Tetherless Computing: Vision and Current Research

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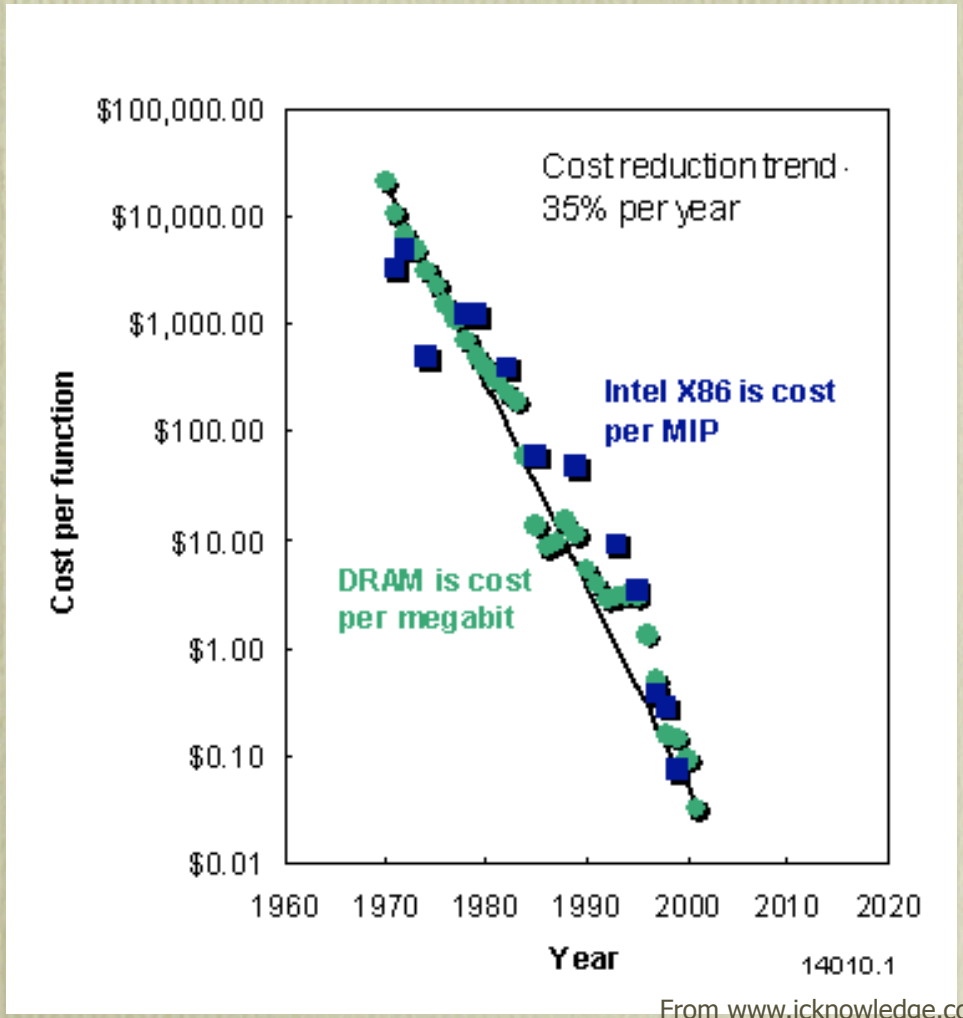
Agenda

