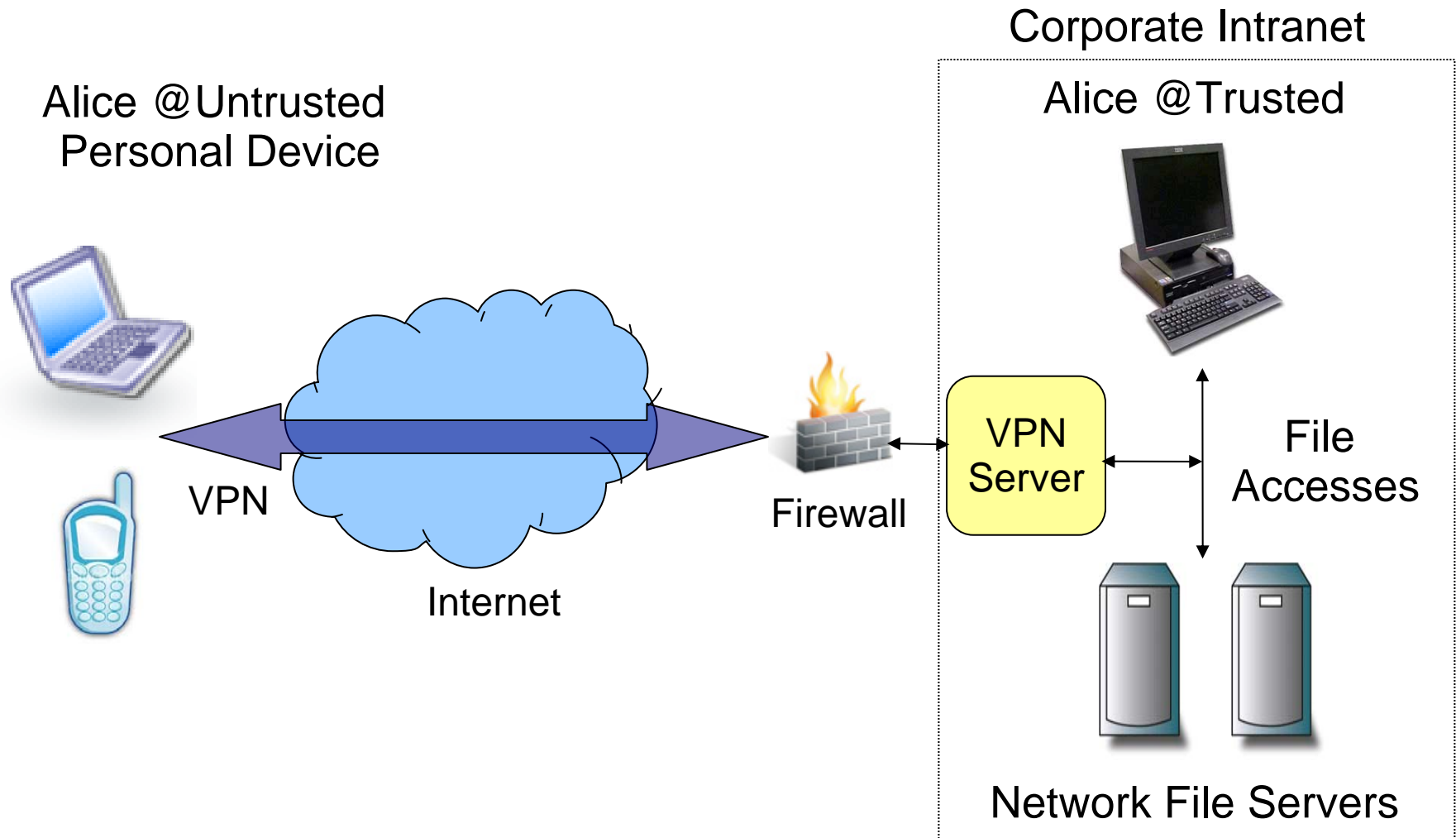


Working Set-Based Access Control for Network File Systems

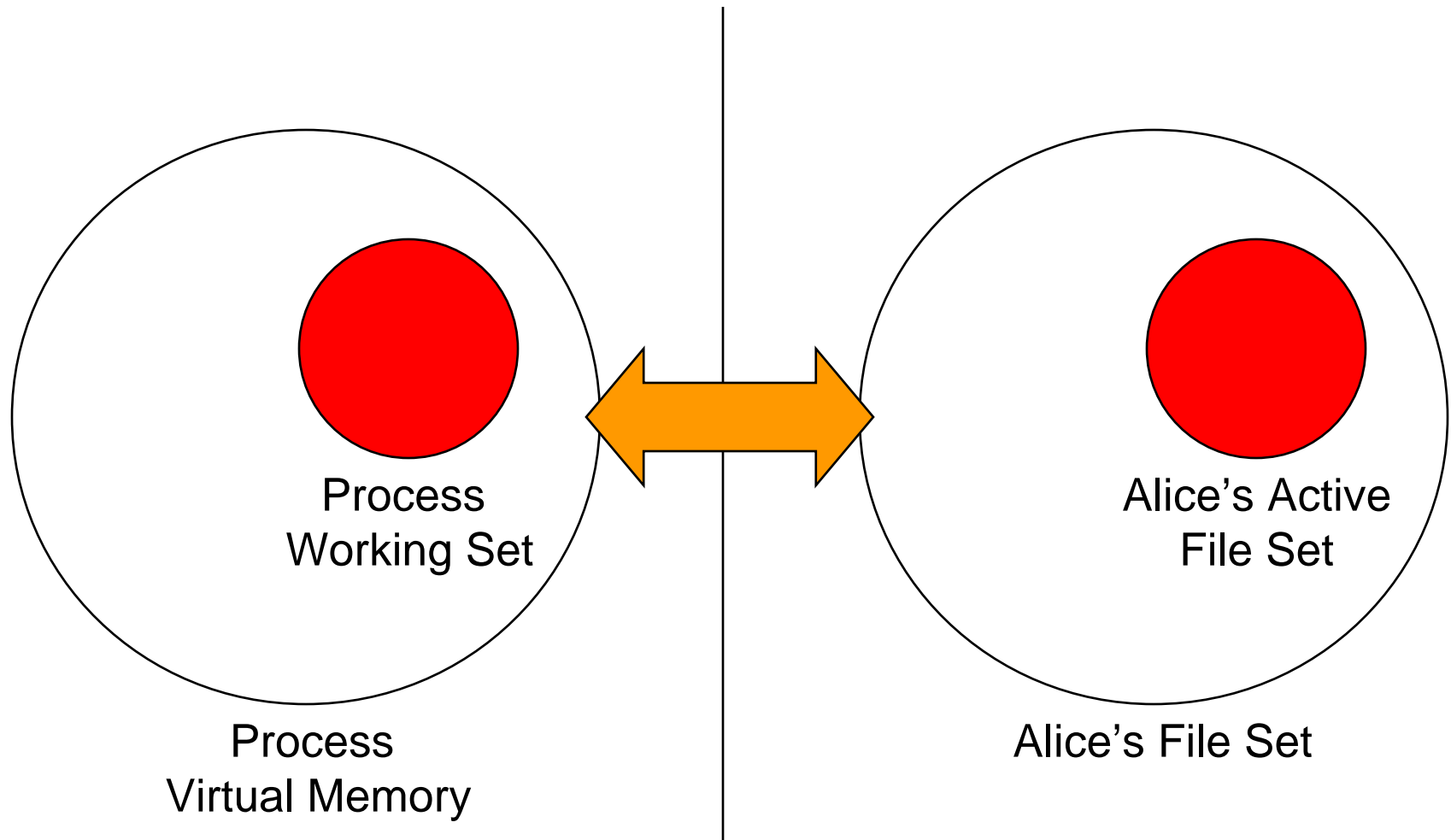
Stephen Smaldone, Vinod Ganapathy, and Liviu Iftode

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Rutgers, The State University of New Jersey
{ *smaldone, vinodg, iftode* }@cs.rutgers.edu

