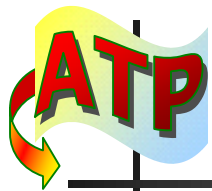
Query request



User request

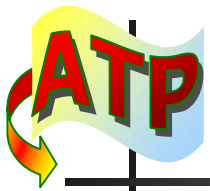


Query response

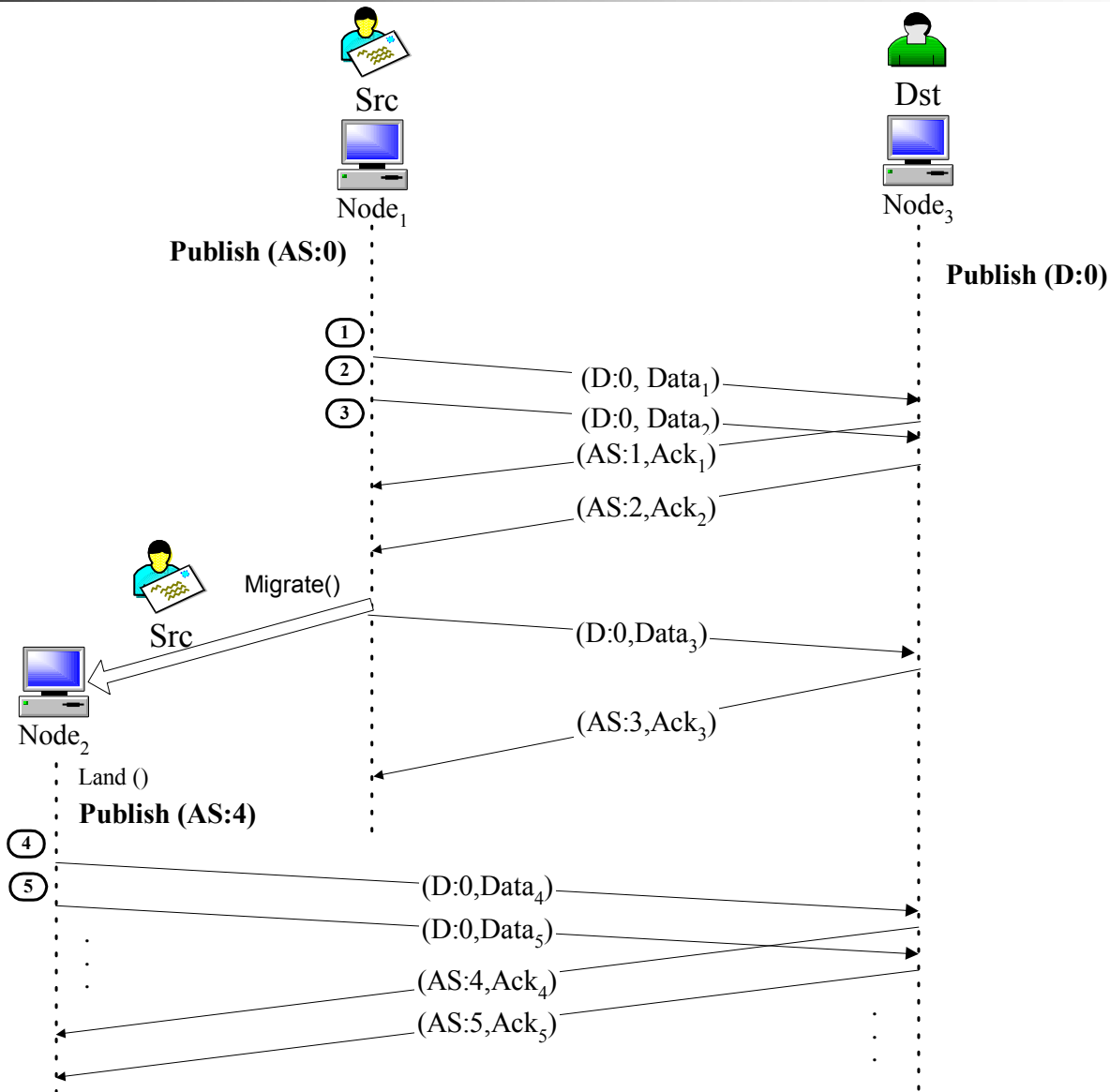


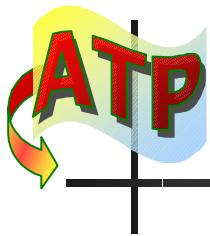
# ATP over IBN

- IBN Content/Instance Addressing
- Contents are the communication endpoints
- Instances are agents working on behalf of mobile entities
- ***AS:i***: ATP agent for the source S with index *i*
- Index *i* means the agent is responsible for sending packets starting from sequence number *i*



# Source Migration Scenario





# Design Issues

- *Reclaiming Network Resources*
  - Enforcing a lifetime or using a leasing mechanism for publishing in the IBN
- *Acknowledgement Mechanism*
  - Cumulative vs Range Acks
- *Fault tolerance*
  - Relies on IBN route discovery service and/or on ATP mechanism to alleviate the node failure and link failure problems
- *Security*
  - How to handle privacy, authenticity, and trust ?
- *End-to-End Semantics*
  - Shifts the burden of waiting from the source endpoint which allows the source to terminate earlier.



# Related Work

---

- TCP over Mobile IP
- TCP Connection Migration
- I3
- Mobile Tapestry
- Shortcomings
  - User is bound to a single host during connection lifetime
  - Communication endpoints must exist simultaneously



# Current Status

- Implemented a Java prototype of the ATP protocol over Pastry
  - The prototype is deployed over a set of independent nodes at University of Maryland.
  - A simple ATP-aware application runs on each node of the network
- Simulation in progress
- Further information
  - <http://www.cs.umd.edu/projects/atp>
  - <http://www.cs.umd.edu/projects/ibn>