Towards Deployment-Time Dynamic Analysis of Server Applications

Luís Pina Cristian Cadar

{l.pina / c.cadar}@imperial.ac.uk
Imperial College London
London, UK

October 26th, 2015

Workshop on Dynamic Analysis (WODA) 2015

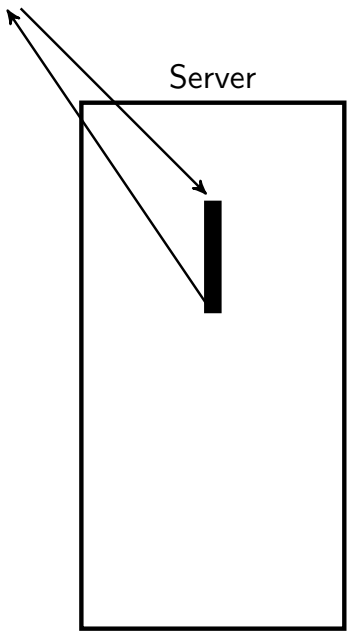
Deploying Dynamic Analysis

- Valgrind
- GCC/Clang Asan and MSan

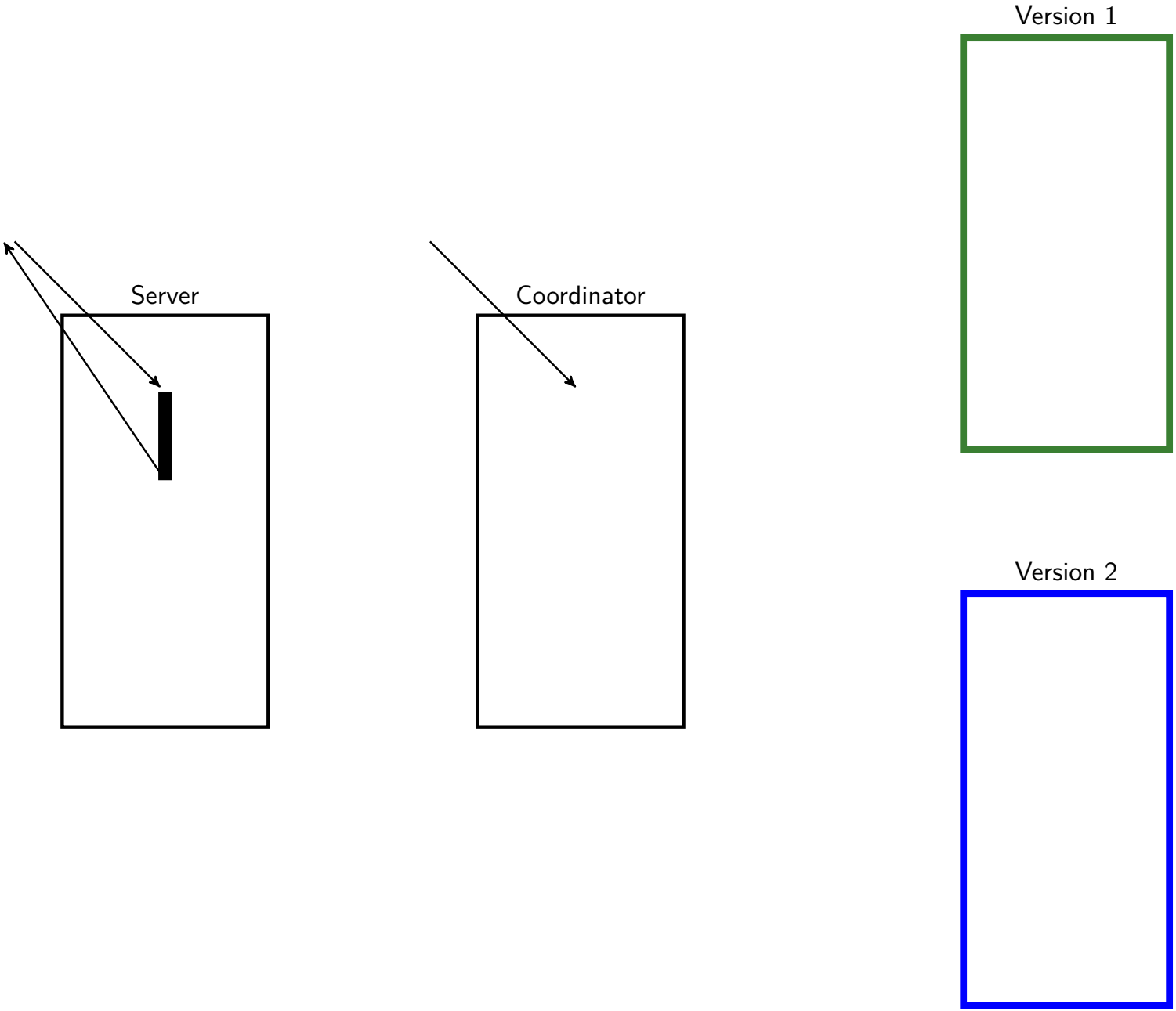
Deploying Dynamic Analysis

- Valgrind
  - **7x–57x slowdown**
- GCC/Clang Asan and MSan
  - **1.10x–2.67x slowdown**