Mobile Access to Network File Systems Increasing



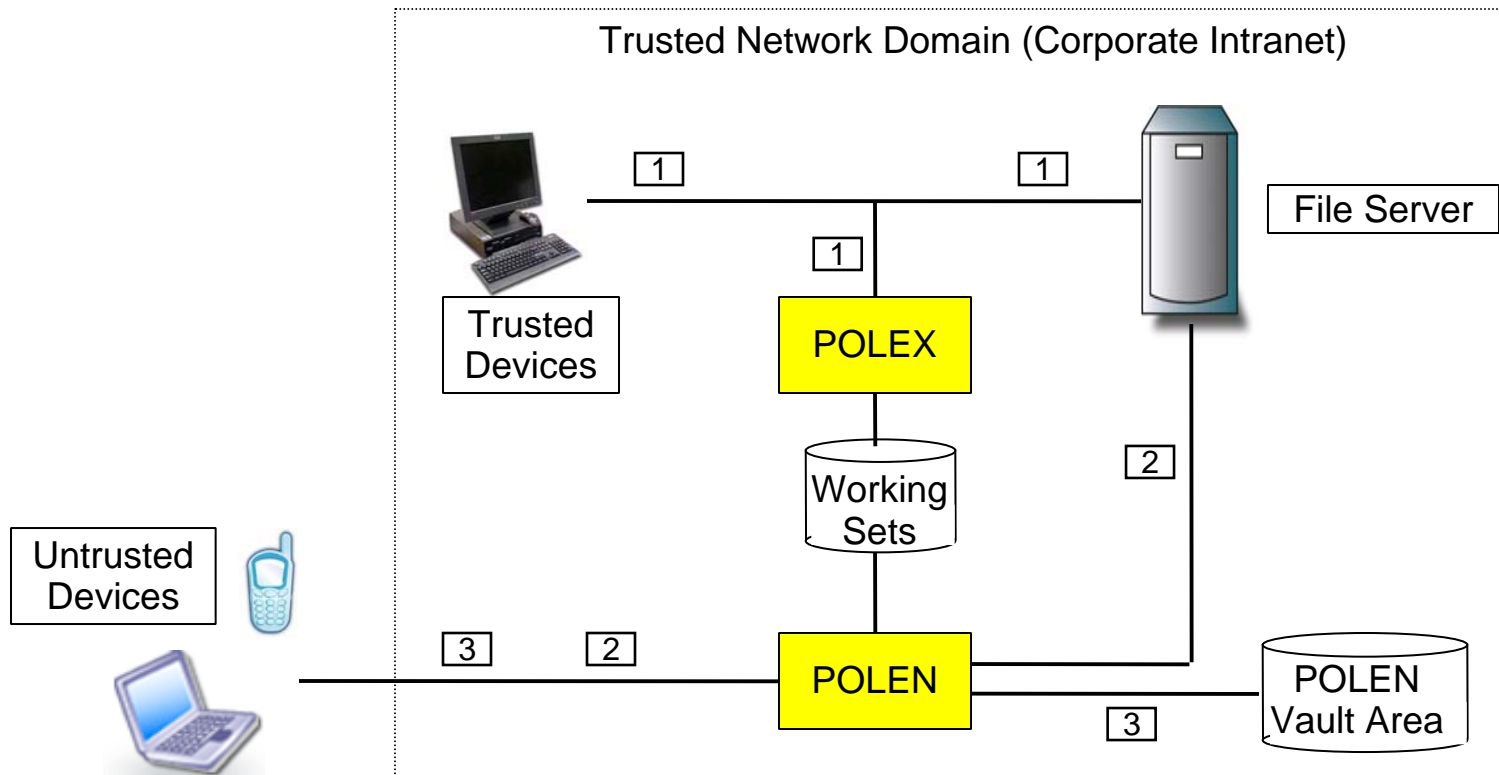
WSBAC: Working Set-Based Access Control



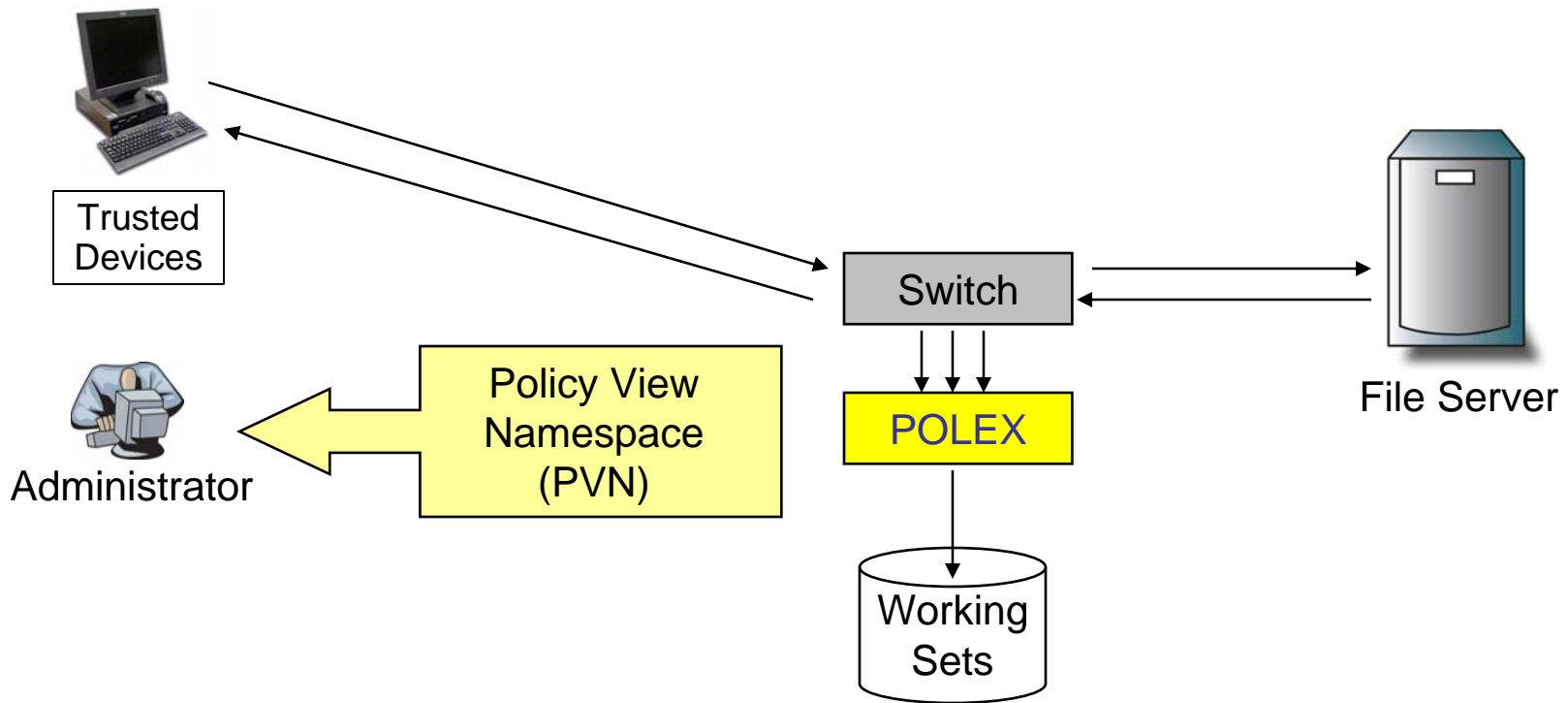
Outline

- Introduction
- **WSBAC Design**
 - POLEX and POLEN Design
- **WSBAC Implementation**
 - Background: FileWall
 - POLEX and POLEN Implementations
 - Policy View Namespace (PVN)
- **Related Work**
- **Conclusions and Future Work**

