FEATURE: PERFORMANCE ISSUES IN DEVOPS

Performance Issues? Hey DevOps, Mind the Uncertainty!

Catia Trubiani, Gran Sasso Science Institute

Pooyan Jamshidi, University of South Carolina

Jurgen Cito, Massachusetts Institute of Technology

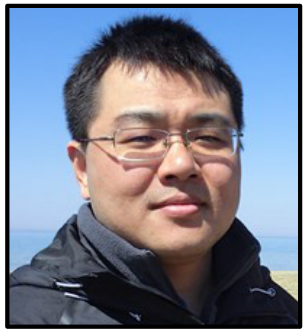
Weiyi Shang, Concordia University

Zhen Ming Jiang, York University

Markus Borg, RISE Research Institutes of Sweden AB





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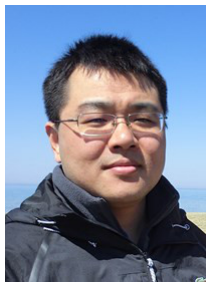
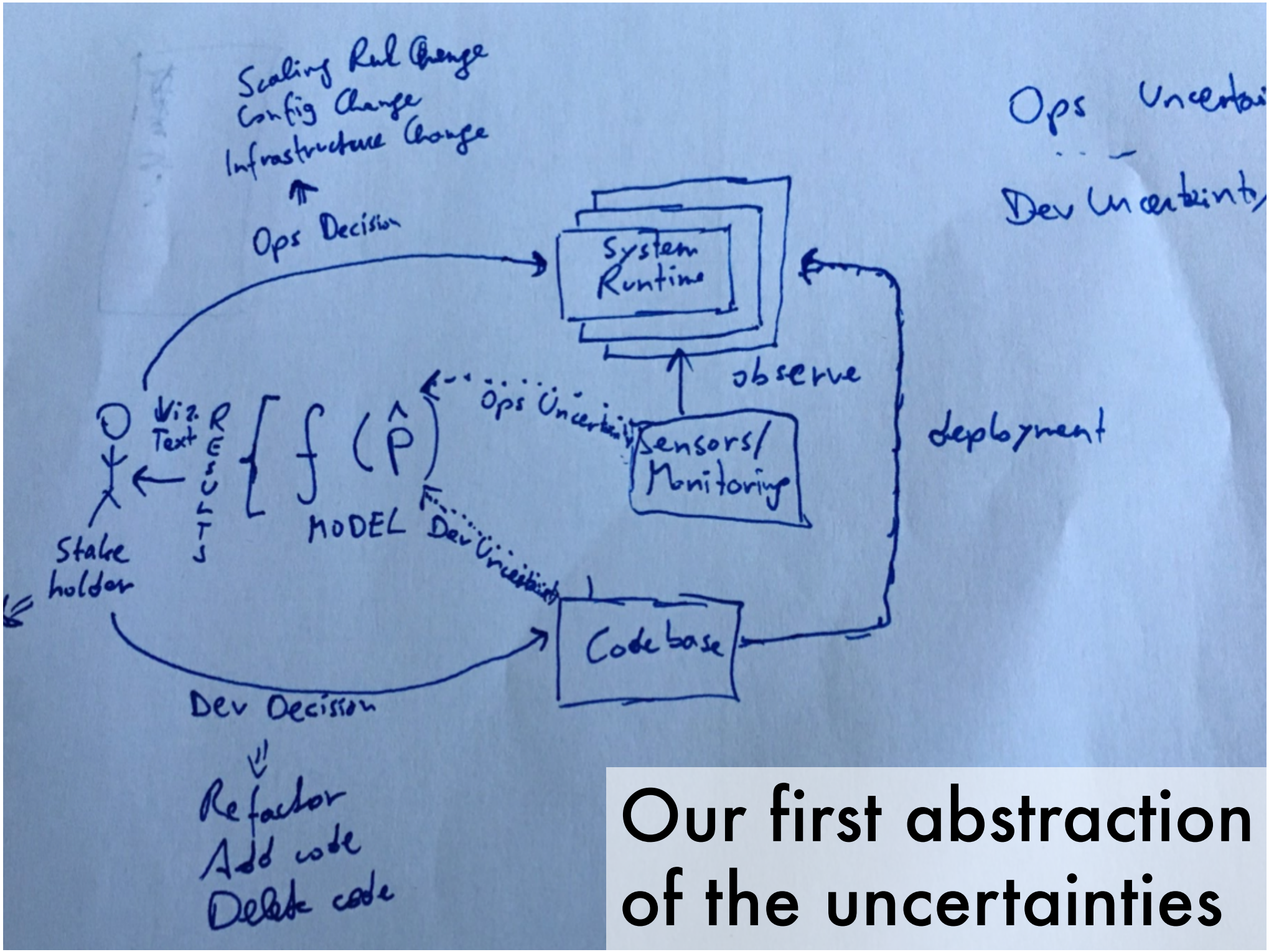
Software Performance Engineering in the DevOps World