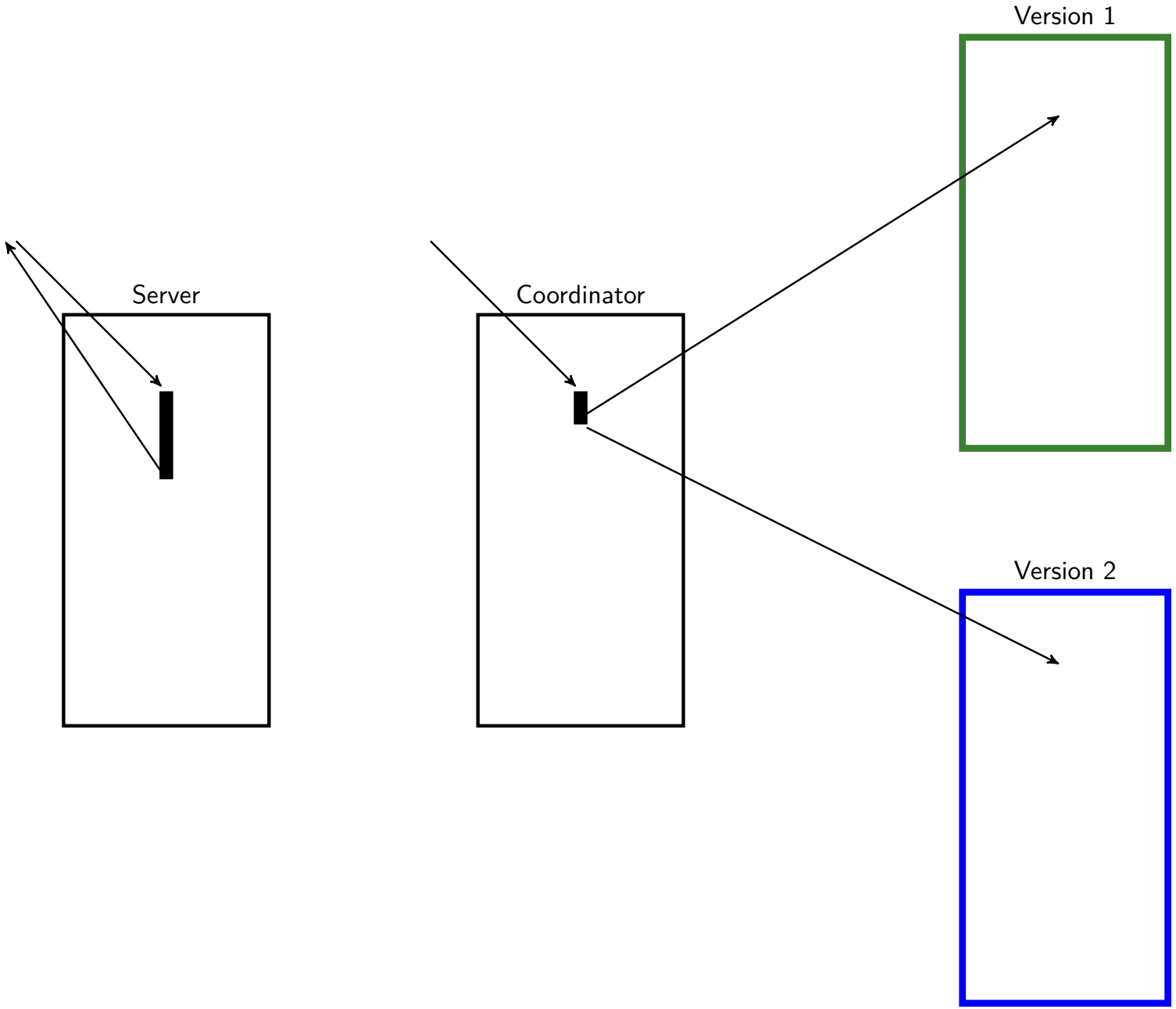
N-Version Execution



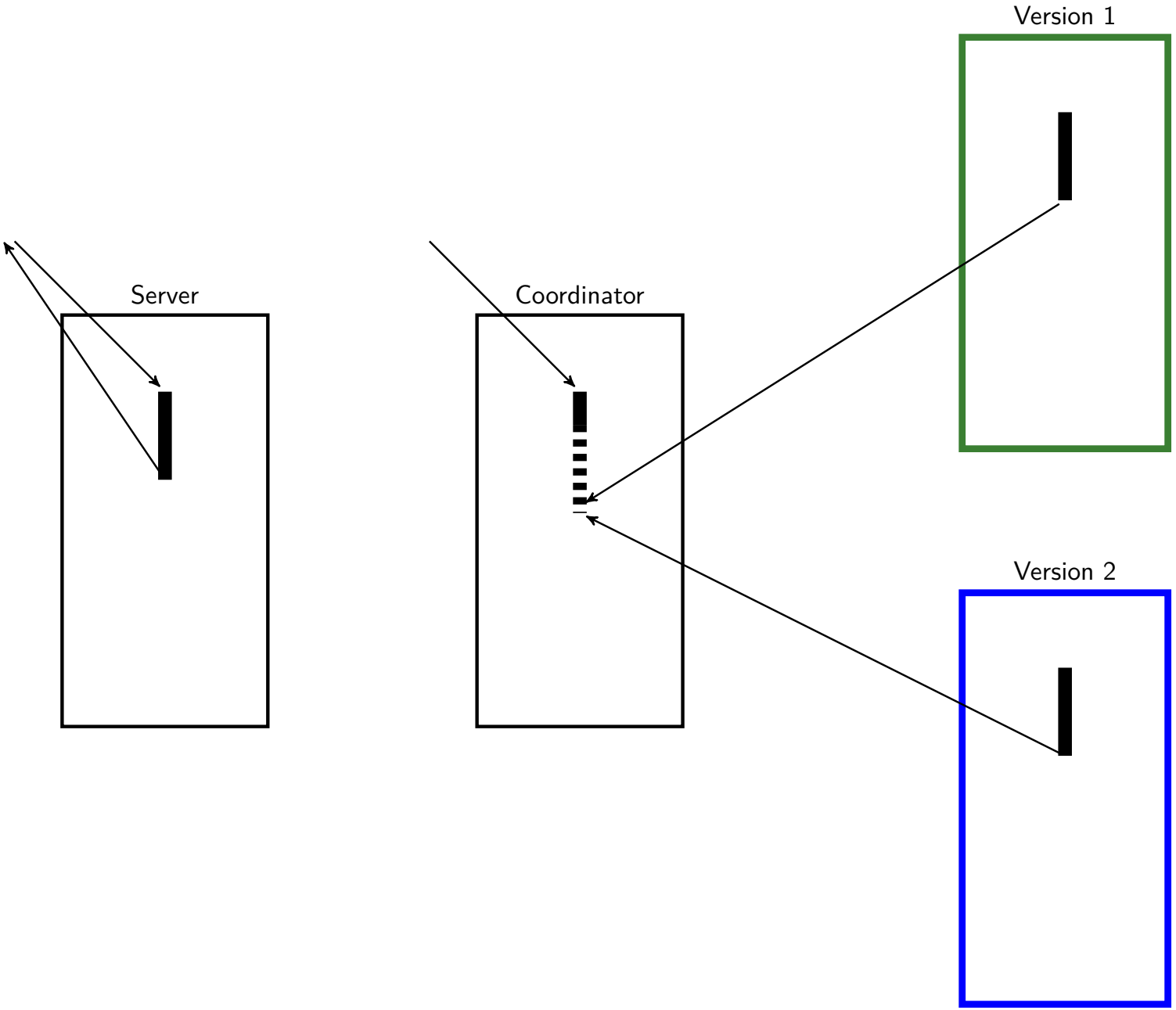
N-Version Execution



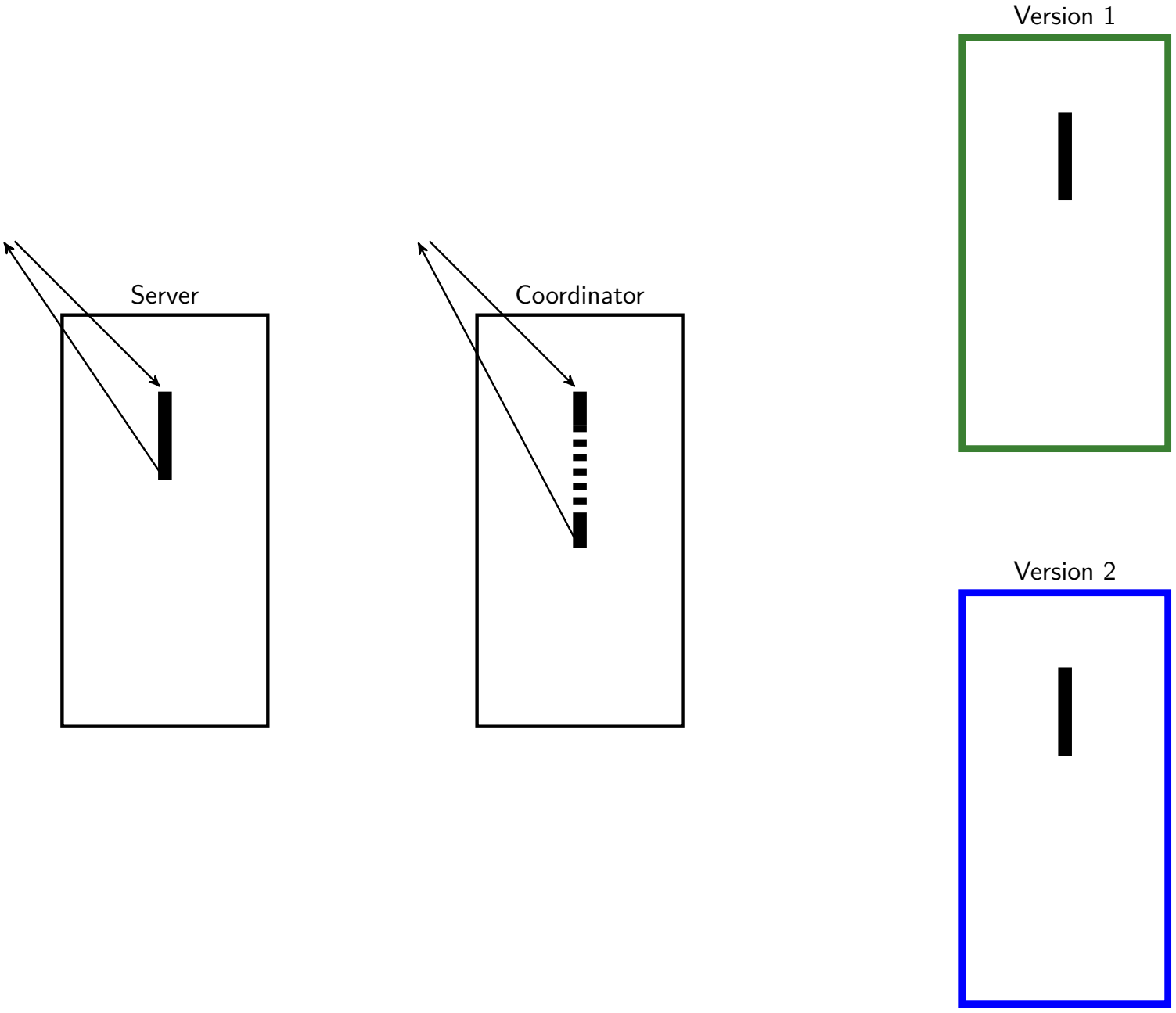
N-Version Execution



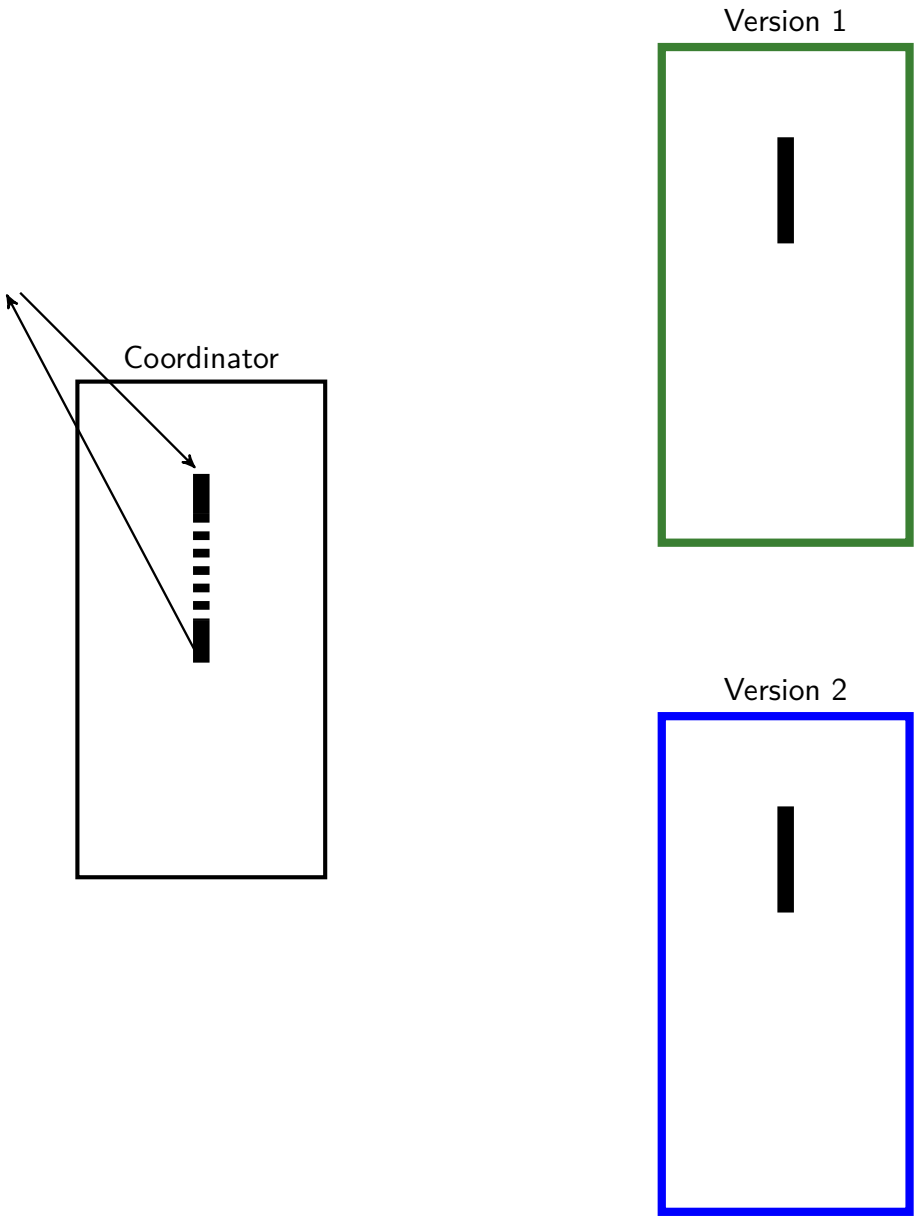
N-Version Execution



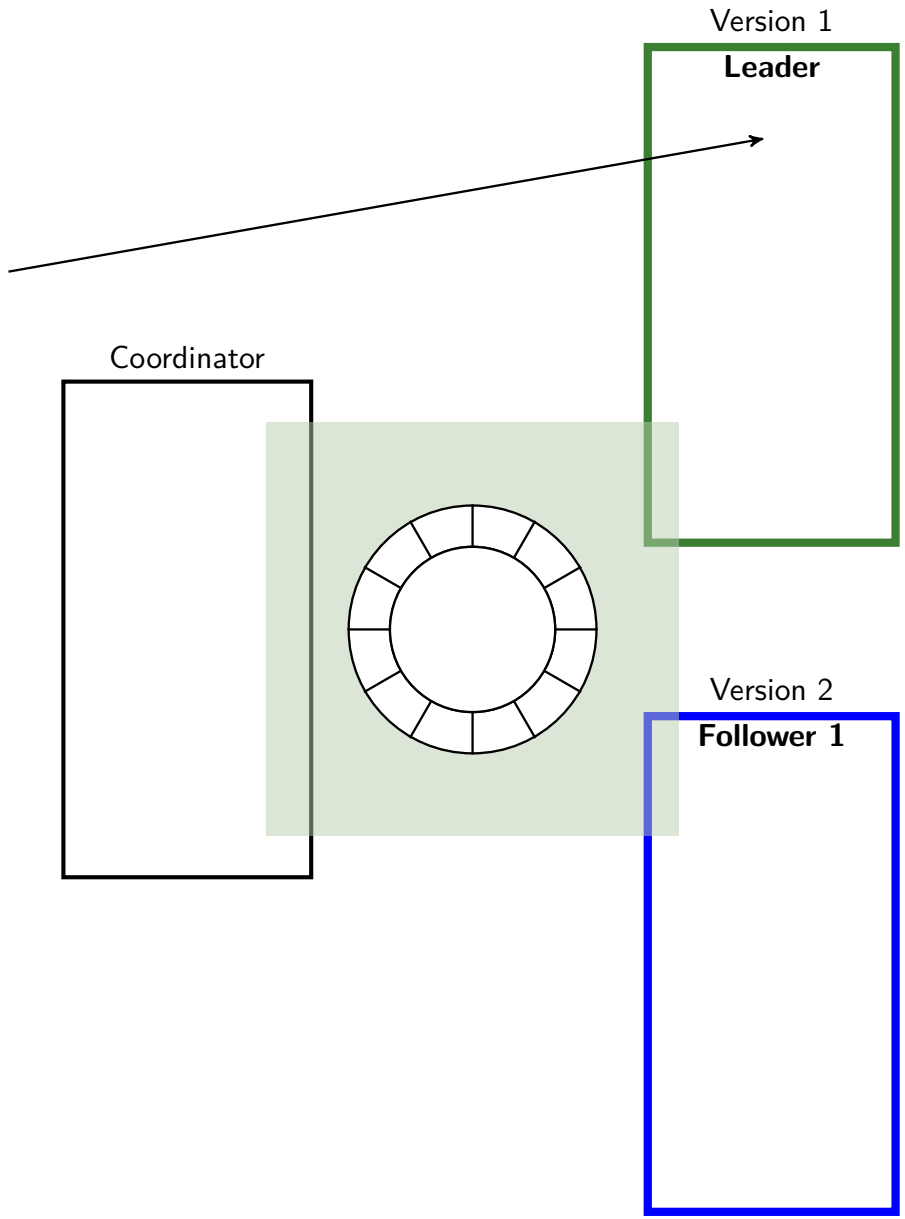
