

Adaptive file systems for wireless hosts

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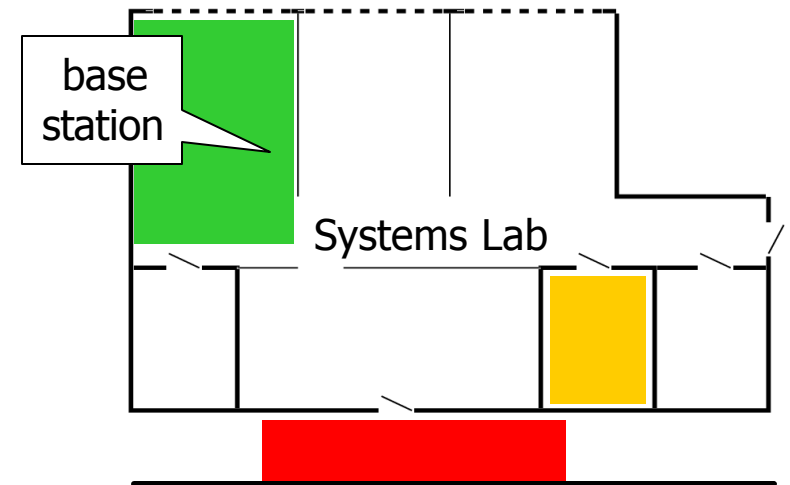
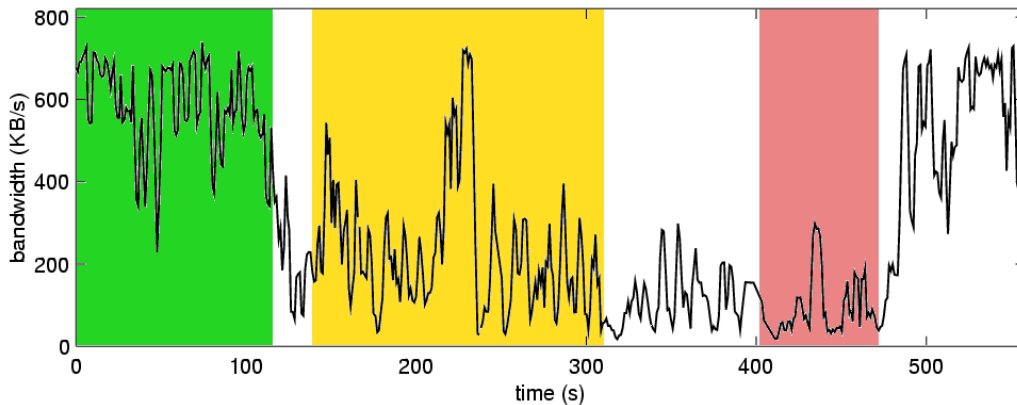
Ithaca, NY

File systems in mobile computing

- Characteristics of mobile hosts
 - Limited disk space
 - More prone to "mishaps"
 - Potentially weak connection to other hosts
- File system design for mobile hosts
 - Client-server distributed file system
 - Whole-file caching (stateful server)
 - Asynchronous writes

Wireless network performance

- Noisy medium leads to high error rates
 - 802.11b is "reliable", but throughput drops
- Mobile hosts experience rapid changes
 - Difficult to predict future bandwidth

