

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

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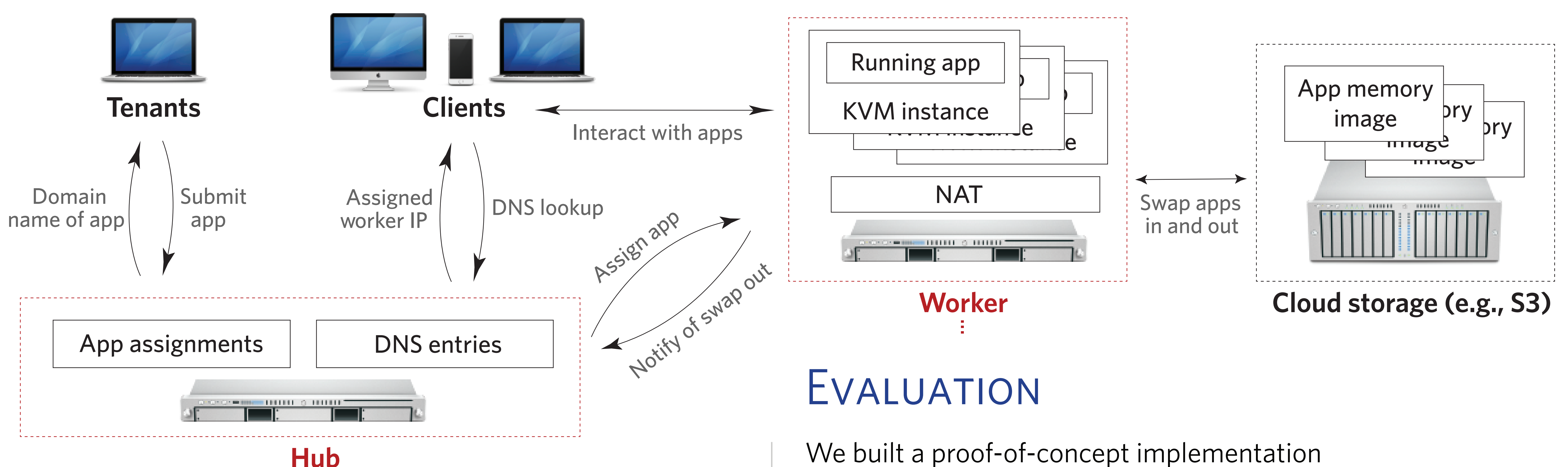
MOTIVATION