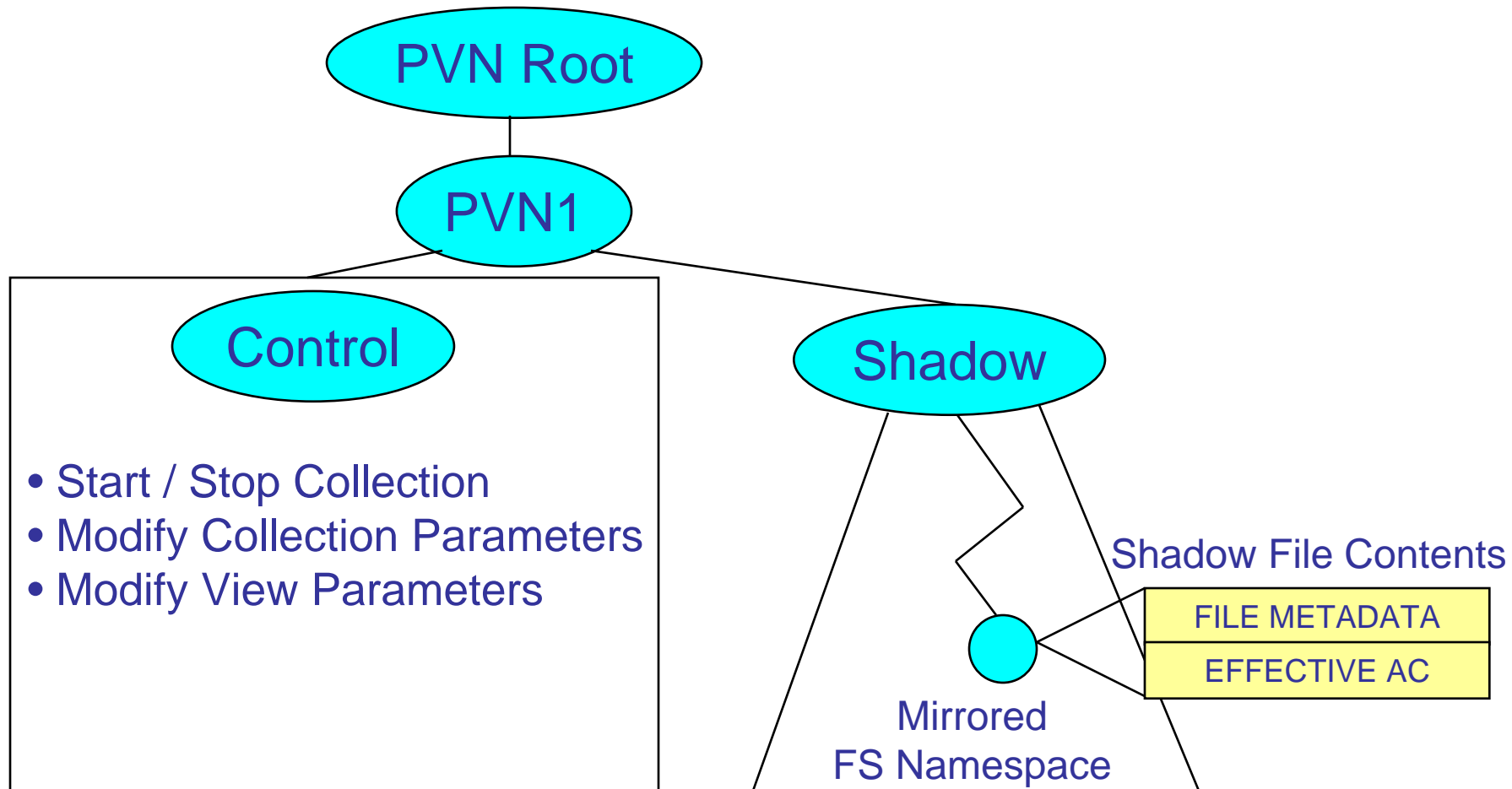
WSBAC Overview



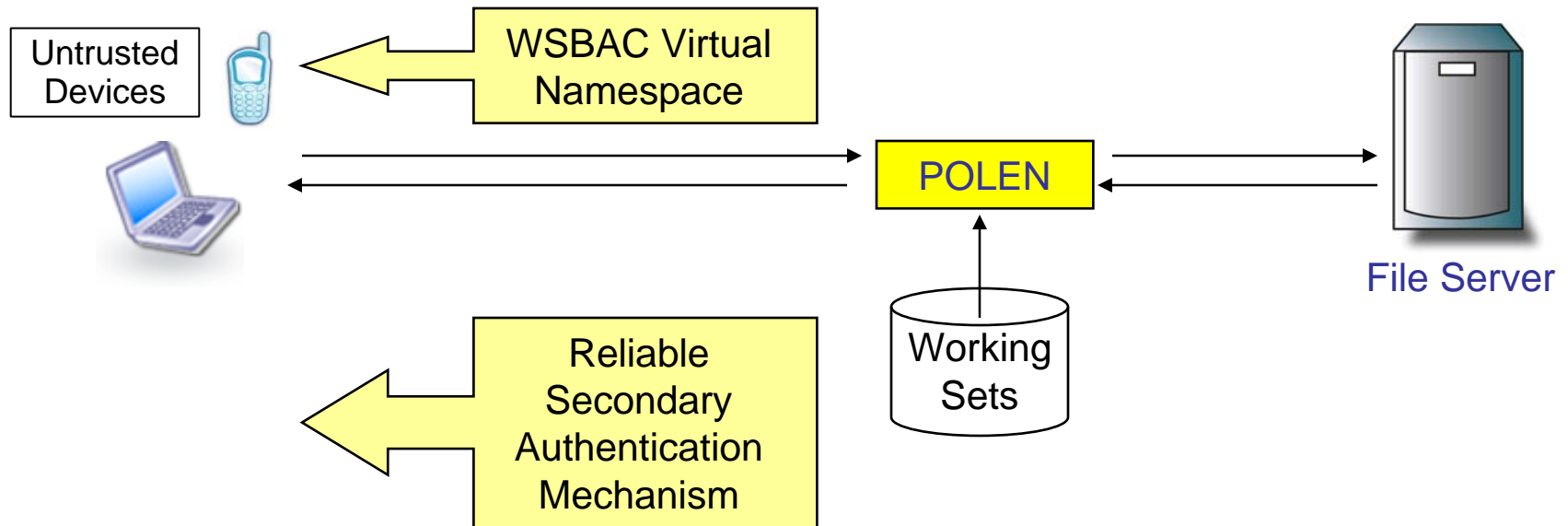
