# Picocenter: Supporting long-lived, mostly-idle applications in cloud environments


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## Motivation

End-users wish to run long-lived but mostly-idle (LLMI) apps
- E.g., web/email servers, distributed social networks

But running them in today's cloud (e.g., AWS) is inefficient:
- User pays for an entire VM, even when the app is idle
- Provider reserves resources for idle VMs
- Idle apps need not stay in memory

Options for running LLMI apps in cloud today:
- Sharing VMs with users (Privacy and accounting challenges)
- PaaS, such as AppEngine (Limited programming environment)

Goal: Support LLMI apps in cloud environments
- Pay-by-usage billing, not charge by time
- Swap idle apps off to secondary storage

## Picocenter

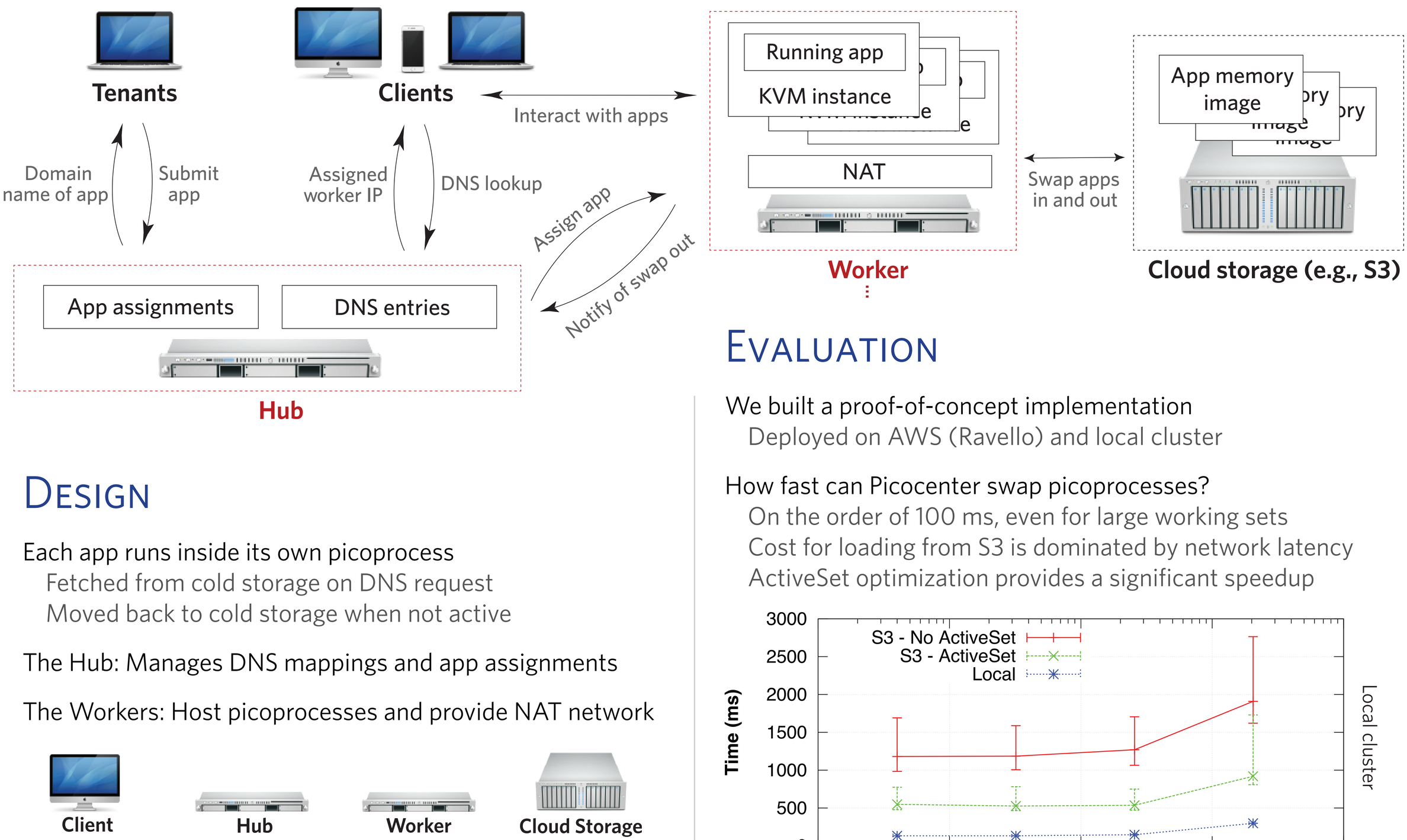
A hosting infrastructure designed to support LLMI apps
- Can be deployed on top of today's cloud
- Run today's apps efficiently (e.g., Nginx, Python apps)