N-Version Execution



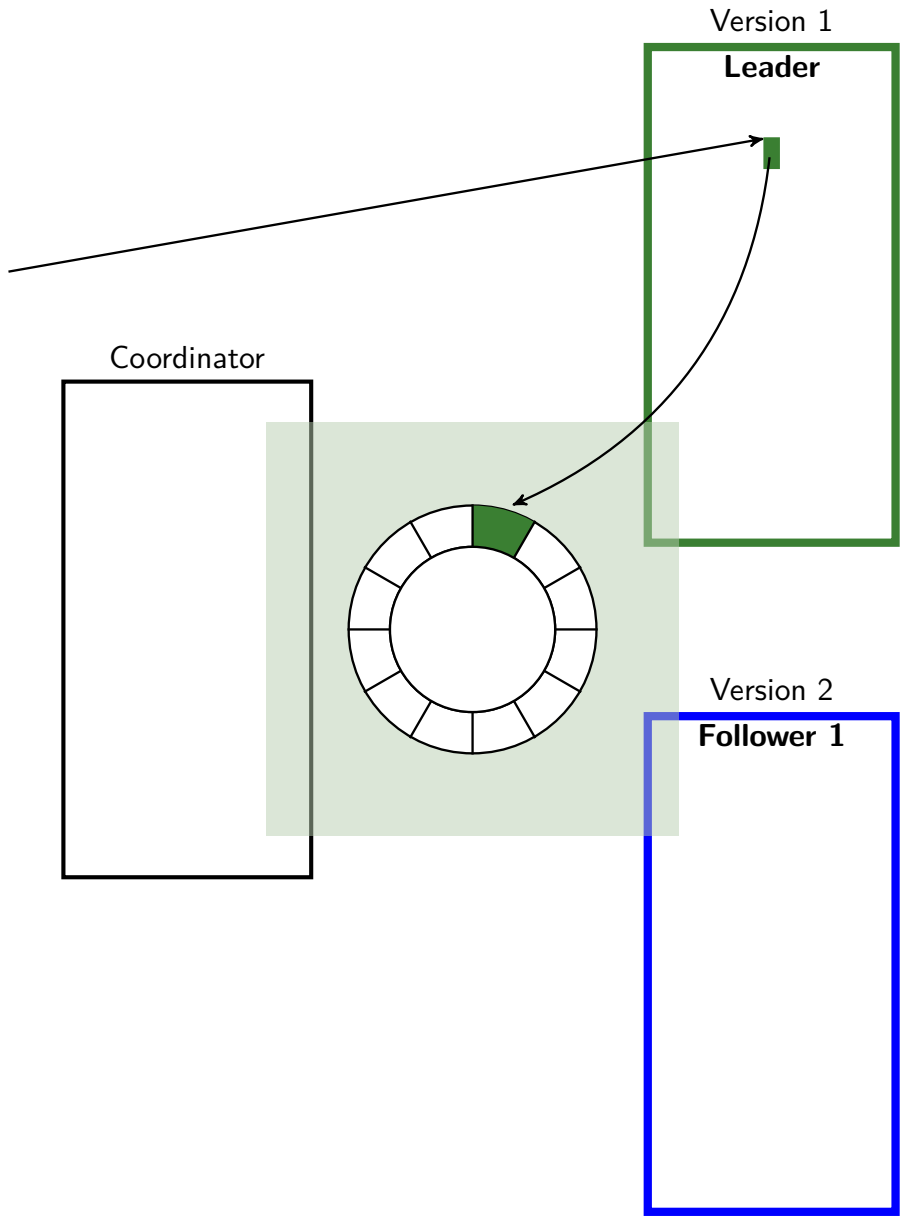
Varan



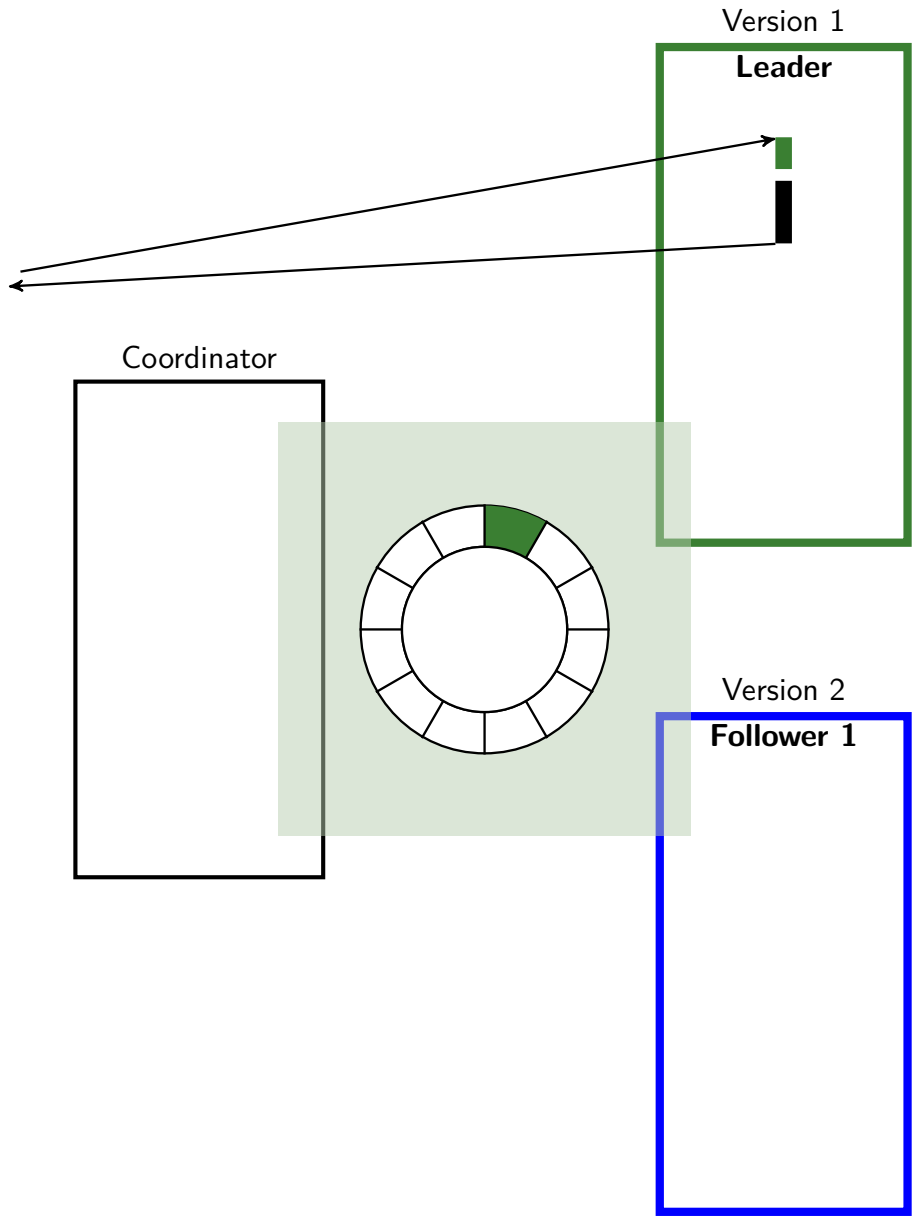
Varan



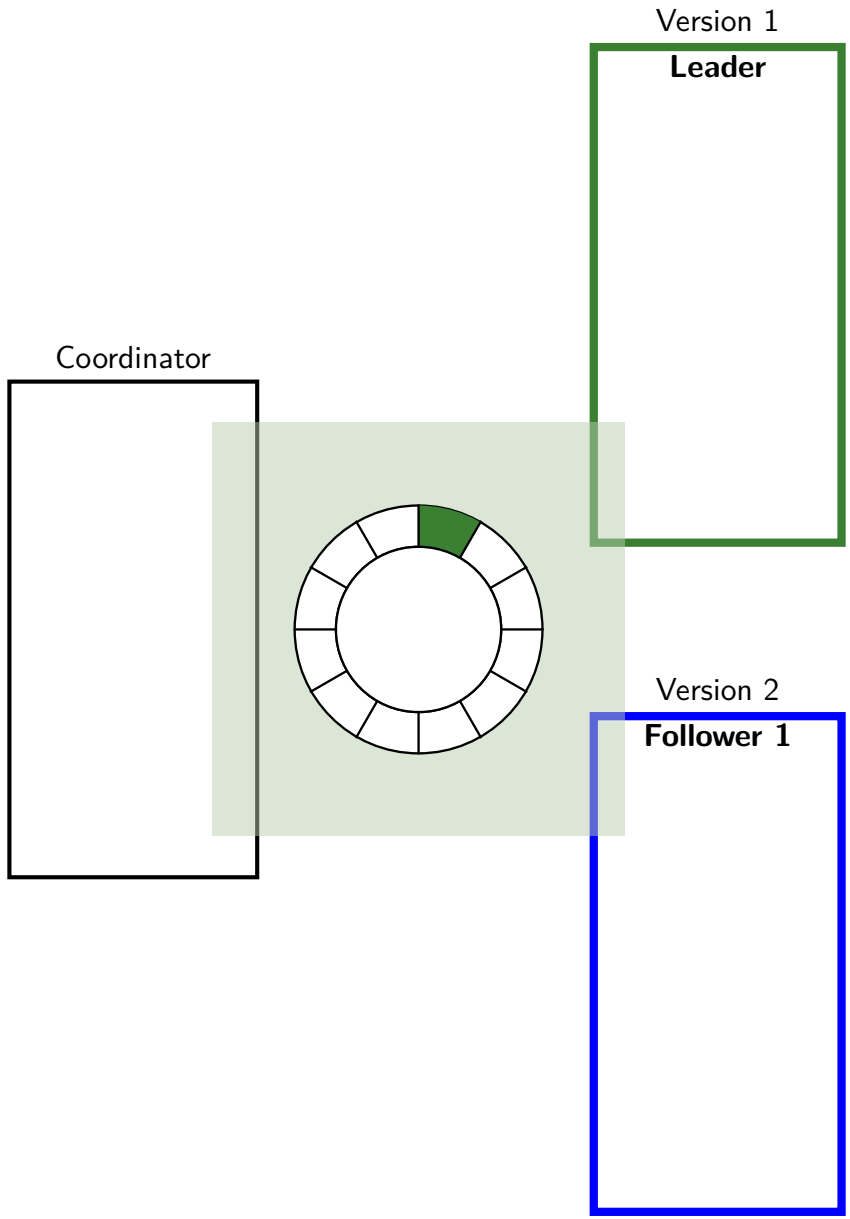
Varan



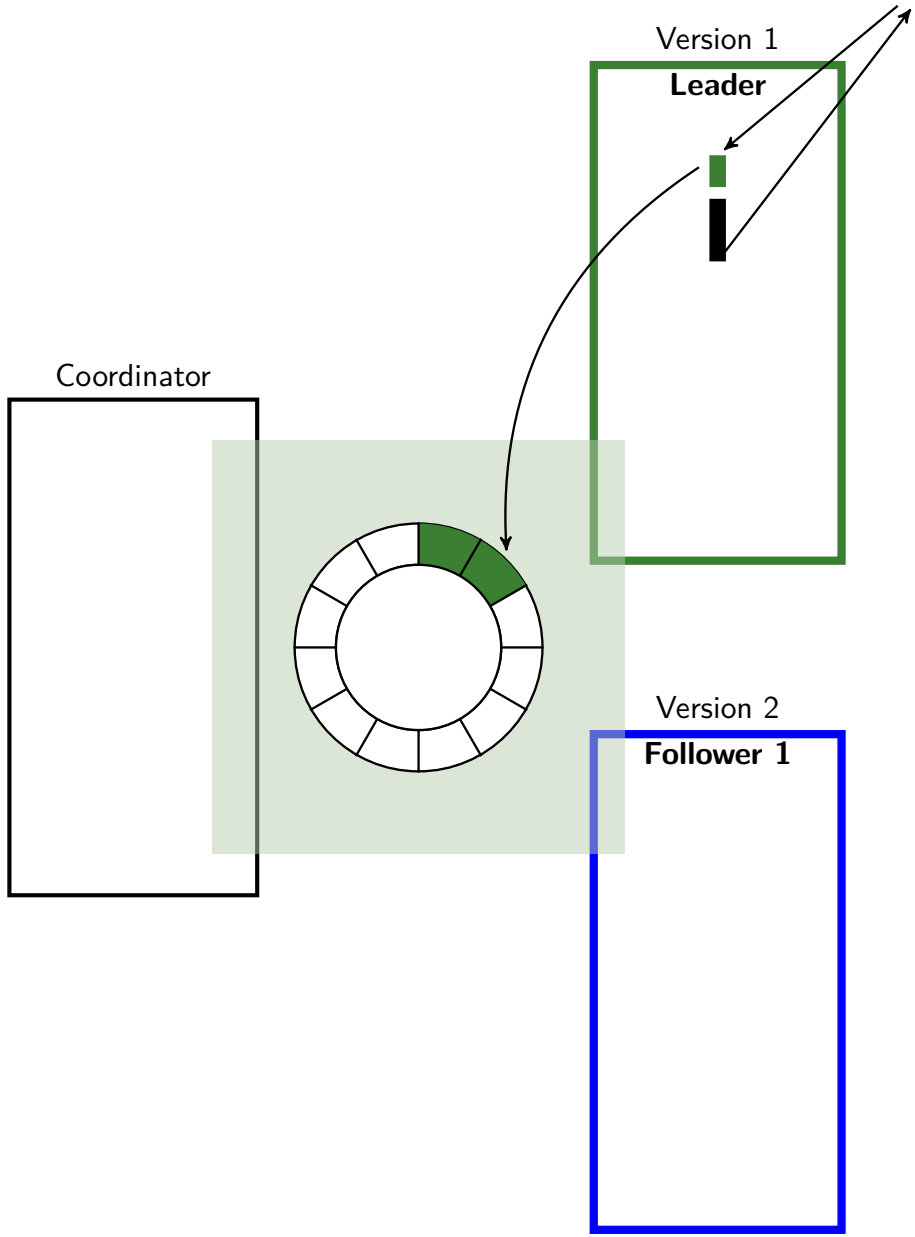
Varan



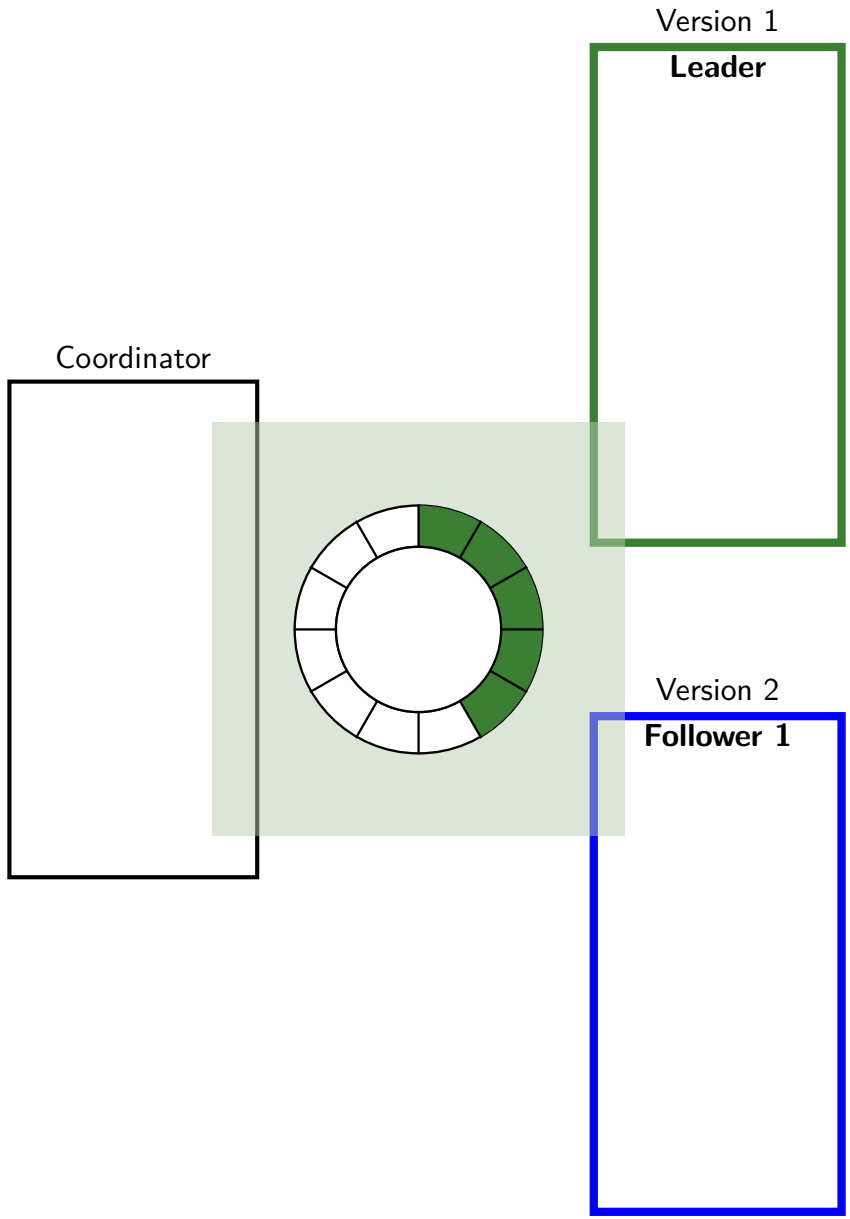
Varan