POLEX: POLicy EXtraction for Network File Systems



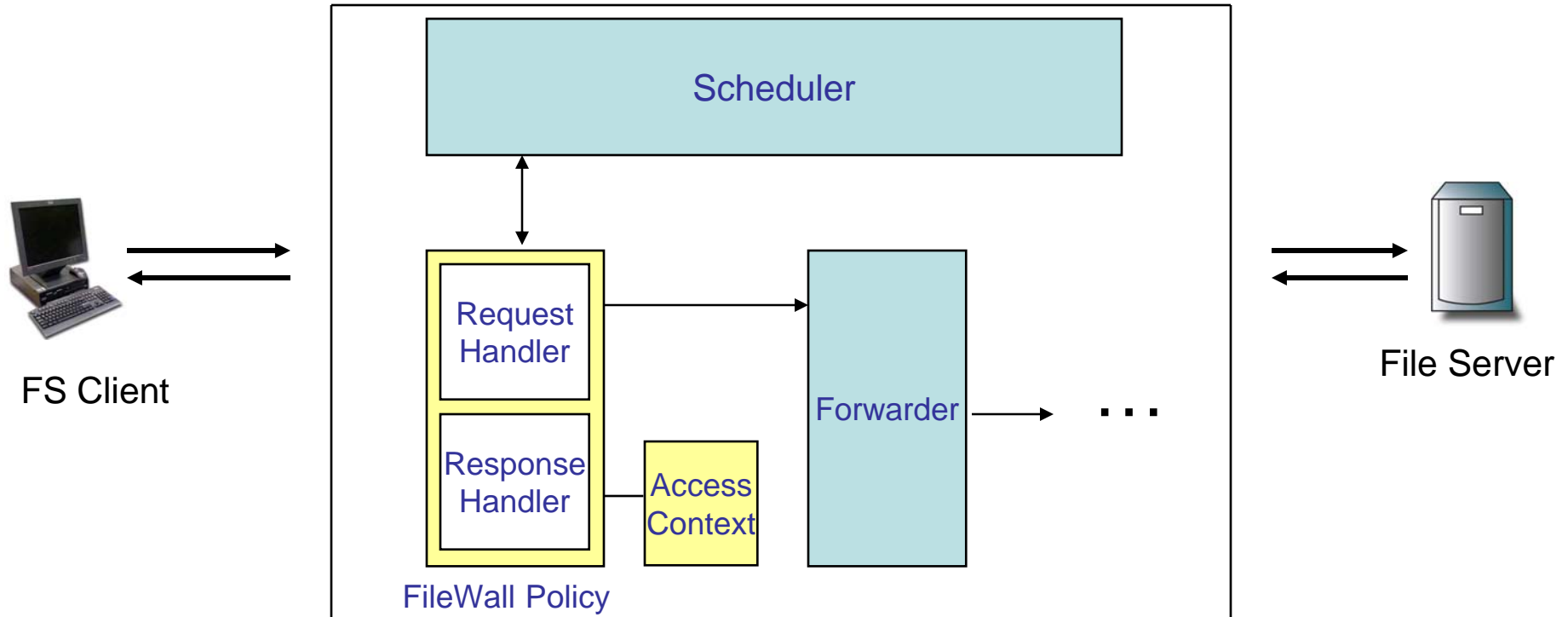
Policy View Namespace (PVN)