Key challenge: VM is not designed for fast swapping

Solution: Process-based model for computation consolidation

Extend Picoprocess [NSDI'13] for LLMI apps in the cloud
- Fine-grained control of paging, networking and timer
- Transparent checkpoint and restore

ActiveSet: predictive page fetching
- Prefetch active working pages
- Predictive page loading based on packet metadata

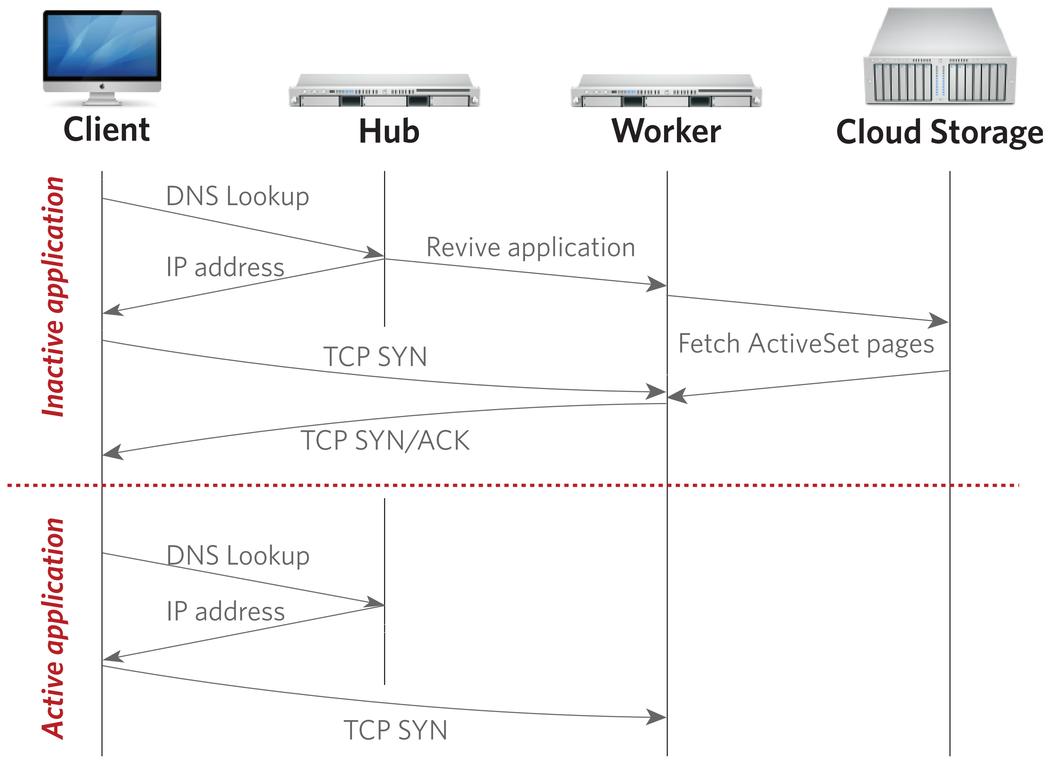



## Design

Each app runs inside its own picoprocess
- Fetched from cold storage on DNS request
- Moved back to cold storage when not active

The Hub: Manages DNS mappings and app assignments

The Workers: Host picoprocesses and provide NAT network




## Evaluation

We built a proof-of-concept implementation
- Deployed on AWS (Ravello) and local cluster

How fast can Picocenter swap picoprocesses?
- On the order of 100 ms, even for large working sets
- Cost for loading from S3 is dominated by network latency
- ActiveSet optimization provides a significant speedup




## Related Work

Hardware virtualization (e.g., Xen, KVM)
- Performance and management overhead of running OS

Operating system containers (e.g., Docker, BSD jail)
- Bound to particular hosting operating system kernel

Process or VM migration
- Heavy operations; inspect kernel or hardware states