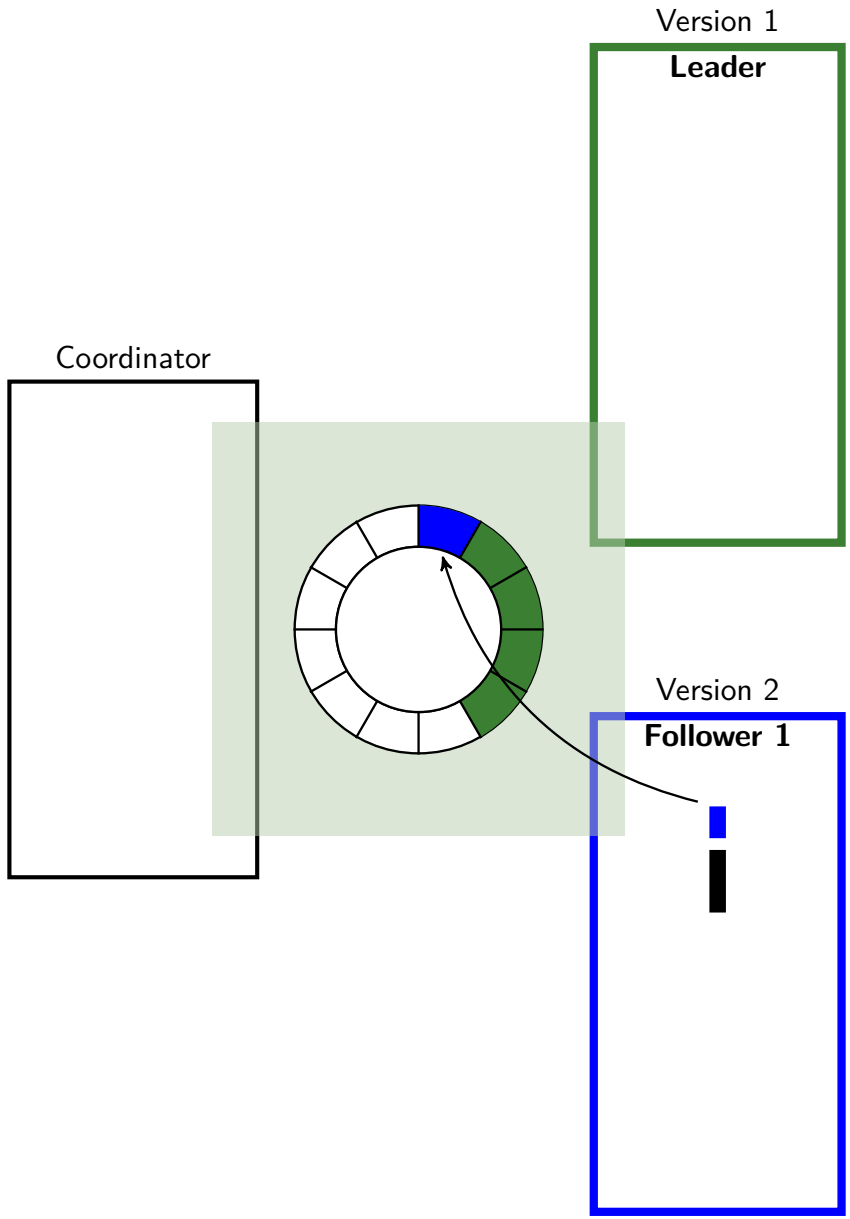
Varan



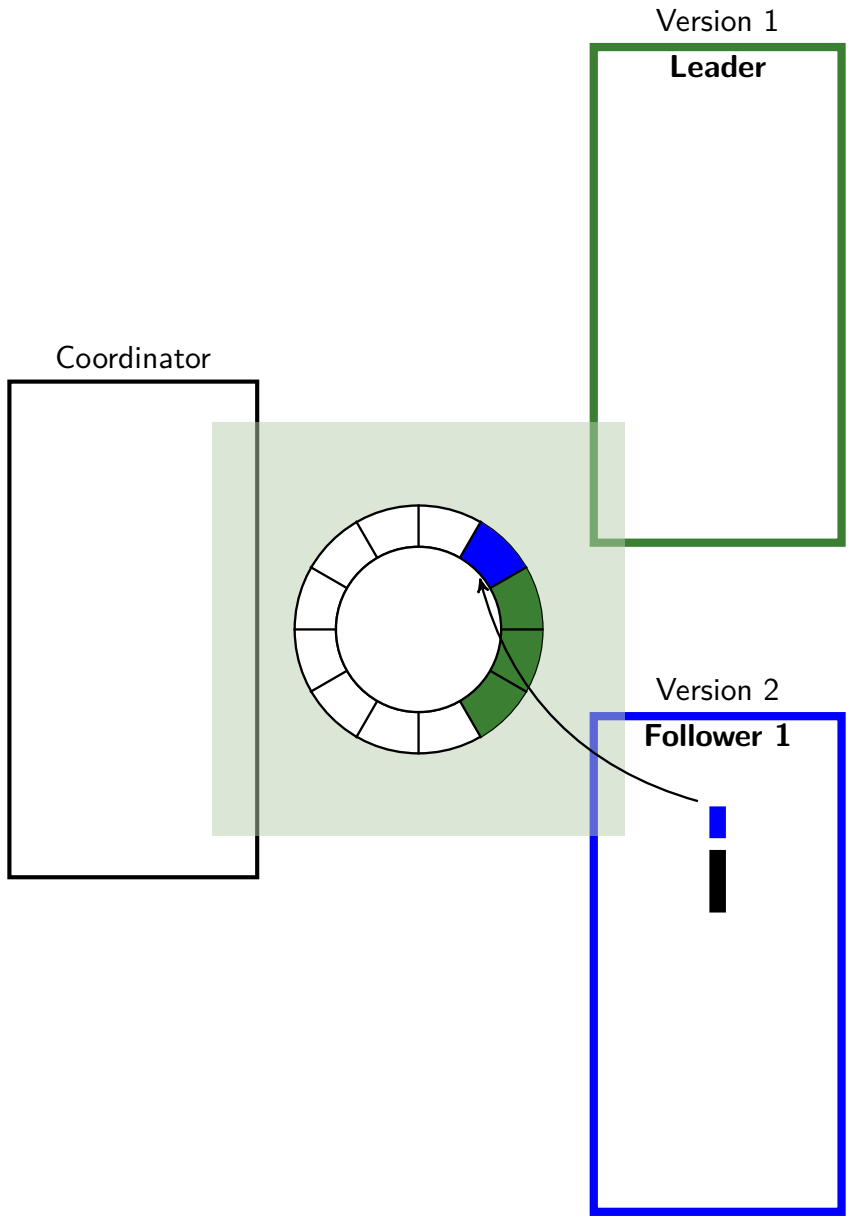
Varan



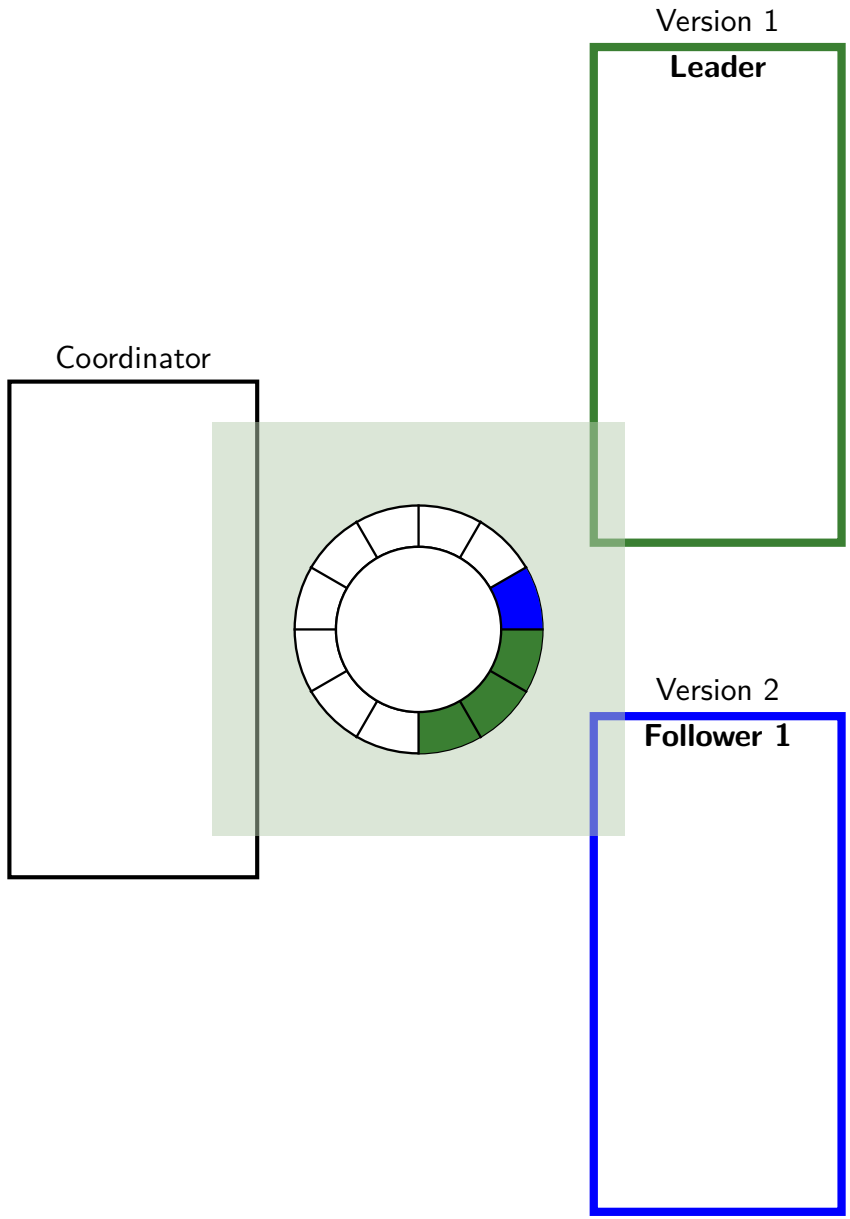
Varan



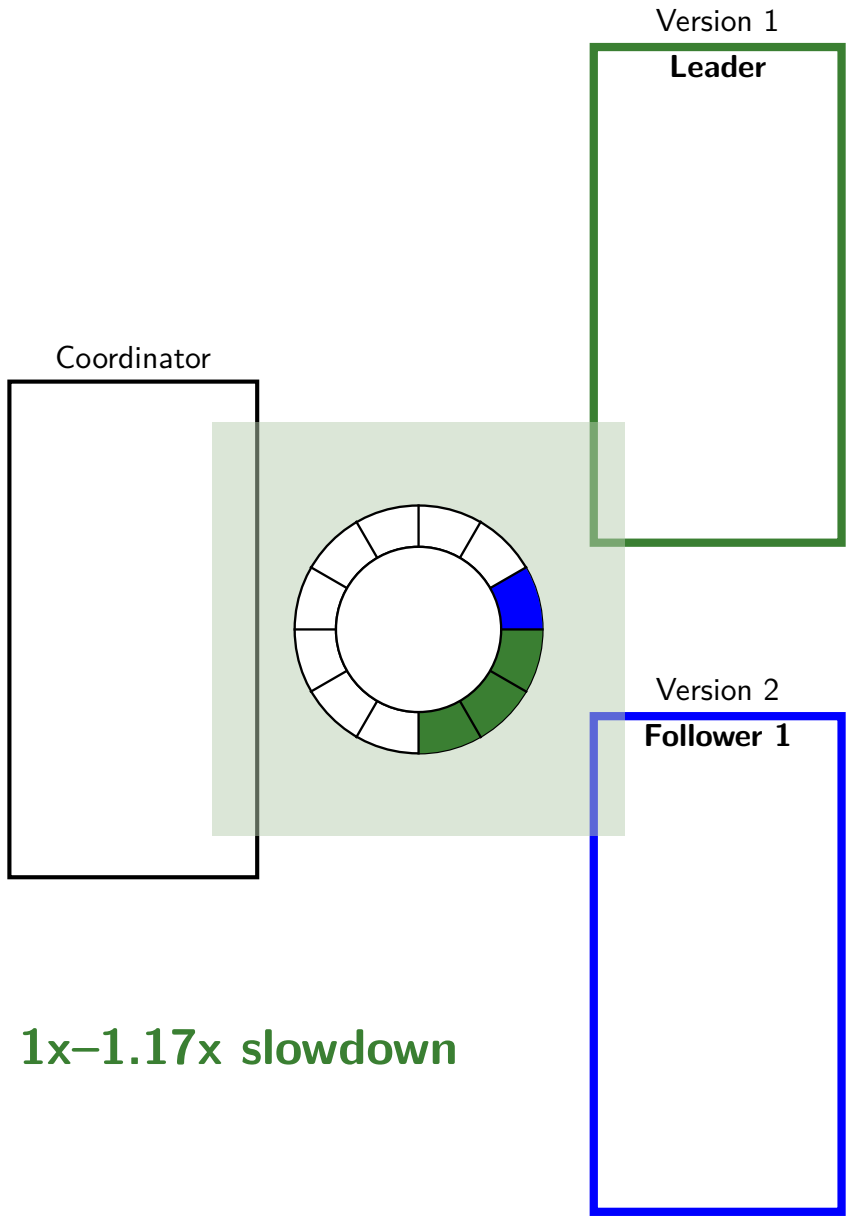
Varan



Varan

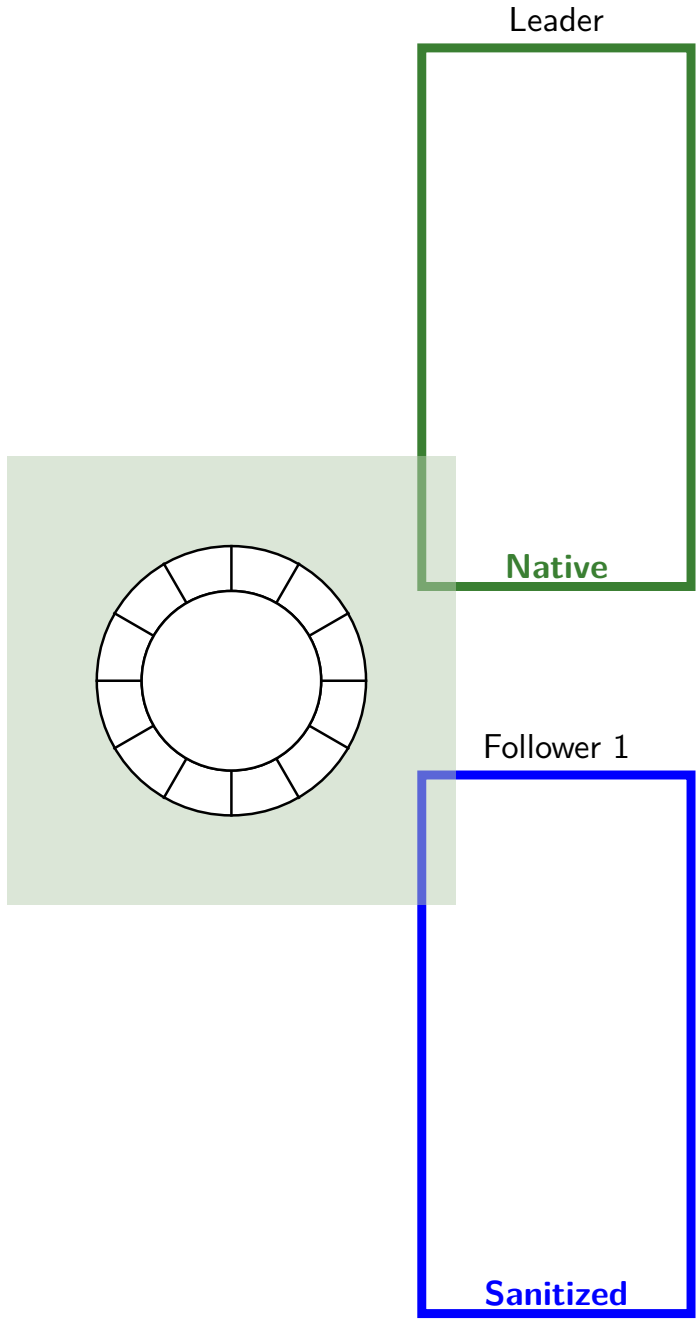


Varan

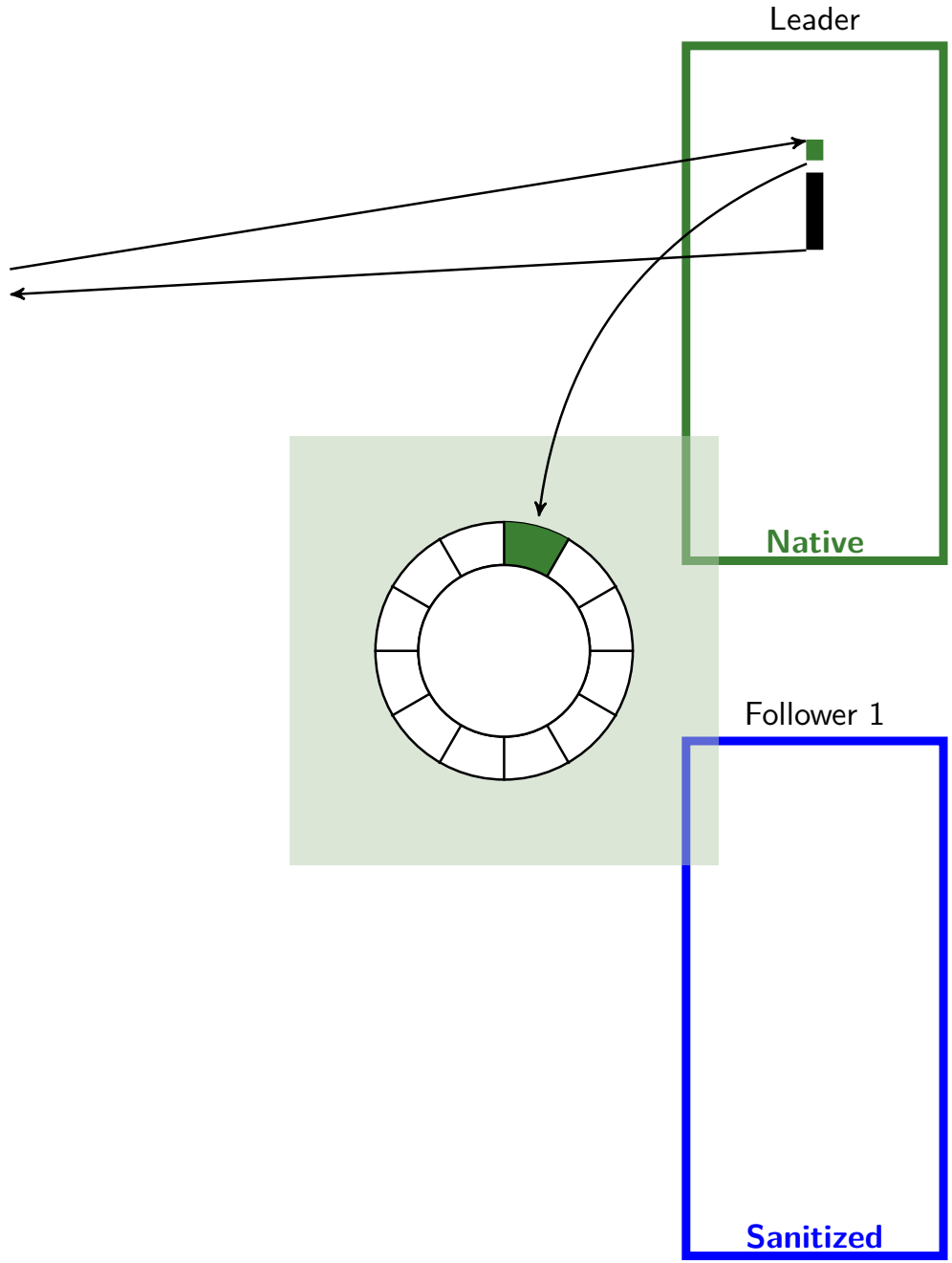