POLEN: POLicy ENforcement for Network File Systems

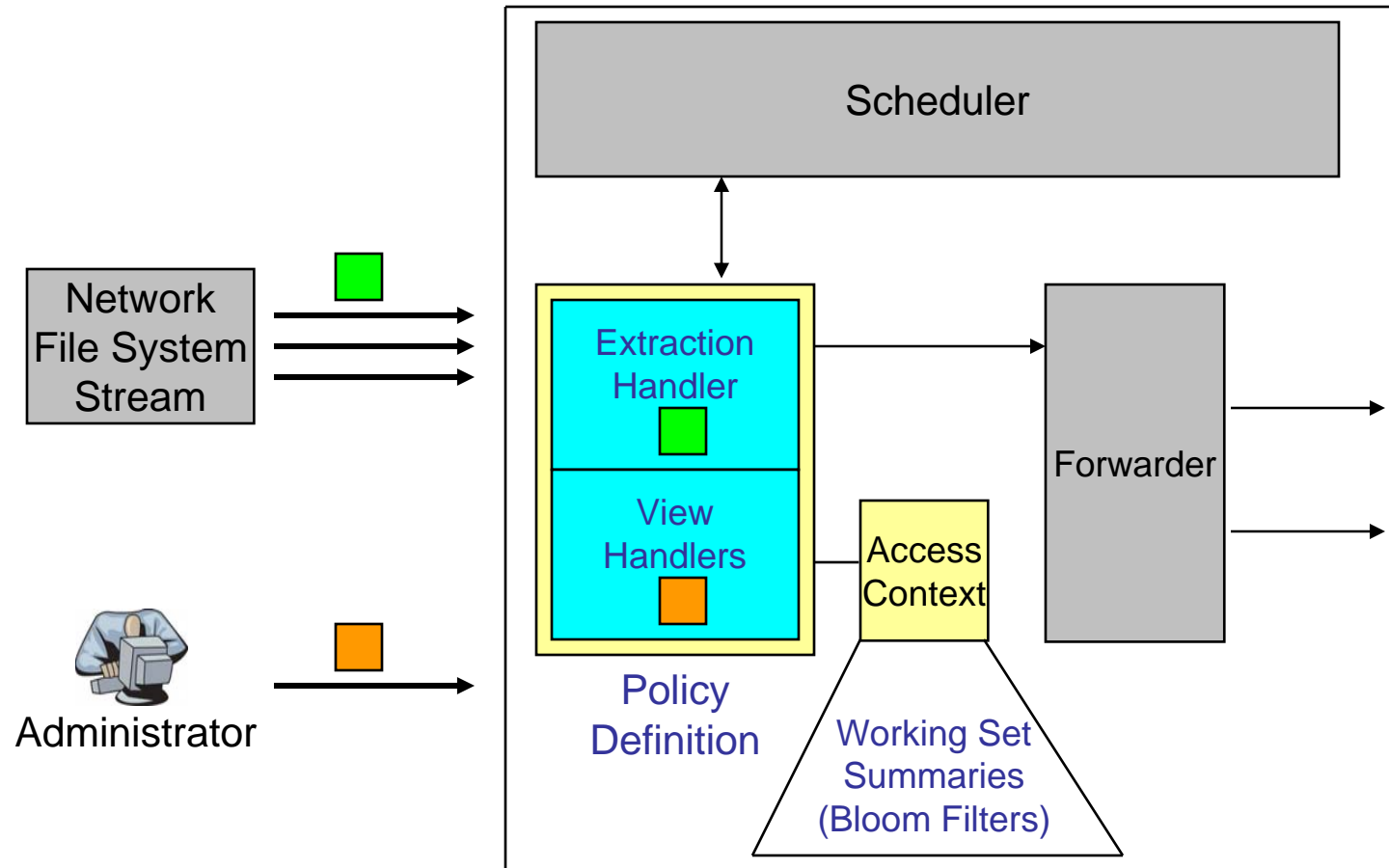


Background: FileWall



FileWall: A Firewall for Network File System, S. Smaldone, A. Bohra, and L. Iftode.
*In the Proceedings of the 3rd IEEE International Symposium
on Dependable, Autonomic and Secure Computing (DASC'07).*

The POLEX Implementation



Outline

- Introduction
- WSBAC Design
- WSBAC Implementation
- **Evaluation and Results**
- **Related Work**
- **Conclusions**

Evaluation

- Goals

- Measure accuracy of a working set extraction: w.r.t. errors and over-estimations
- Measure overheads imposed network file system access
- See paper for full evaluation and results