- Technology trends
- Tetherless computing vision
- Research overview

1. Computing costs are plummeting



From www.icknowledge.com

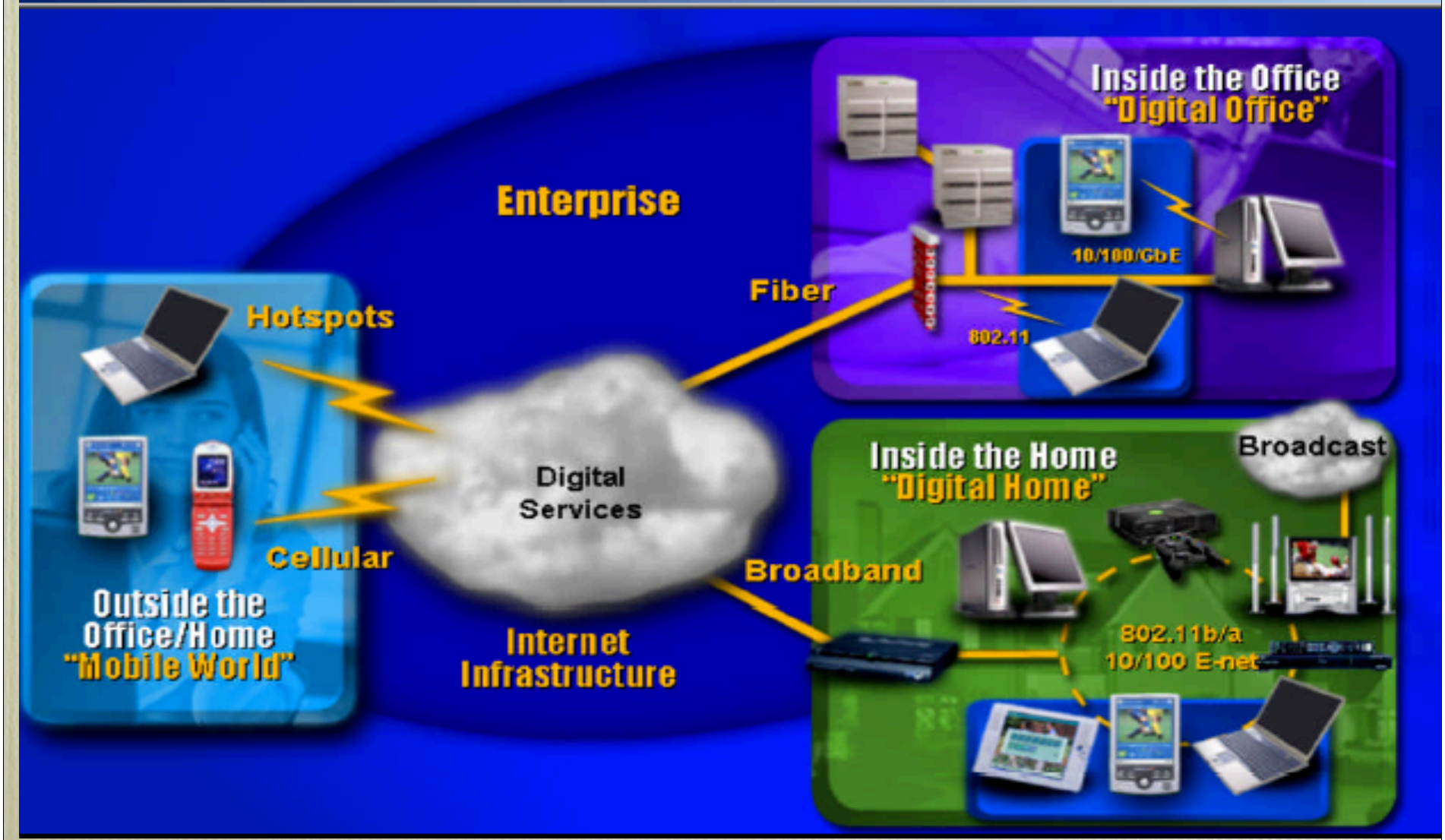
CMOS does logic, memory, imaging and RF

In 2015:

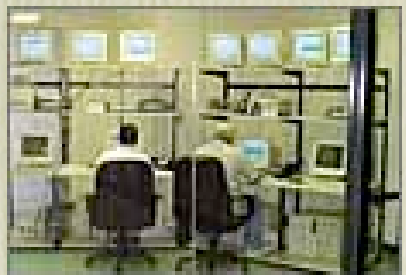
- Mobile devices will have 6TB storage, a 40 GHz processor and will cost $500