1x–1.17x slowdown

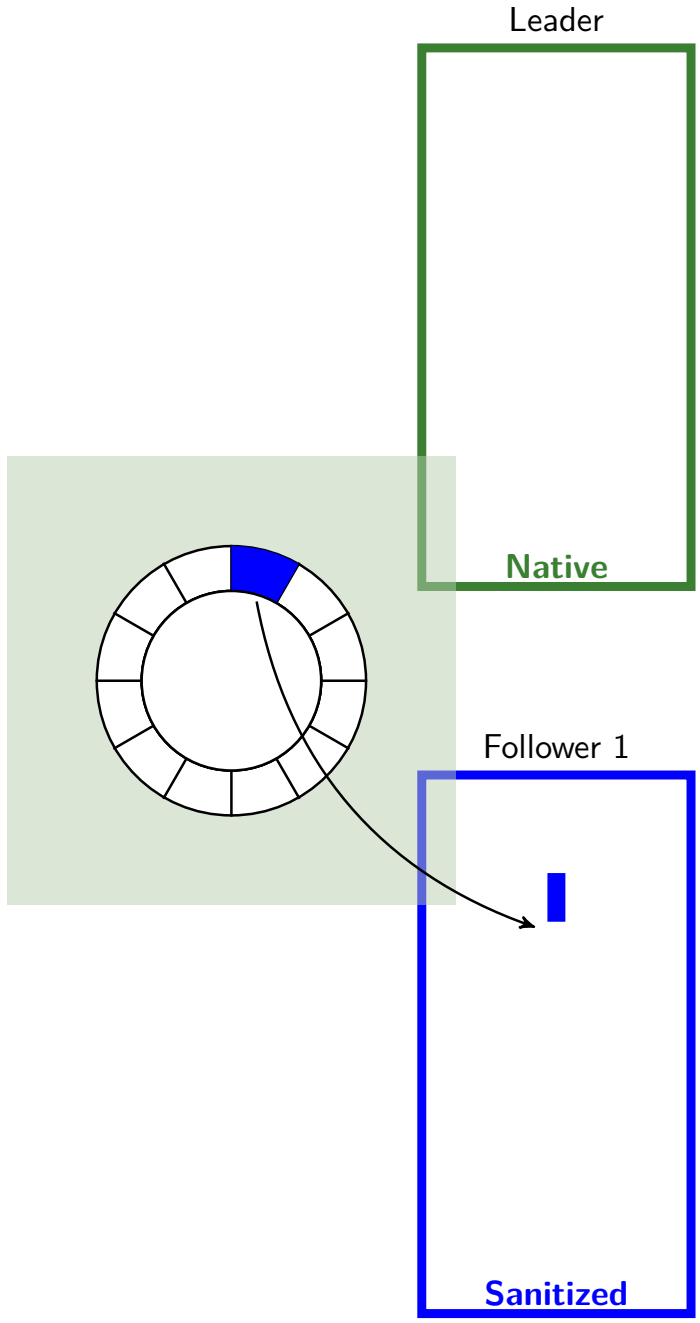
Varan + Dynamic Analysis



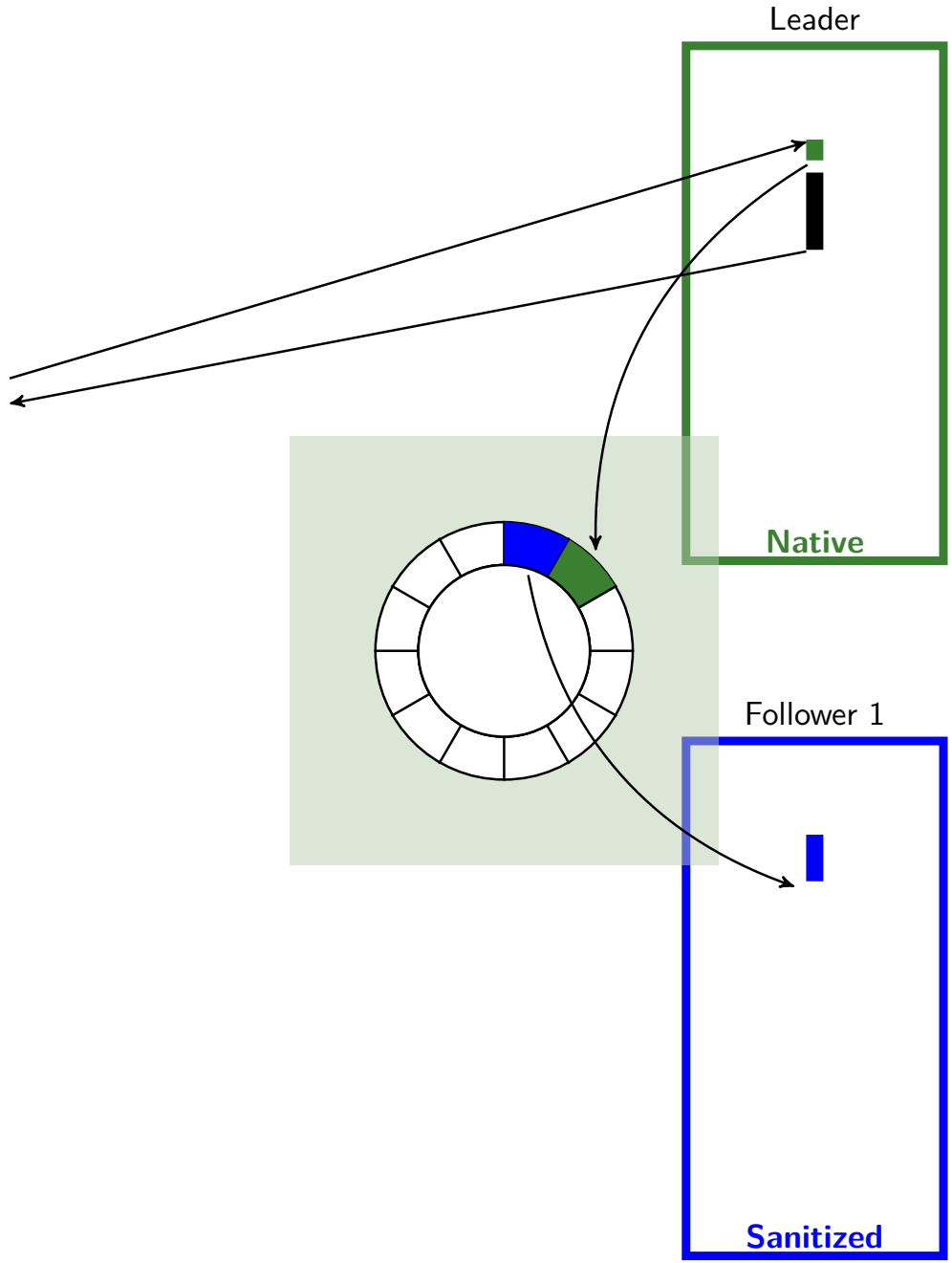
Varan + Dynamic Analysis



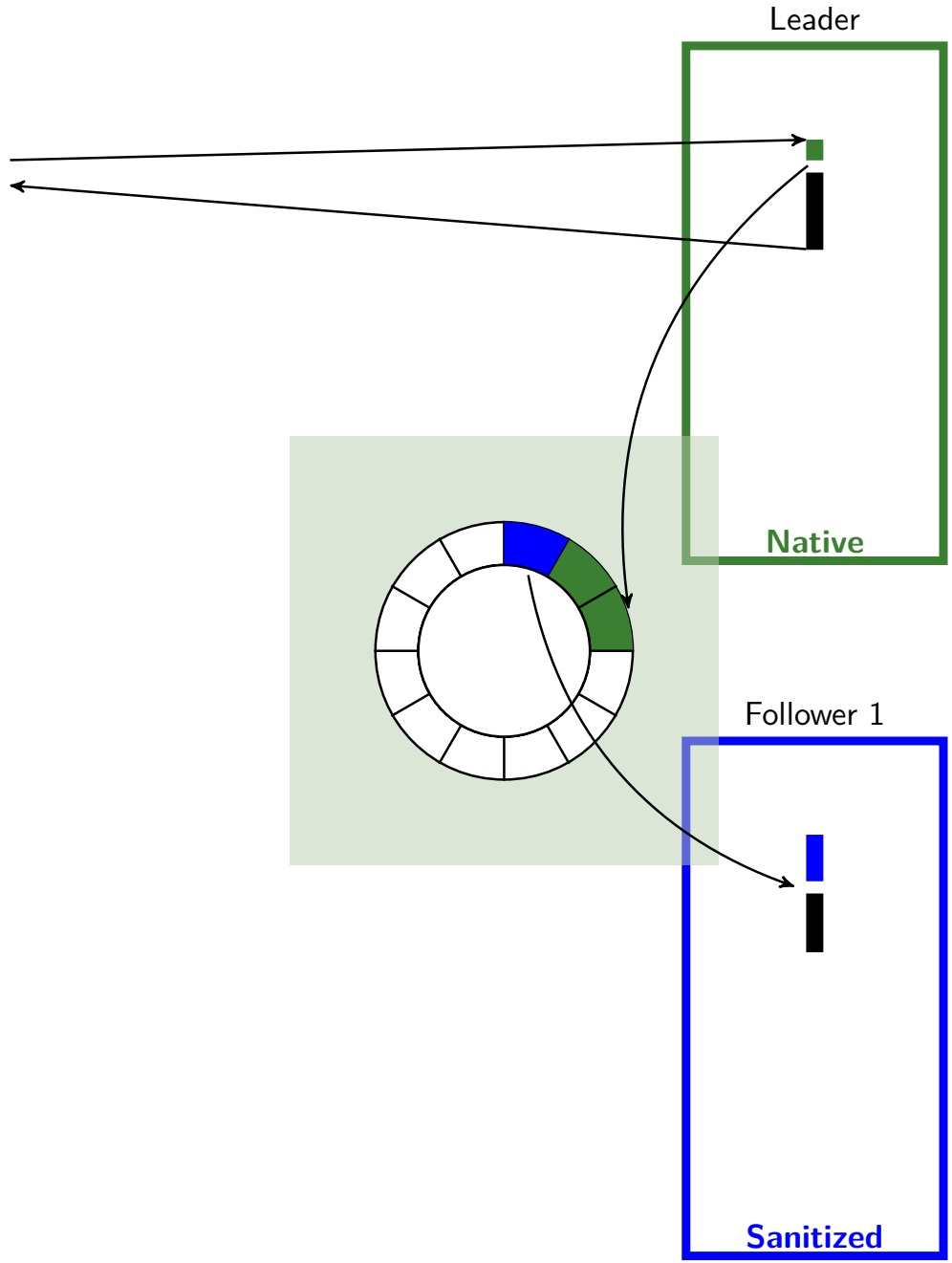
Varan + Dynamic Analysis



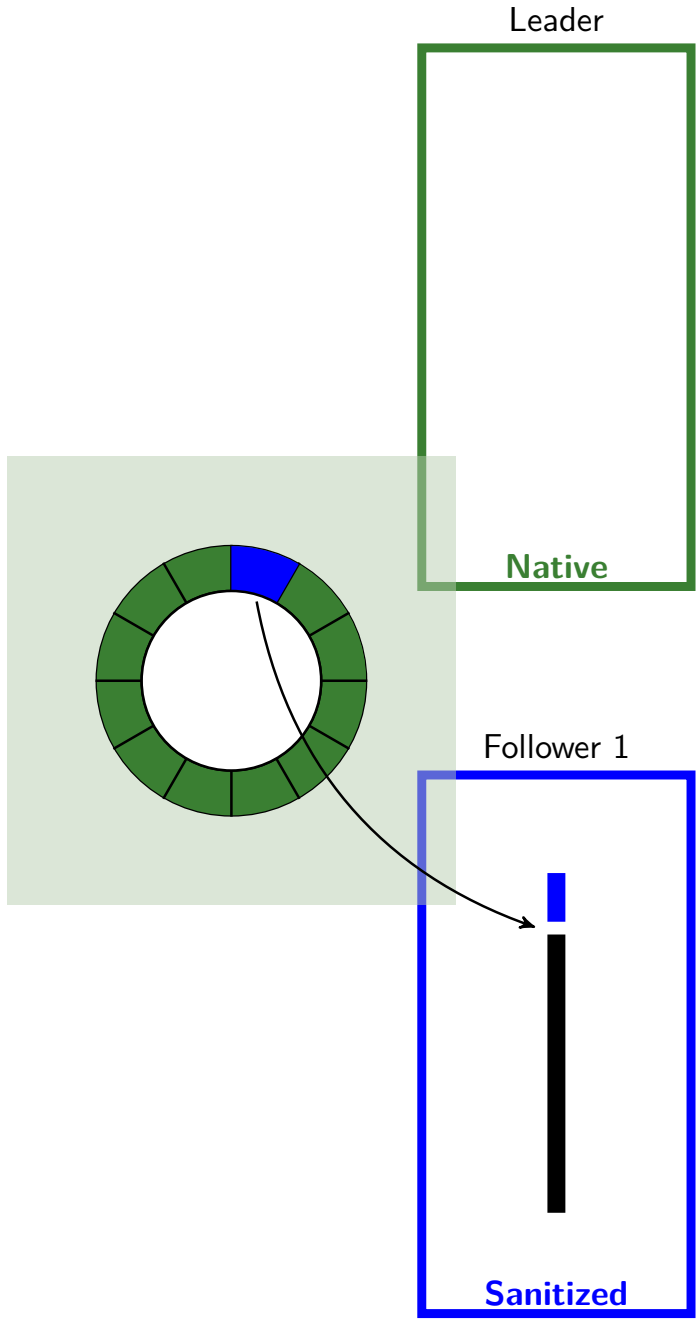