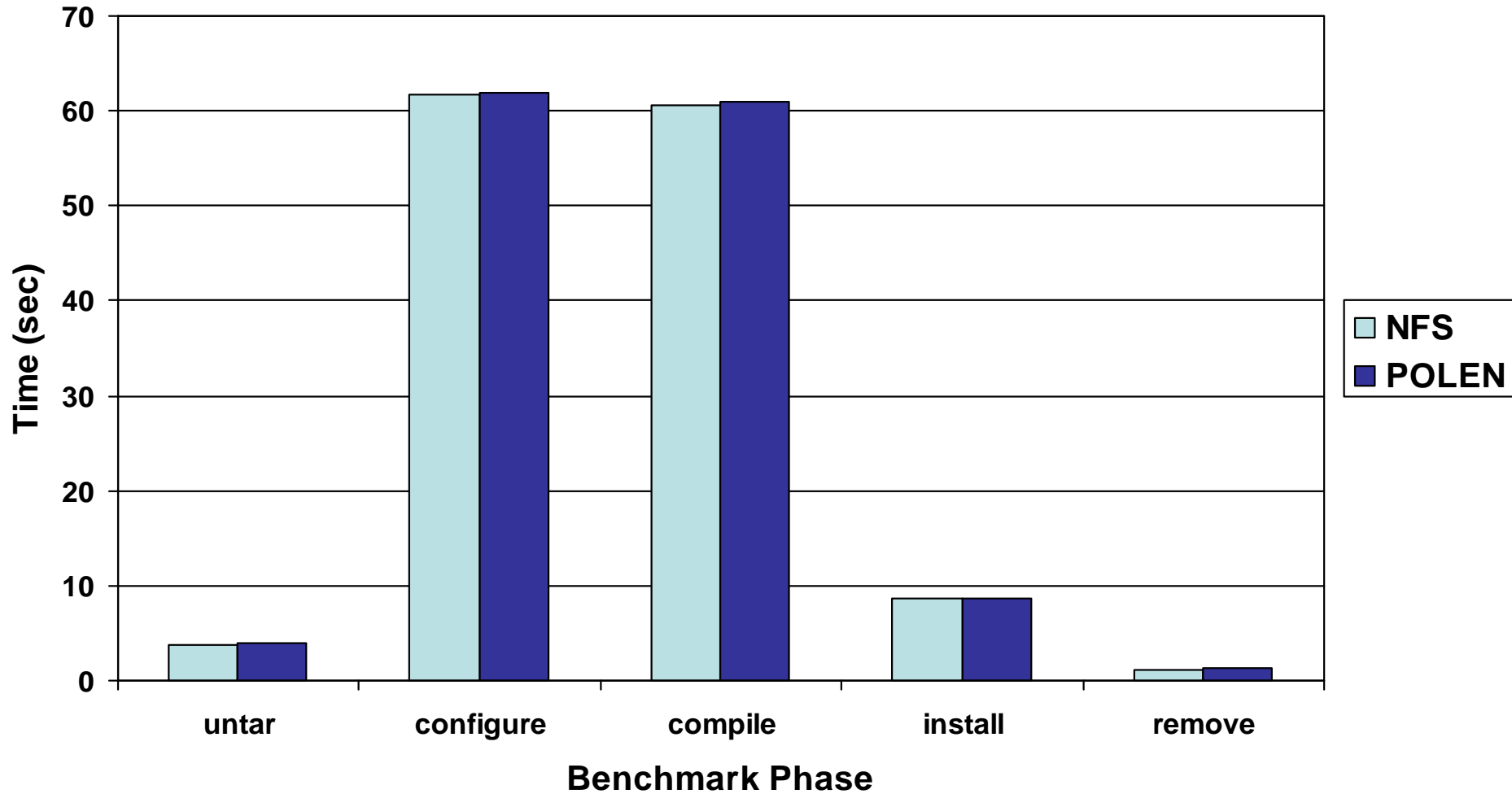
- Setup

- Systems: Dell systems, Dual 2.4 GHz CPUs, 3 GB RAM, running Linux 2.6
- Perform offline analysis using Harvard File System Traces [Ellard'03]
- OpenSSH compilation as application performance benchmark

Evaluation: POLEX Accuracy

| | Average Error Rate | Over-Estimation Rate |
|---------|--------------------|----------------------|
| Run 1 | 1.08% | 31.6% |
| Run 2 | 0.76% | 41.2% |
| Run 3 | 1.02% | 42.5% |
| Run 4 | 0.79% | 36.5% |
| Run 5 | 0.97% | 42.9% |
| Average | 0.92% | 38.9% |

Evaluation: POLEN Application Benchmark



Related Work

- Policy Extraction and Inference
 - RBAC Role Mining [Kuhlmann'03, Schlegelmilch'05]
 - XACML AC Property Inference [Anderson'04, Martin'06]
 - Firewall Policy Inference [Golnabi'06, Tongaonkar'07]
 - Gray-Box Systems [Arpaci-Dusseau'01]
- Context-Aware Access Control
 - Secure Collaborations in Mobile Computing [Toninelli'06]
 - Ubiquitous Services [Corradi'04, Yokotama'06]
 - Ad-Hoc Networks [Saidane'07]
 - Web Services [Bhatti'05, Kapsalis'06]

Conclusions

- WSBAC: Working Set-Based Access Control for Network File Systems
 - Access control technique that estimates per-user working sets to formulate access control policy for accesses from untrusted devices
 - Prototype design and implementation of POLEX and POLEN
 - Empirical evaluation suggests that WSBAC is highly effective, exhibiting low error rates
- Conference Paper
 - Working Set-Based Access Control for Network File Systems, S. Smaldone, V. Ganapathy, and L. Iftode
To appear in the Proceedings of the 14th ACM Symposium on Access Control Models and Technologies (SACMAT 2009), June 2009.

Thank You!