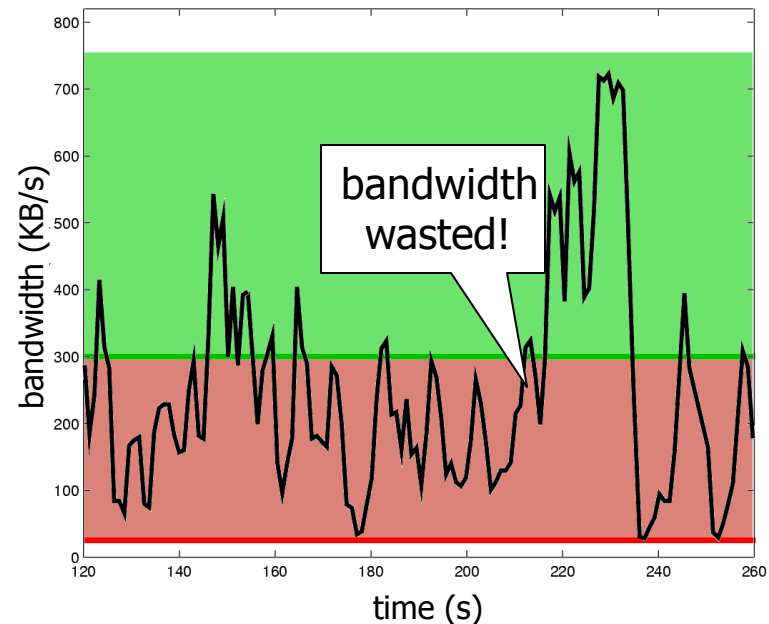


Adaptive file system communication

- Multiple types of communication (RPCs)
 - Retrieve uncached data from server
 - Write back modified files
 - Prefetch if bandwidth is available
- Adaptation properties
 - Minimise delay for "must-block" operations
 - Ensure high utilisation of bandwidth
 - Strong cache consistency when required

Conventional file system adaption

- Coda-style modal adaptation
 - No/low/high bandwidth modes
 - Switch based on threshold
- Weakly-connected mode
 - Asynchronous writes to log
 - Aggregate writes to same file
 - Log periodically flushed
- "Unpredictable" changes in semantics

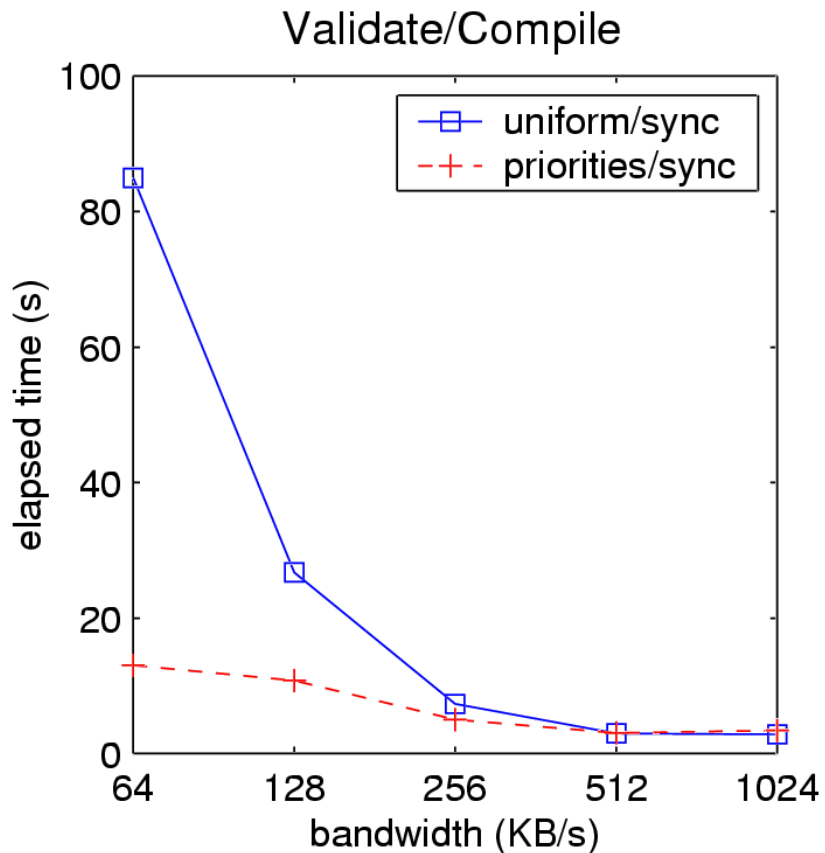


Mobile File System (MFS)