Varan + Dynamic Analysis



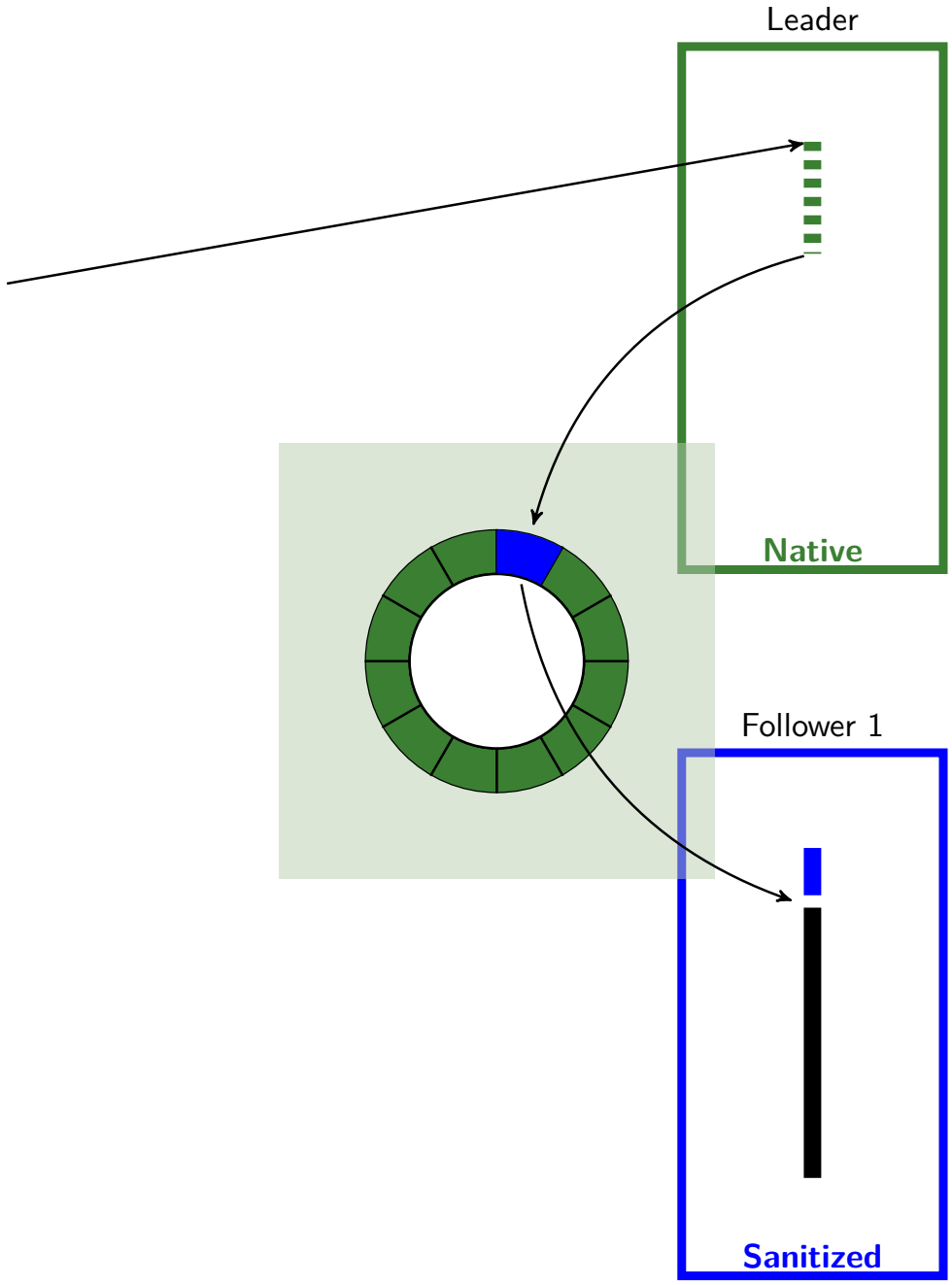
Varan + Dynamic Analysis



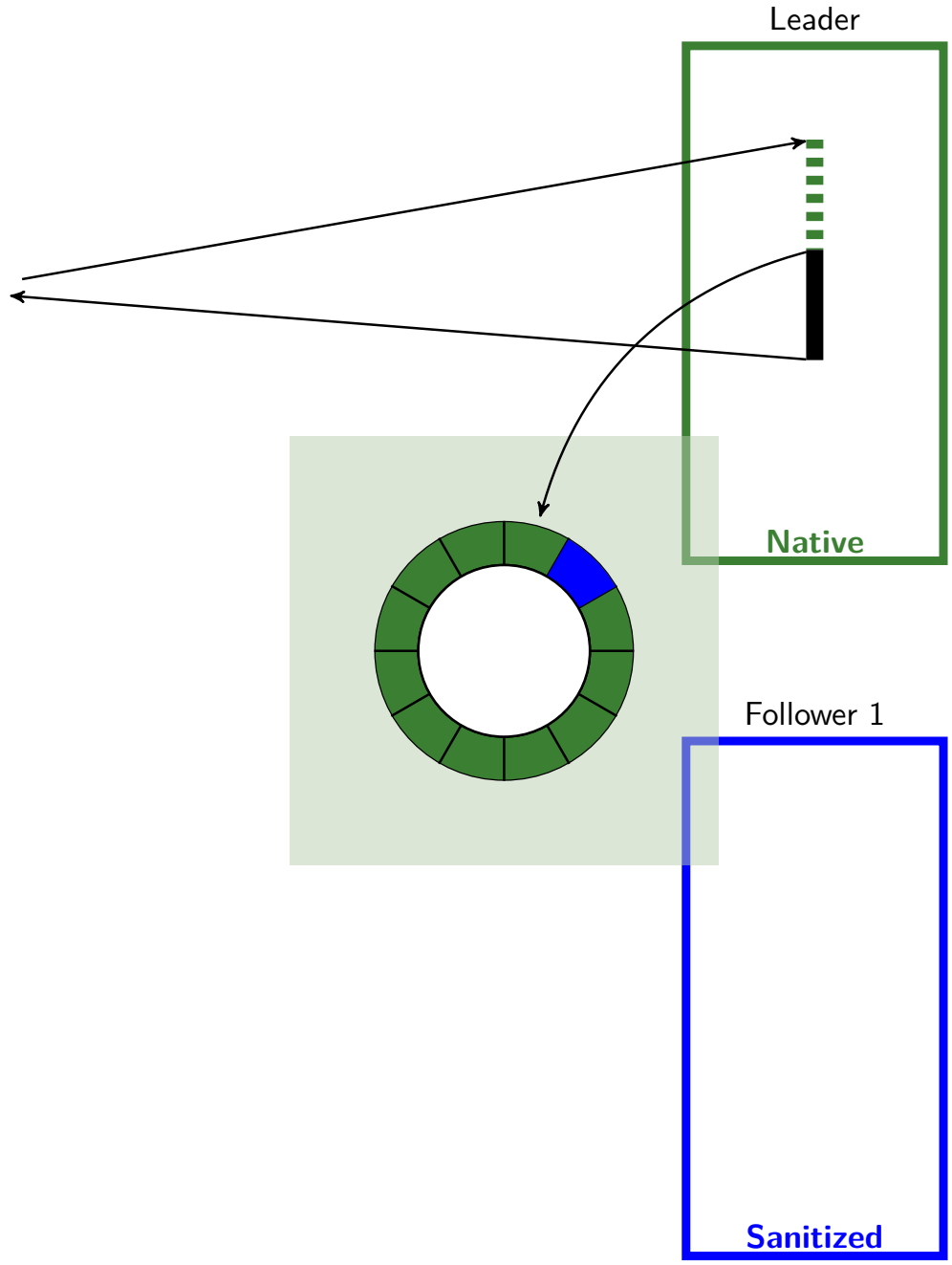
Varan + Dynamic Analysis



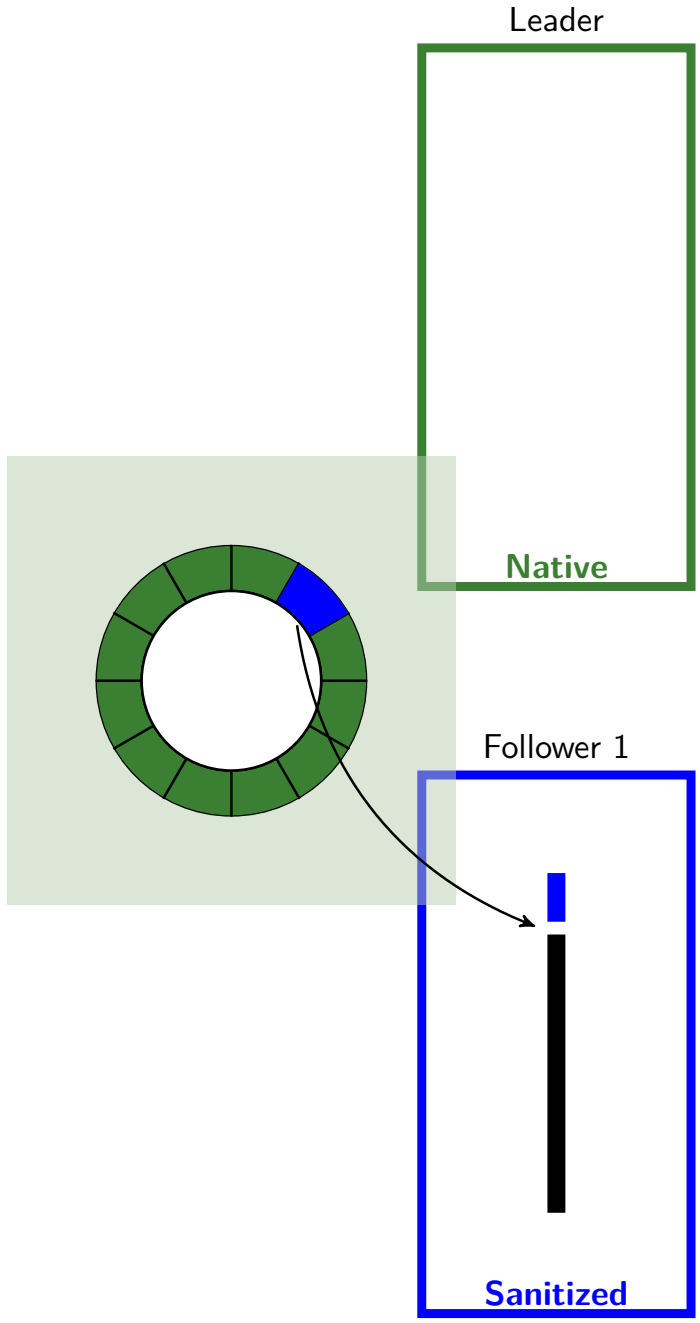
Varan + Dynamic Analysis



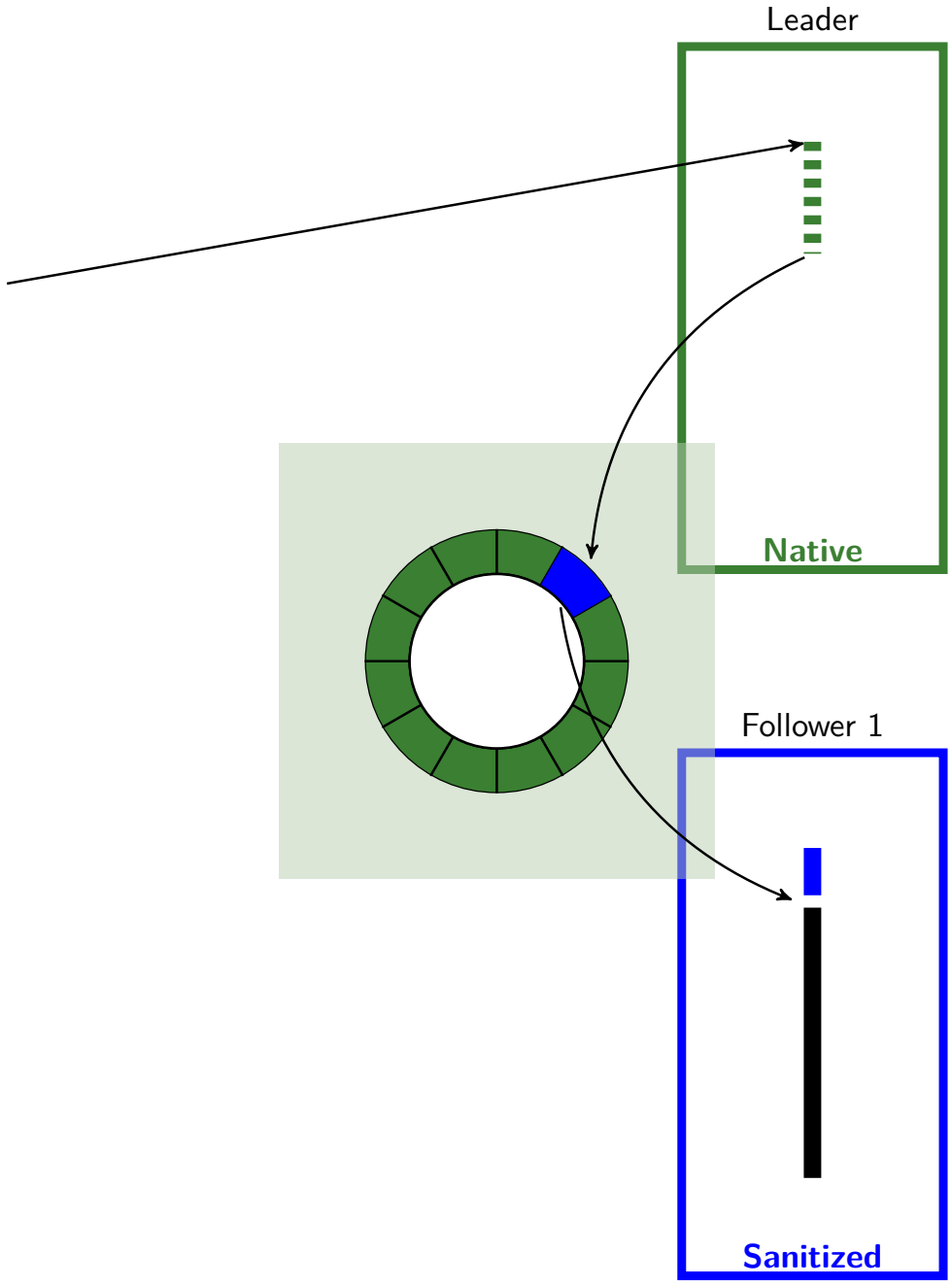