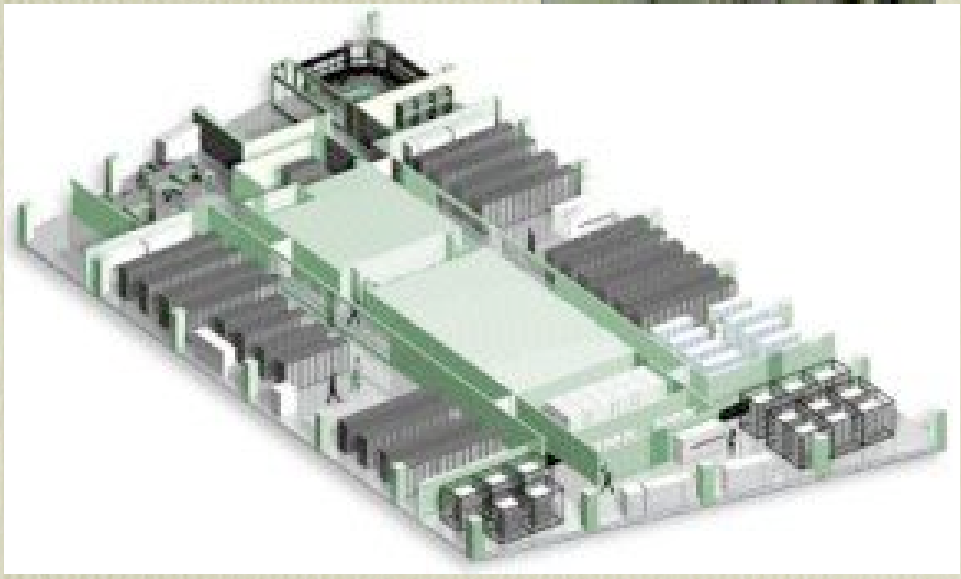
-Mobile devices with today's capabilities will cost < $10