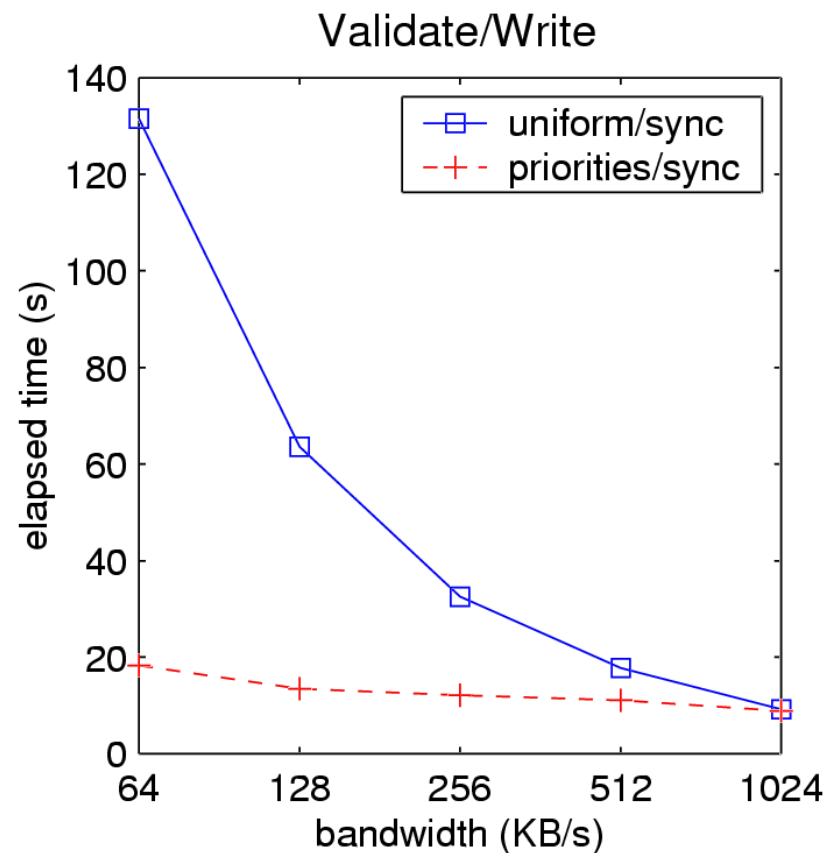
- Modeless rather than modal
- RPCs are assigned priorities
 - Fine-grained adaptation
- Client assumes high bandwidth
 - RPC library handles adaptation
 - e.g. Always fetch files before writing back a file
 - (Asynchronous writes where possible)

VALIDATE (high)
FETCH DATA
METADATA
STORE DATA
PREFETCH (low)

