Backup and Bypass: Introducing Delay-tolerant Networking to Mobile Phones

Motivation

Mobile communication services rely on wireless infrastructure provided by third party operators even if communicating peers are in reasonable geographical proximity

- Potentially suboptimal from a performance perspective
- May be expensive to use particularly when roaming abroad
- May not be available when in less well covered regions

Powerful personal communication devices

- In particular: mobile phones (virtually always turned on)
- Basis for ad-hoc networking environment
- *Bypass* communication infrastructure for cost-savings
- Provide *backup* if no infrastructure is available

Delay-tolerant Networking (DTN)

- Communication based upon asynchronous messaging
- No reliance on end-to-end path at any point in time
- Store-and-forward delivery as well as physical data carriage
- Deterministic and/or probabilistic routing

DTN Architecture

- Exchange of *Bundles* hop-by-hop via Bundle Protocol Agents
- Bundle Protocol across different internetworks
- Convergence layer provides mapping to lower layer
- Custody transfer for reliability
- Support for end-to-end semantics at the application layer
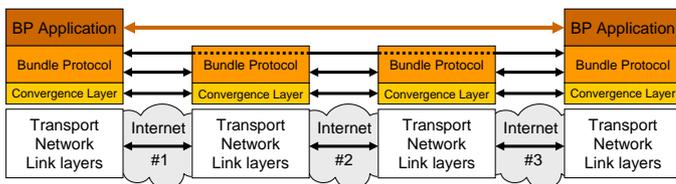
DTN for Nokia 770 Internet Tablet

- Running the DTN reference implementation (UC Berkeley)
- Sample application for HTTP-over-DTN
- Further applications under development
- Interacts with PC-based peer applications via WLAN

DTN for Symbian Mobile Phones

- TKK development
- Plug-in concepts for convergence layers and routing
- Interoperable with DTN reference implementation
- Sample application for multimedia messaging
- Interacts with PC- and 770-based applications
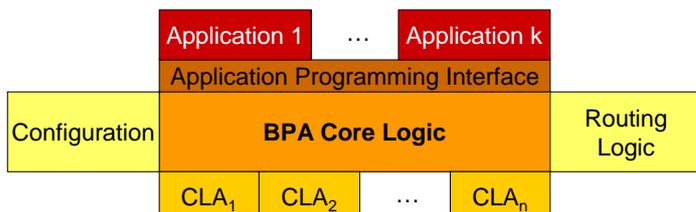
Issues with Mobile Ad-hoc Networking

Present applications require end-to-end communications
Limited *effective* node density makes the existence of an end-to-end (for a sufficient period of time) unlikely

- Number of mobile users with mobile devices in an area
- Only some of them are actually in communication range
- Not all devices are interoperable
- Users may not be willing to cooperate (battery, memory)
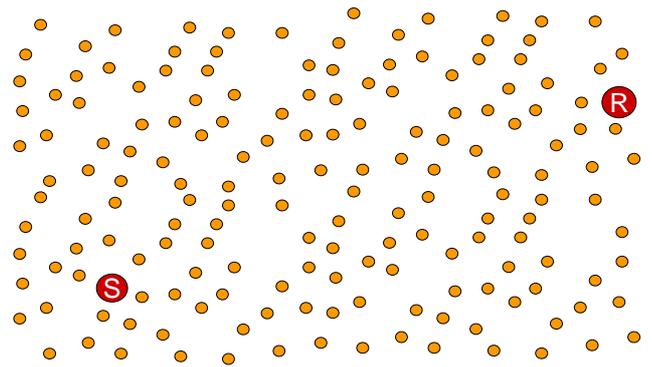
From dense to sparse ad-hoc networking environments
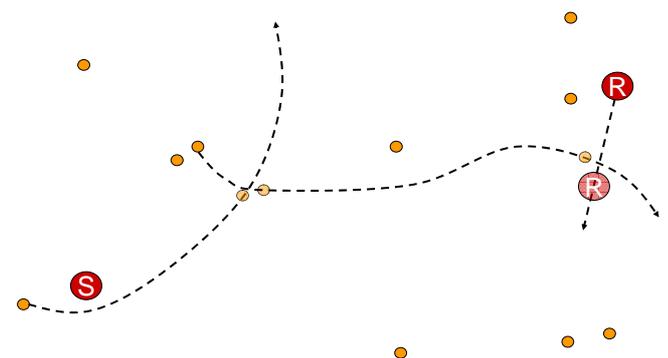
Demonstration scenario at RealMAN 2006

- Hop-by-hop forwarding across different link layers
- Store, carry, and forwarding using physical mobility
- Infrastructureless messaging with intermittent connectivity
- Prototype for asynchronous web browsing

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