<http://discolab.rutgers.edu>

Evaluation: POLEX Time and Storage Requirements

| Size of Trace | Time to Analyze | State Size |
|---|-----------------|------------|
| 1 Day (~3.3 GB - 6,308,023 Req/Res Pairs) | 52 min | 154MB |
| 1 Hour (~140 MB - 262,834 Req/Res Pairs) | 2.49 min | 154MB |

Evaluation: POLEX Sensitivity

| | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|----------------|--------------|--------------|--------------|--------------|--------------|
| User 1 | 0.26% | 0.03% | 0.02% | 0.01% | 0.01% |
| User 2 | 0.31% | 4.4% | 0.0% | 3.3% | 0.27% |
| User 3 | 0.37% | 0.36% | 0.82% | 2.5% | 0.61% |
| User 4 | 0.48% | 1.8% | 0.55% | 0.66% | 0.11% |
| User 5 | 0.18% | 0.28% | 0.18% | 0.34% | 0.27% |
| Average | 0.32% | 1.4% | 0.31% | 1.4% | 0.27% |

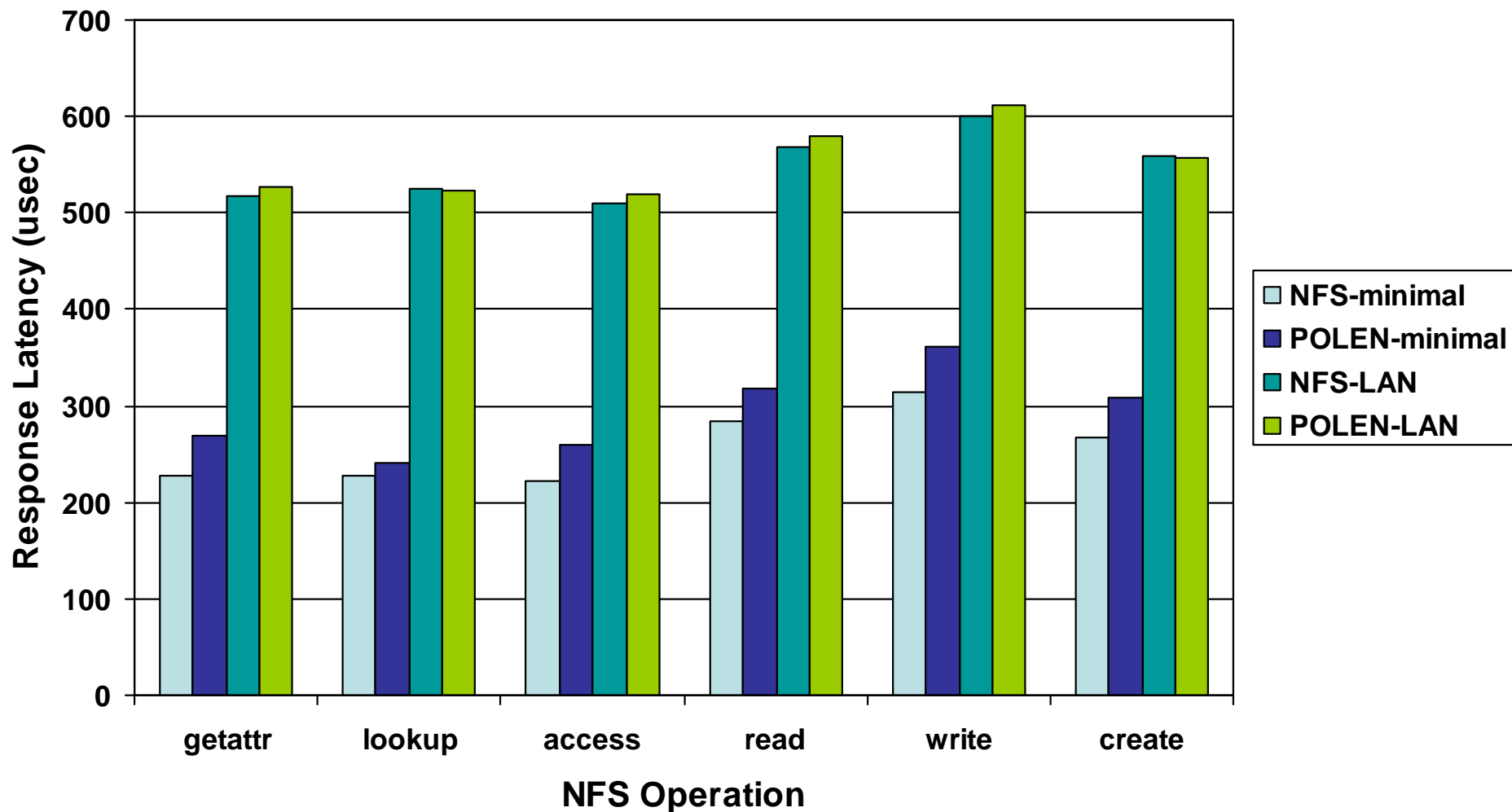
Evaluation: Speculation Rates

| Average | Min | Max |
|---------|------|--------|
| 1.4% | 2.4% | 0.028% |

- For Heavy Users (~500 rqst/day):

| Average | Min | Max |
|------------------------|-------------------------|-------------------------|
| 7 speculative rqst/day | 12 speculative rqst/day | >1 speculative rqst/day |

Evaluation: POLEN Performance Microbenchmark



Contributions

Add after slide 4

The POLEN Implementation

Add after slide 11