2. Wireless networks are proliferating



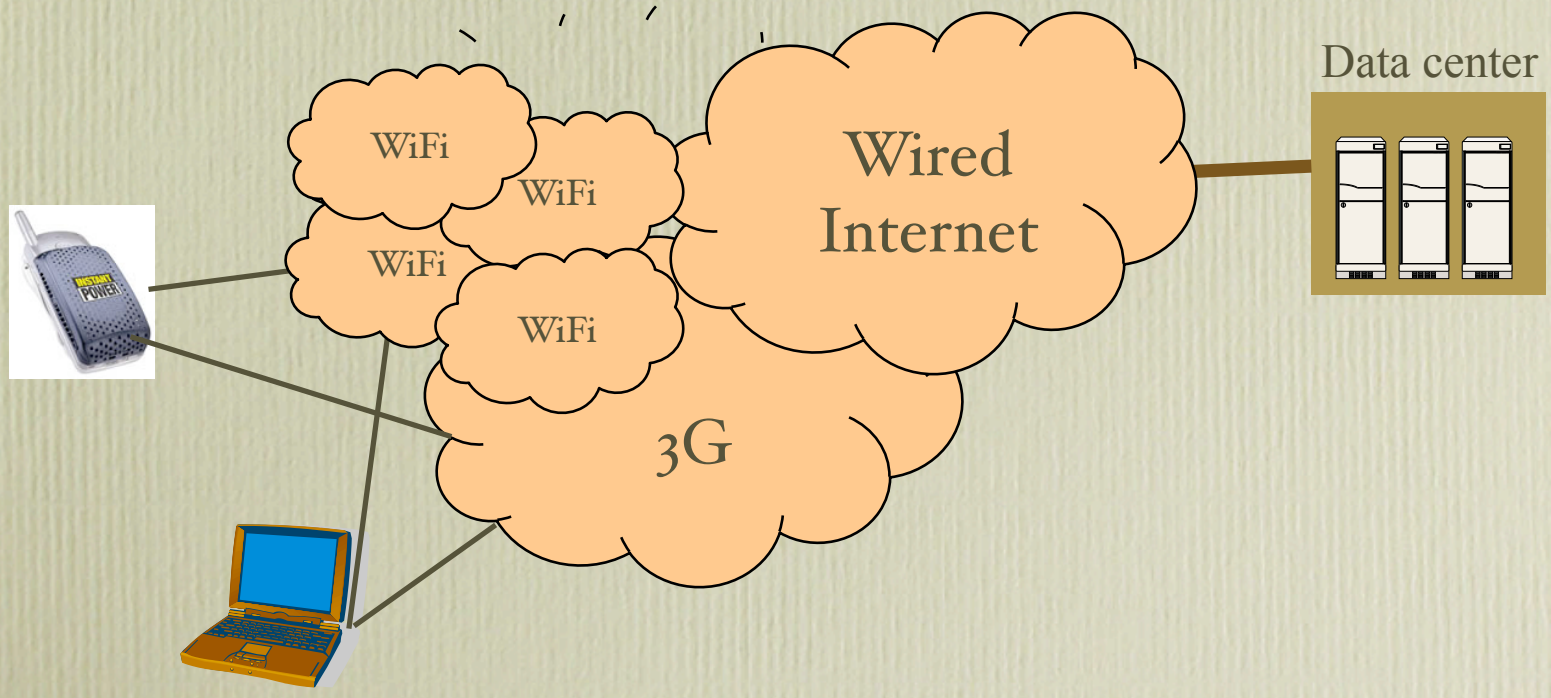
3. Data centers aggregate resources



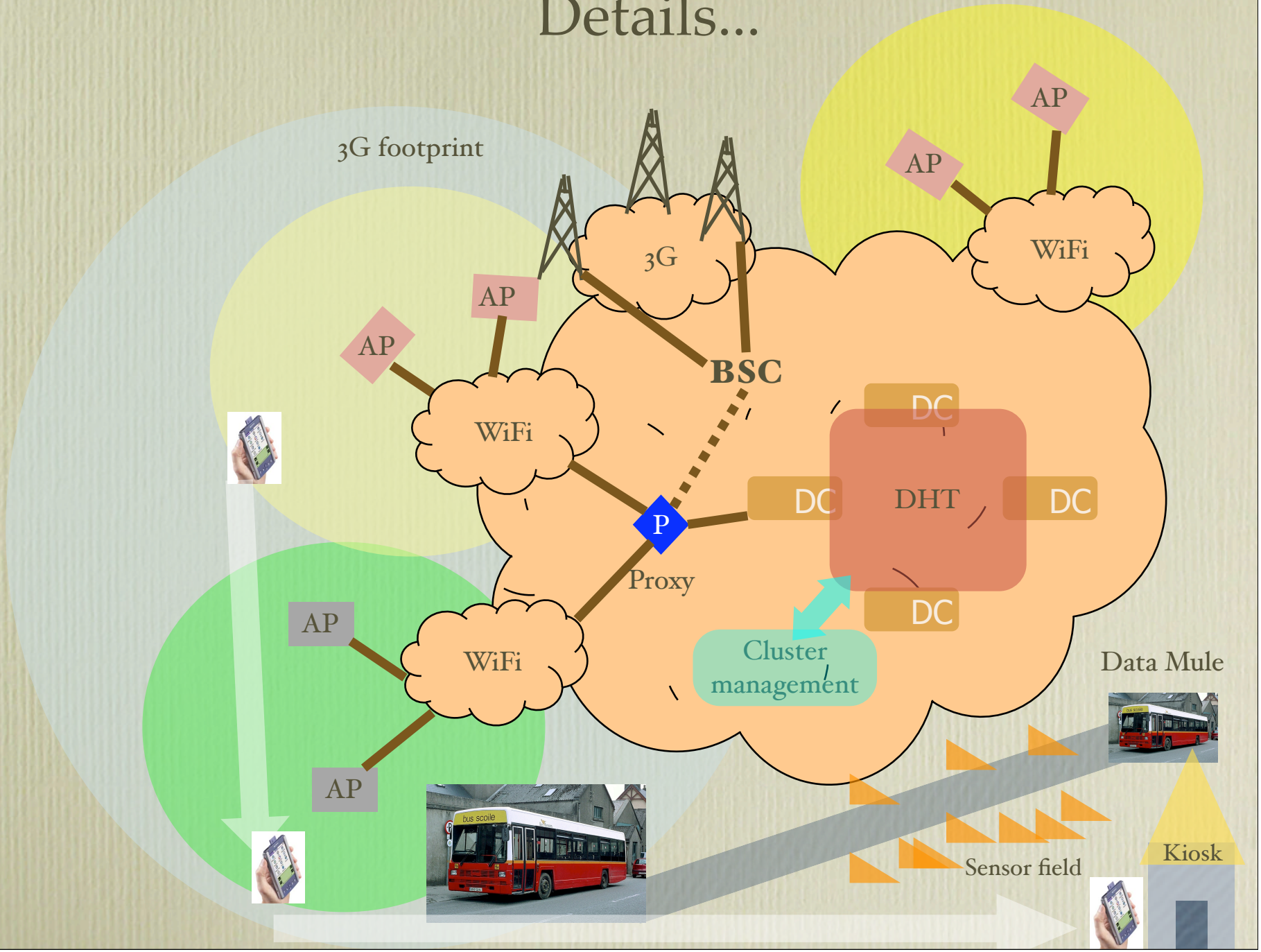


Tetherless computing vision

- **Smart mobile devices** that **opportunistically** communicate with **resource-rich data centers** over **heterogeneously administered wireless** and wireline networks



Details...


3G footprint
AP
AP
AP
AP
AP
AP
3G
WiFi
WiFi
WiFi
BSC
DC
DC
DHT
DC
DC
P
Proxy
Cluster management
Data Mule
Sensor field
Kiosk
bus scolie

Issues

- Physical layer
  - Power management
  - Dealing with channel characteristics (e.g. fading)
  - Software defined radio?
- MAC layer
  - Fast link detection and handover
  - Power-aware MAC

Issues 2

- Network layer
  - Dealing with changing IP addresses (micromobility and mobility)
  - Location management
  - Routing with opportunistic links
- Transport layer
  - Power- and link-aware multi-interface transport protocols
  - Disconnection tolerance at the transport layer
  - Flow and congestion control with opportunistic links

Issues 3

- Session layer
  - Session persistence across disconnections
  - Management of multiple transport connections
- Application layer
  - Delay and disconnection-tolerant application design
- Management
  - Access point failure detection
  - IP address allocation and management

Issues 4

- Security
  - Security for disconnected nodes
  - Identity management
- Computing infrastructure management
  - Application distribution and management
  - Efficient discovery of global state

Current Tetherless Communication Architecture

- Extends existing Internet architecture
- Disconnection resilient
- Allows unrestricted mobility
- Identity is managed
- Provides secure channels to disconnected nodes
- Does access sensing for opportunistic communication

Research projects

- Communication architecture
  - Tetherless communication architecture (Seth, Liang, Kroeker)
  - Opportunistic communication management with multiple interfaces (Seth)
  - Opportunistic link queueing analysis (Ghaderi)
  - Mobility prediction using intelligent access points (Ahmed)
  - Energy-aware routing in sparse ad hoc networks (Thomas)
  - Automatic access point failure detection (Pan)

Projects 2

- Computing architecture
  - Efficient discovery of global state (Ahmed, Chopra)
  - Application distribution and management (Singh)
  - Efficient search in large P2P networks (Zaharia)

Projects 3

- Applications
  - Mobile blog (Garg)
  - DHT-enabled Gnutella (Jain)
  - Tetherless Jabber (Agarwal)

Routing and mobility support