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

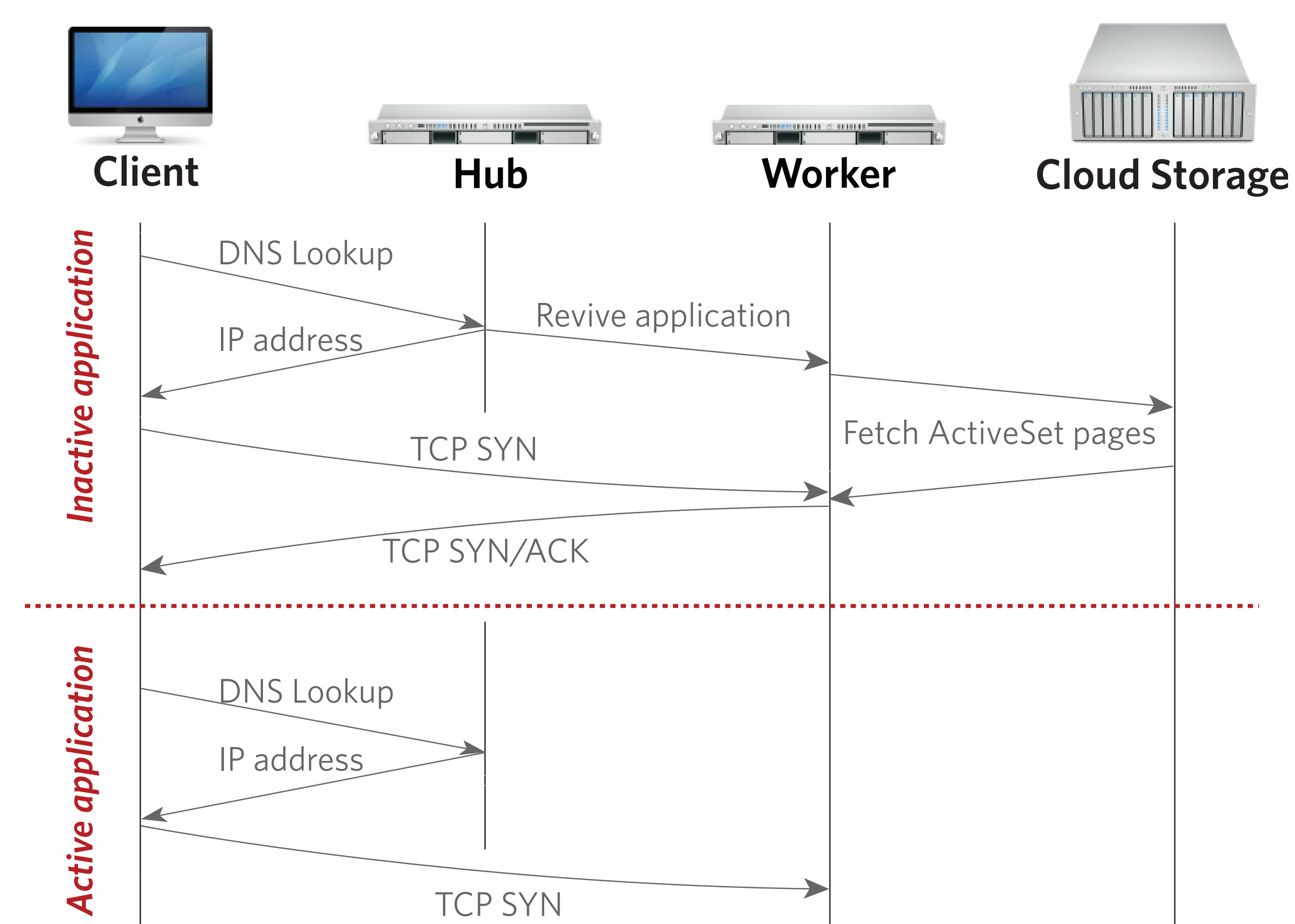


DESIGN

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



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**

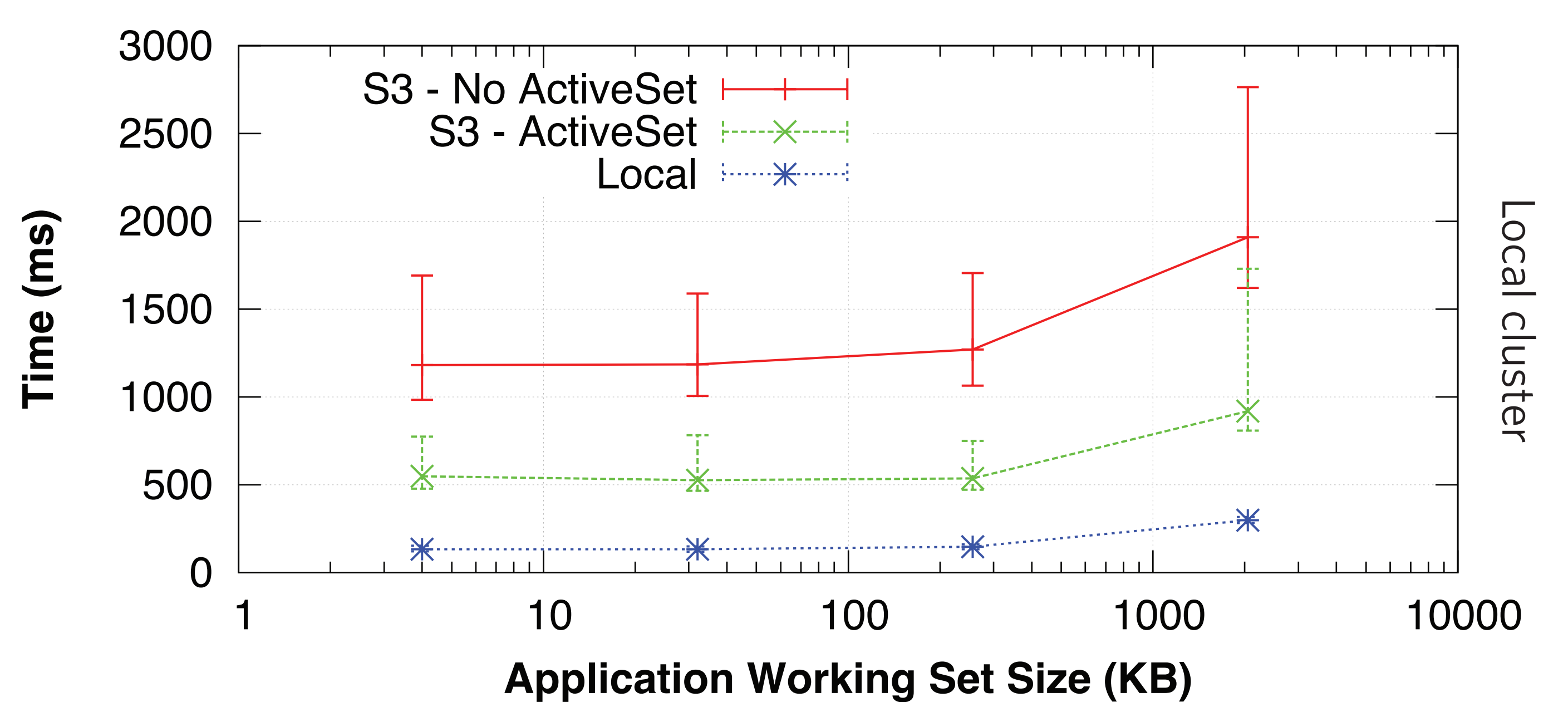
Extend Picoprocess [NSDI'13] for LLMI apps in the cloud
Fine-grained control of paging, networking and timer
Transparent checkpoint and restore

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

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 pages
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