Validate workload

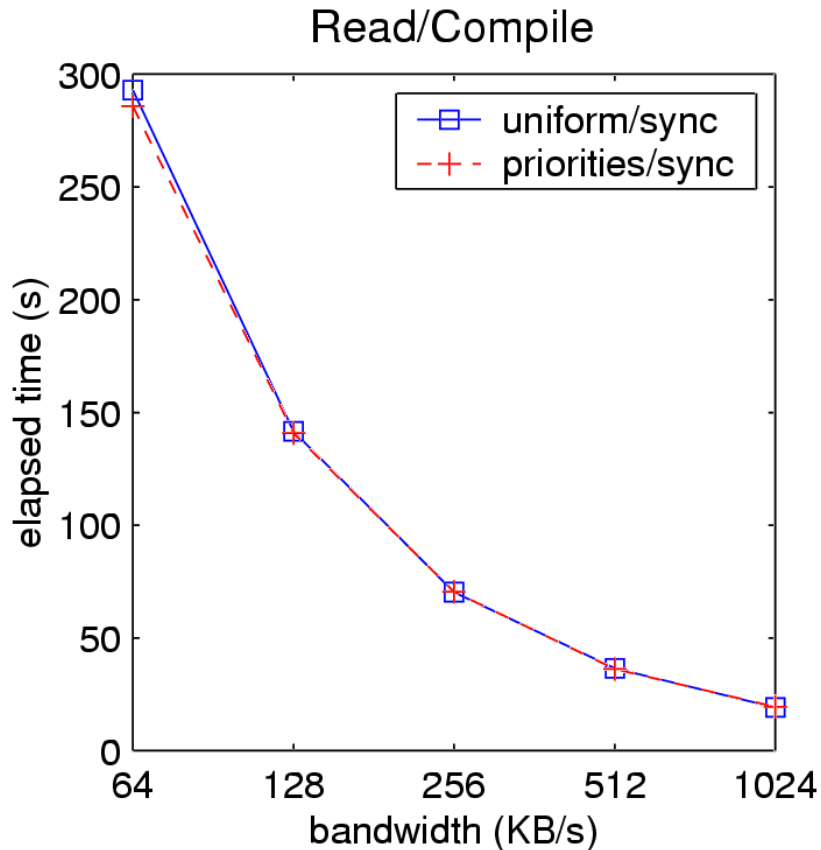


foreground: small RPCs
background: large RPCs, CPU-bound

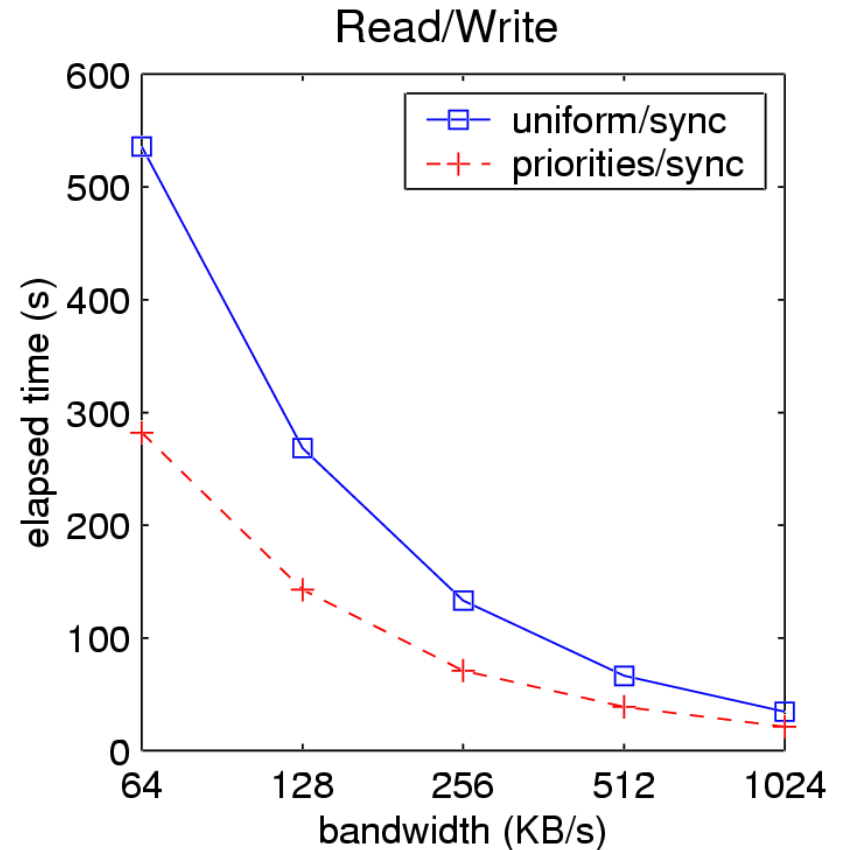


foreground: small RPCs
background: large RPCs, I/O-bound

Read workload



foreground: large RPCs
background: large RPCs, CPU-bound



foreground: large RPCs
background: large RPCs, I/O-bound

Summary

- MFS features omitted
 - RPC subsystem
 - Prefetching
 - Cache consistency algorithms
- Modeless adaptation applied further
 - Network-level (message prioritisation)
 - Web browsing/Publish-subscribe
 - Generic characterisation/construction of modeless applications