Varan + Dynamic Analysis



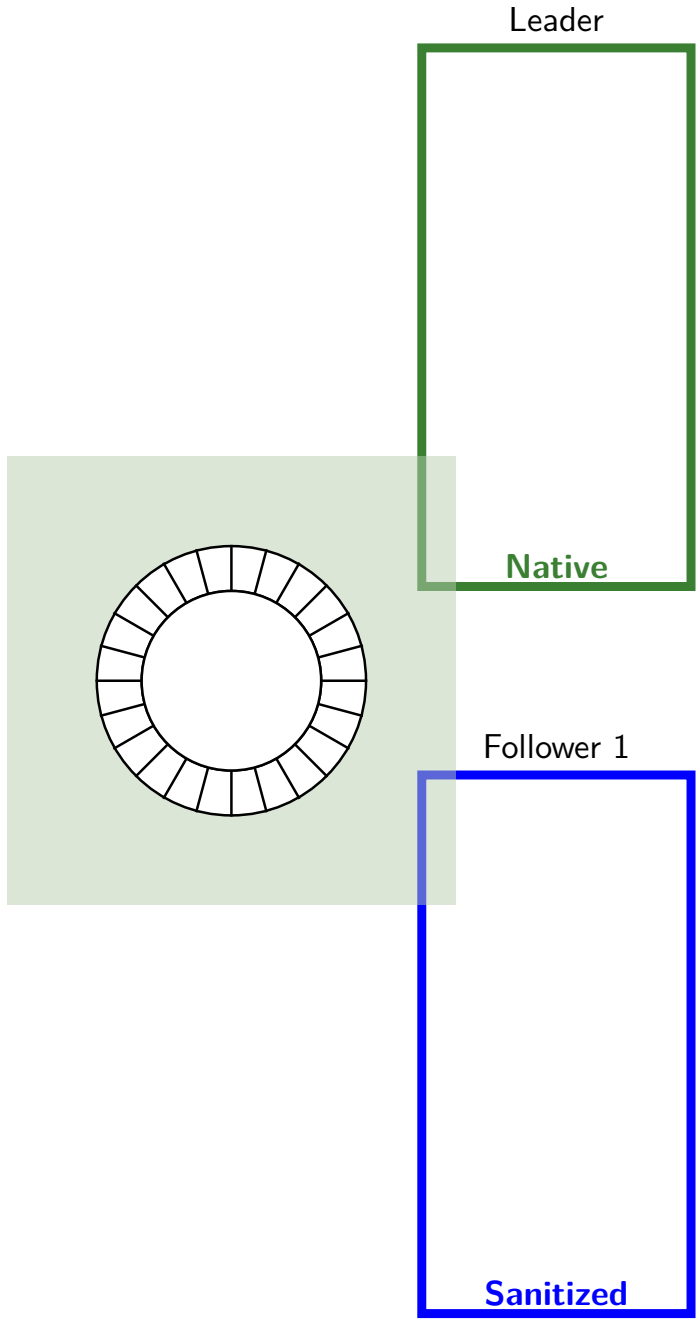
Varan + Dynamic Analysis



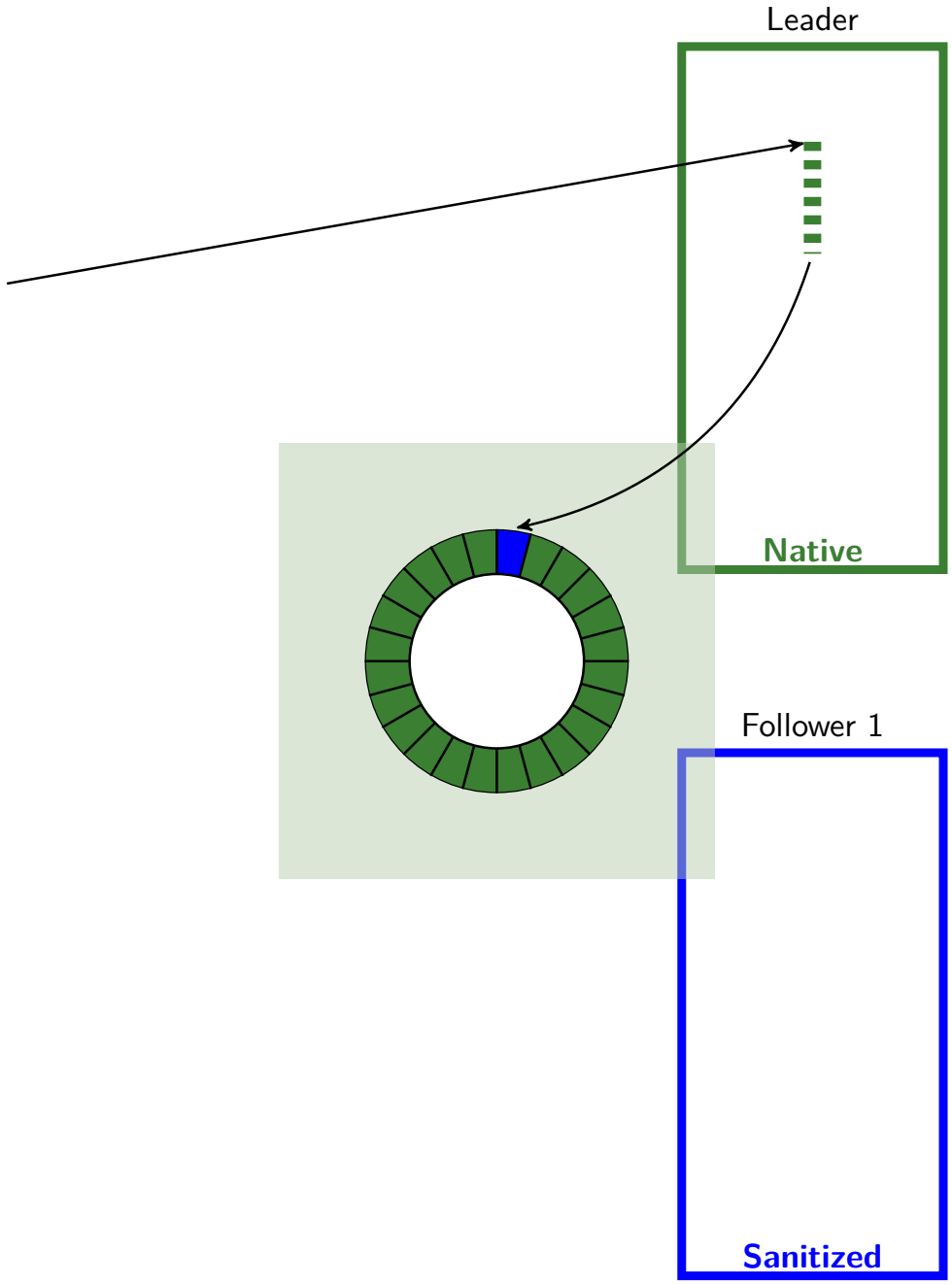
Varan + Dynamic Analysis



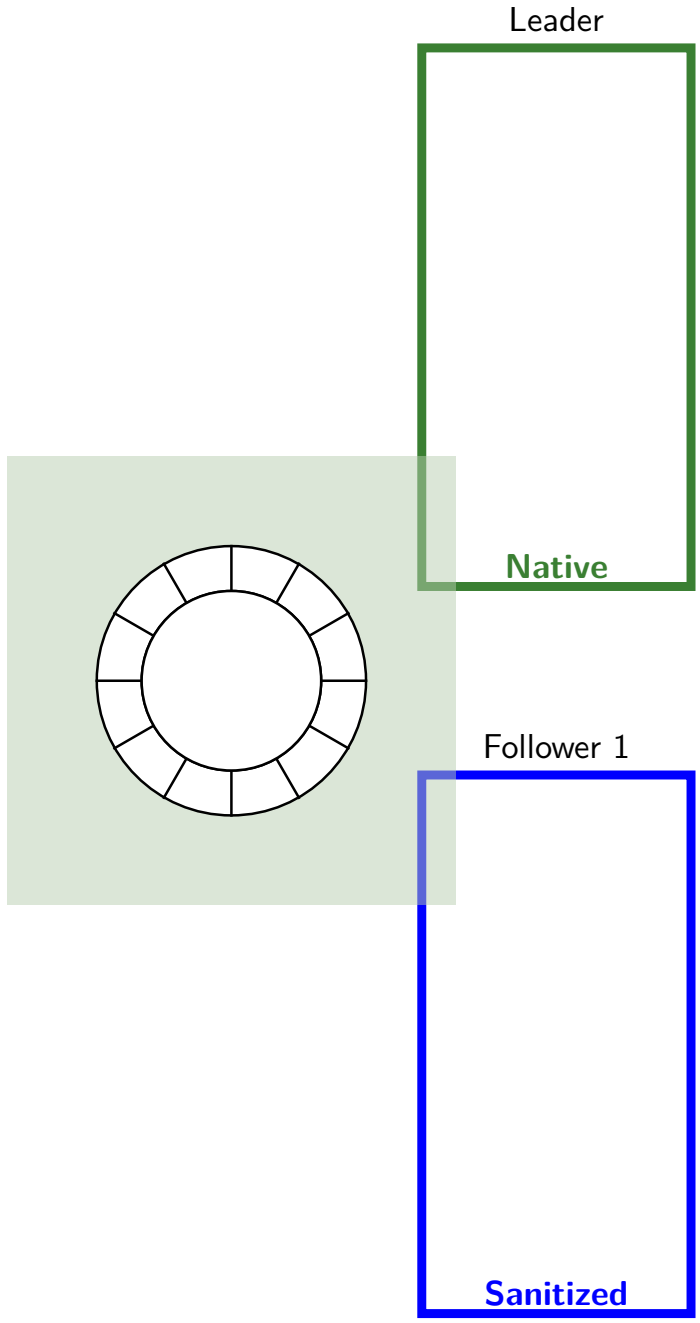
Larger ringbuffer?



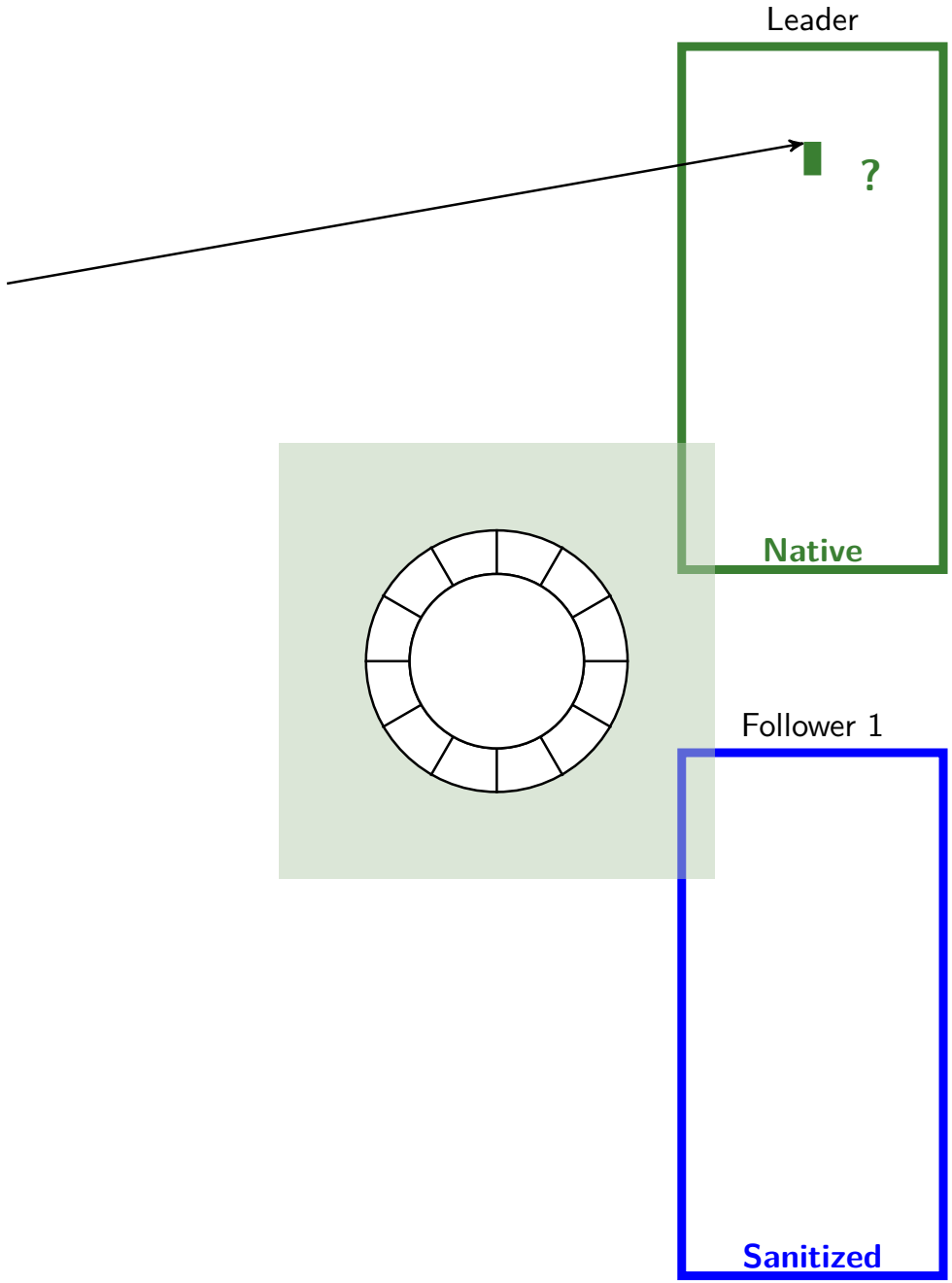
Larger ringbuffer?



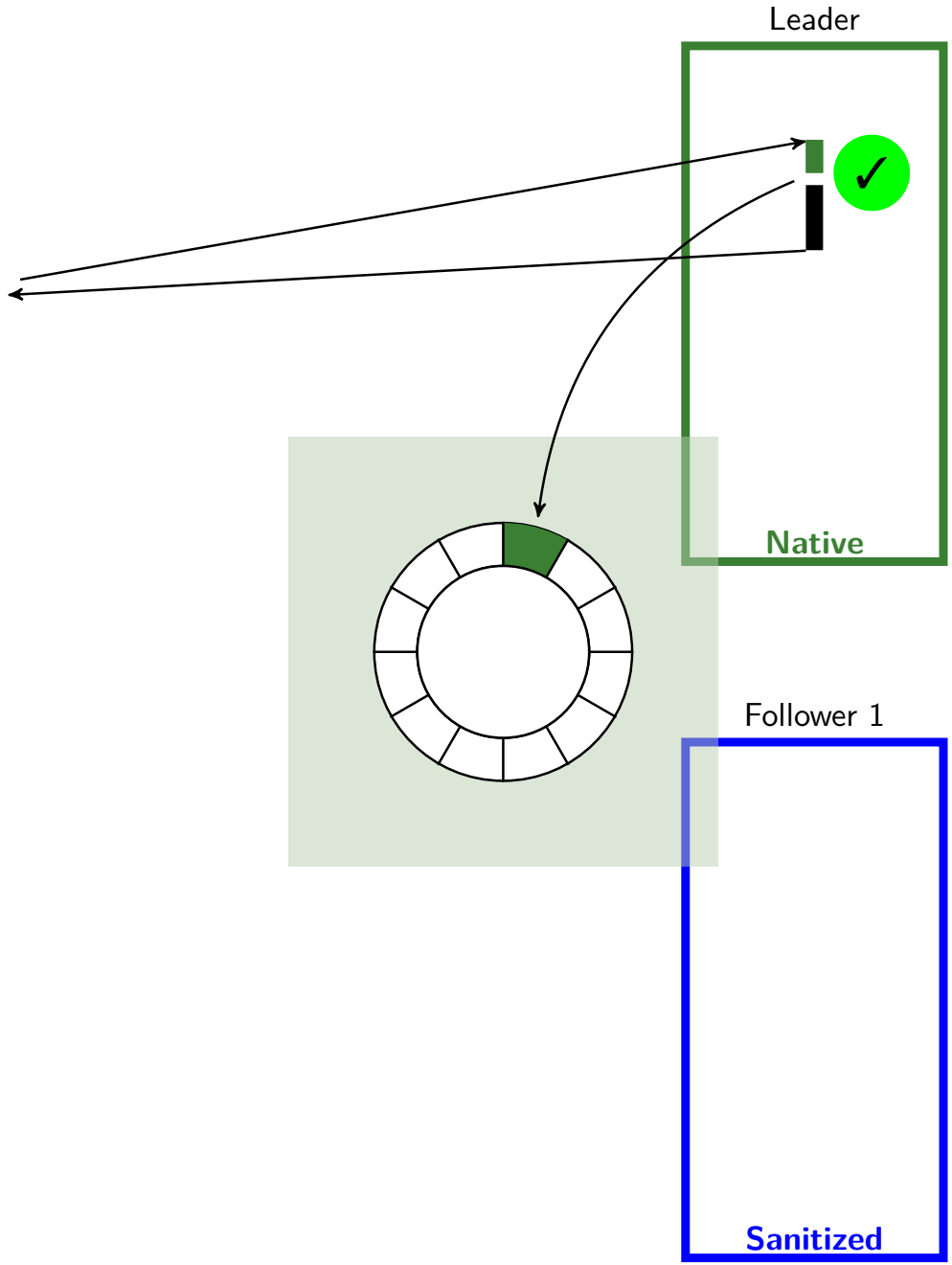
Drop requests



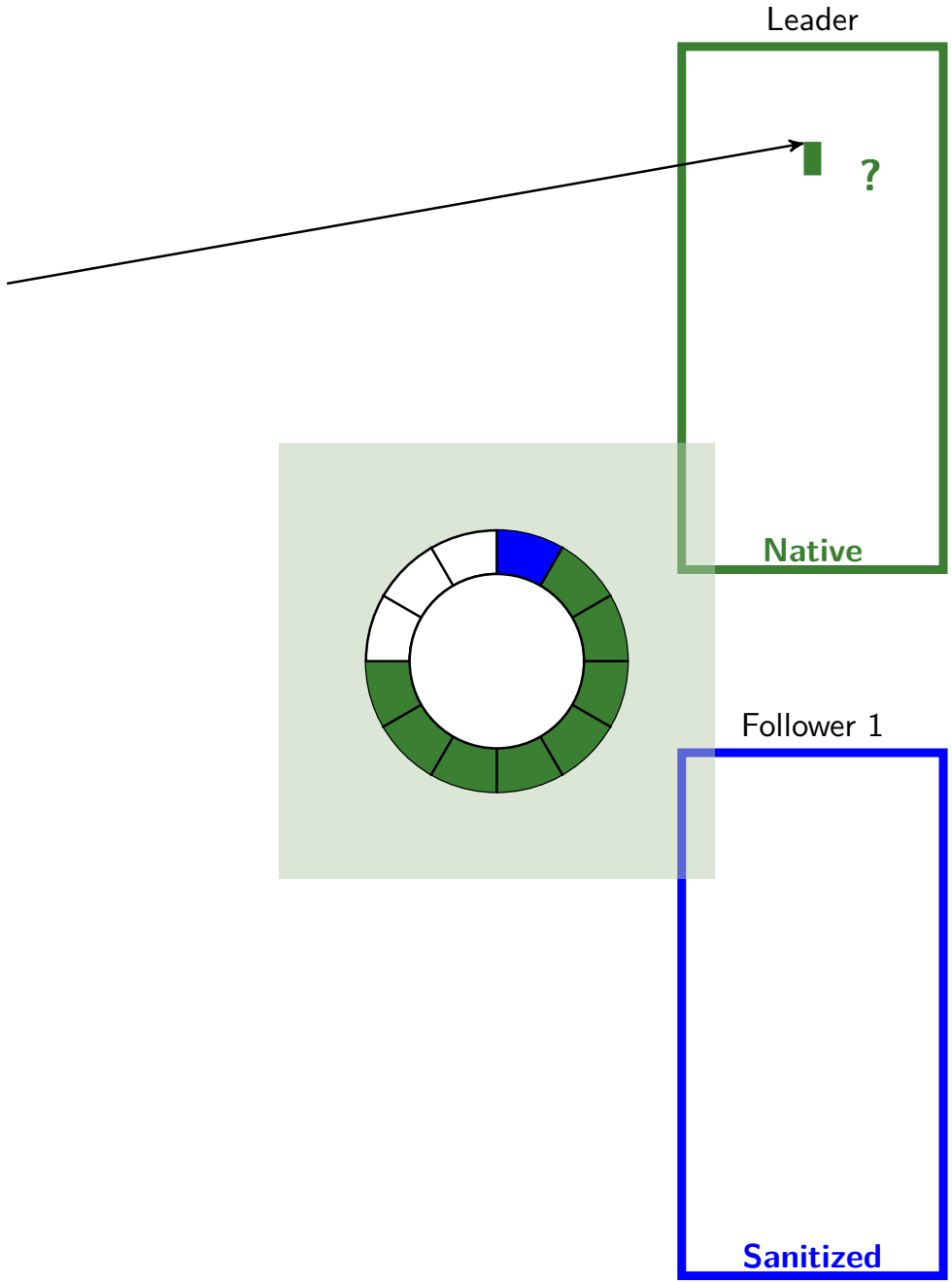
Drop requests



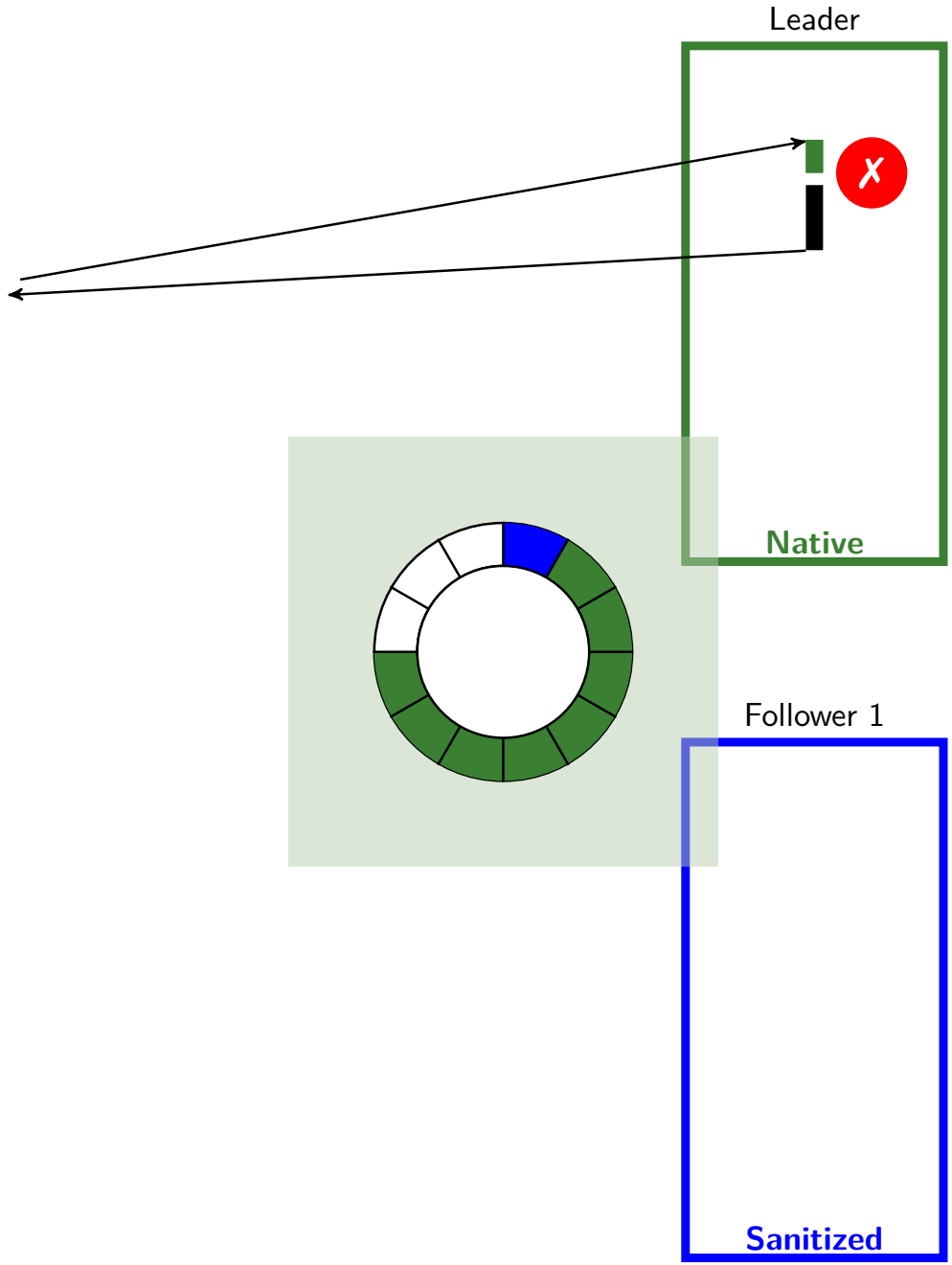
Drop requests



Drop requests



Drop requests

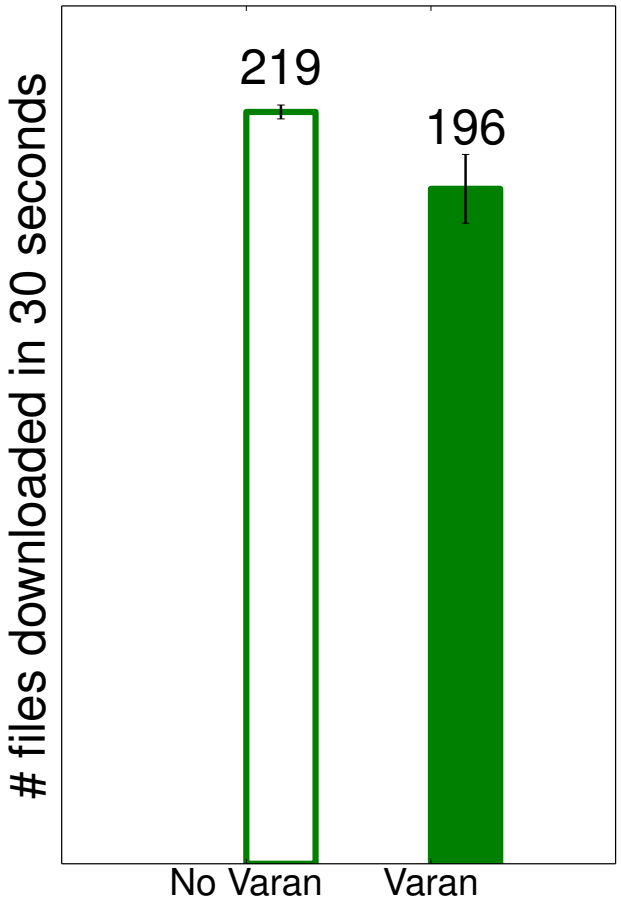


Experiment

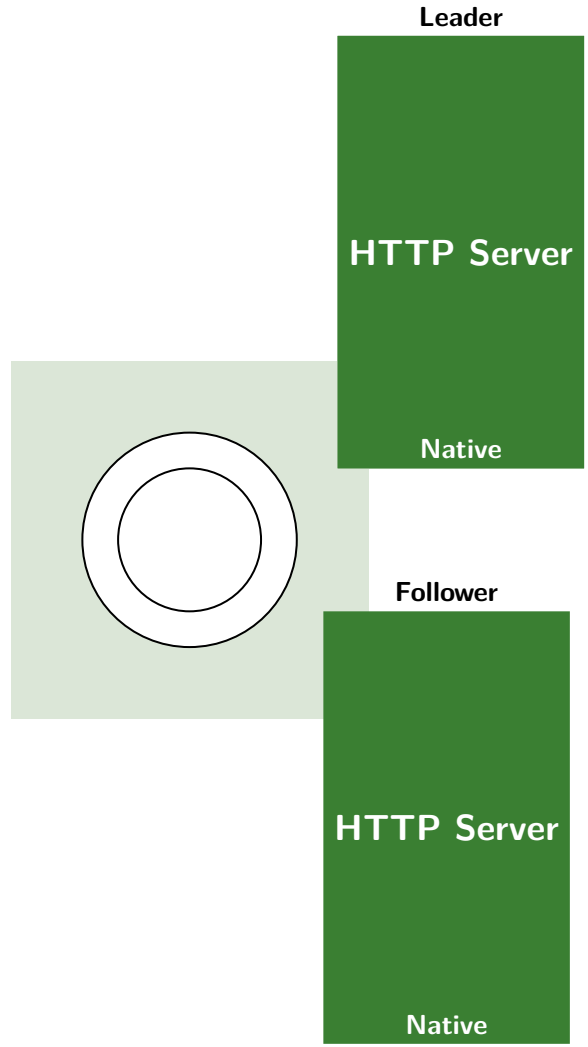
Check performance with varying drop rate on simple HTTP server

- Single process/thread
- BZip2 the response

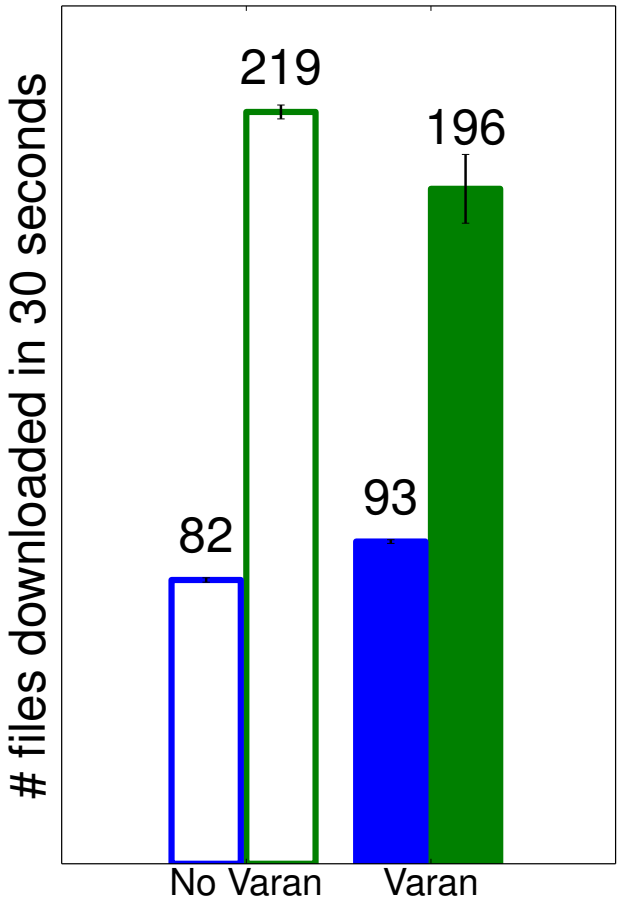
Results


219
196
files downloaded in 30 seconds
No Varan
Varan

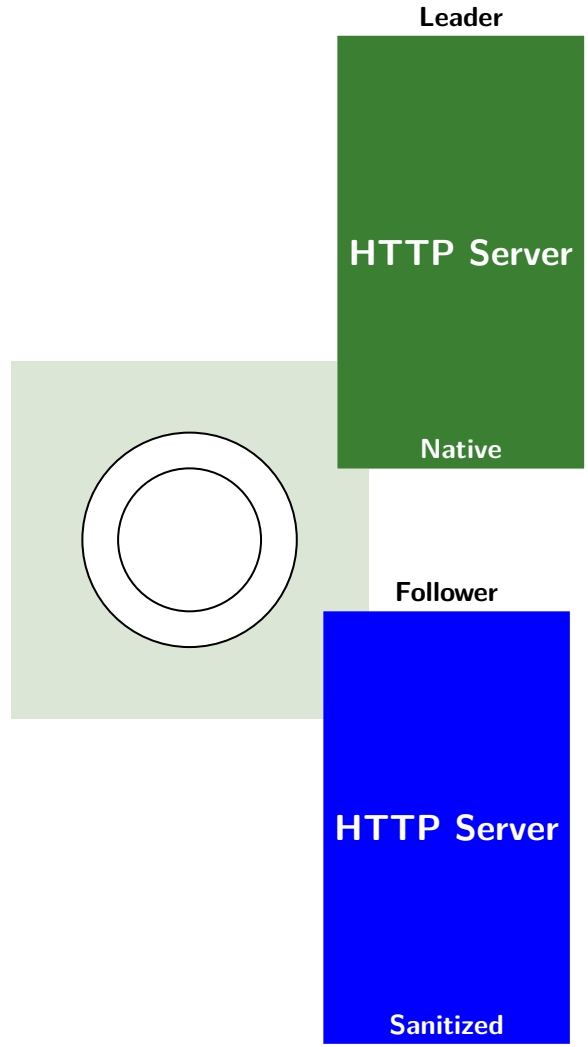

HTTP Server
Native


Leader
HTTP Server
Native
Follower
HTTP Server
Native

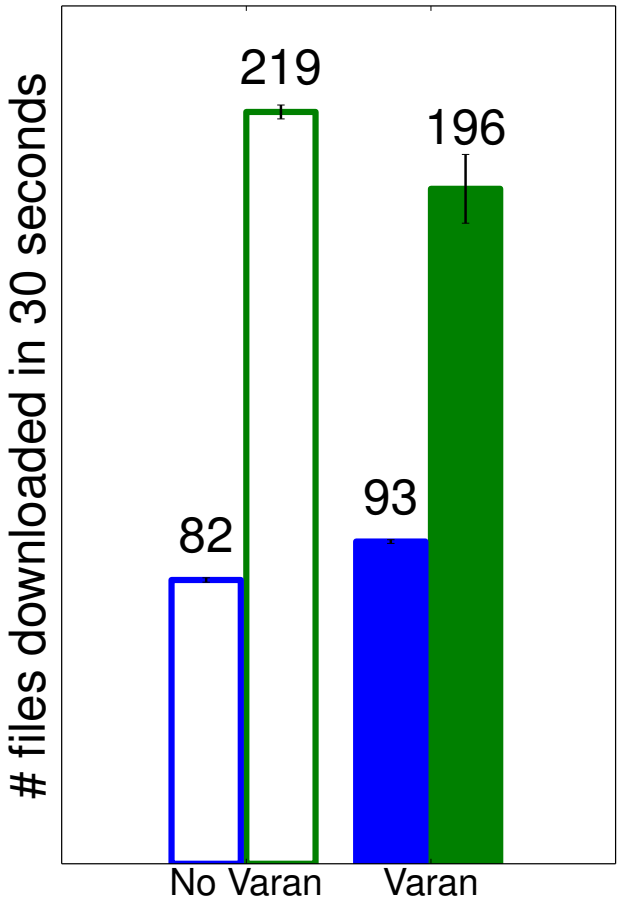
Results

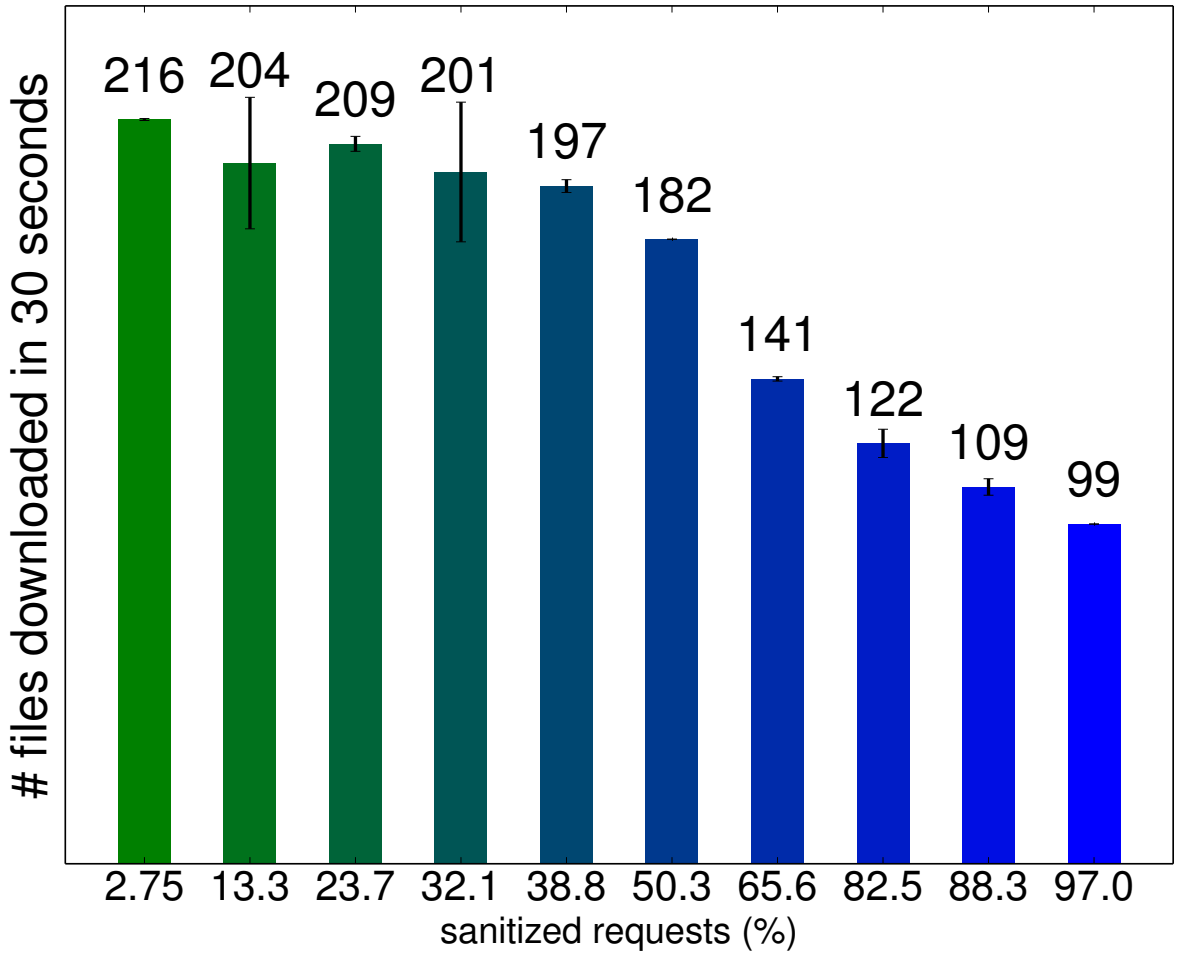

files downloaded in 30 seconds
219
196
93
82
No Varan
Varan


HTTP Server
Sanitized


Leader
HTTP Server
Native
Follower
HTTP Server
Sanitized

Results


files downloaded in 30 seconds
219
196
82
93
No Varan
Varan


files downloaded in 30 seconds
216
204
209
201
197
182
141
122
109
99
2.75
13.3
23.7
32.1
38.8
50.3
65.6
82.5
88.3
97.0
sanitized requests (%)

Questions

- Retain performance? ✓
- Still detect bugs? **?**
- Real server software? **?**
- Other analyses? **?**