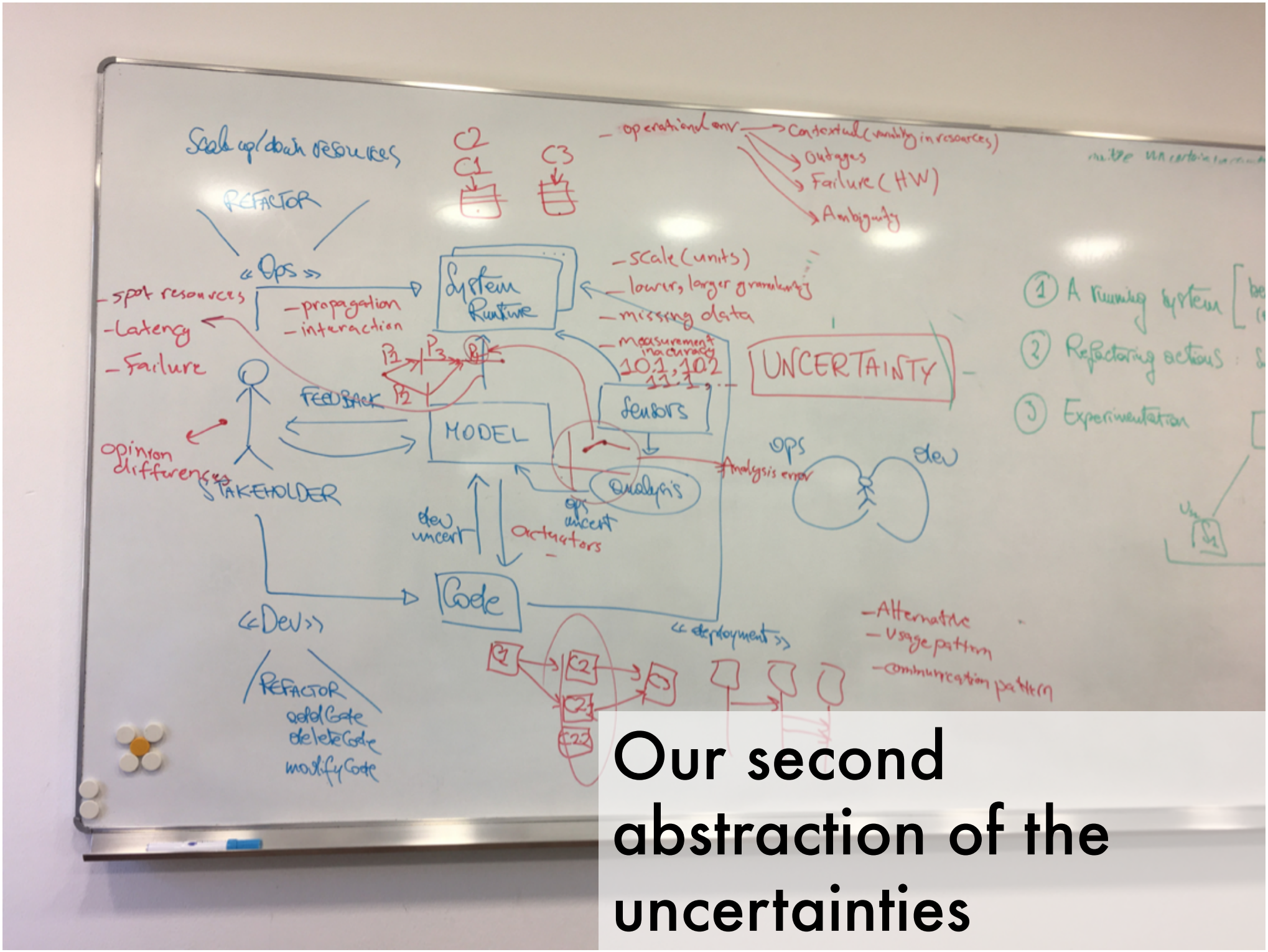
Sources of Uncertainty in Performance-aware DevOps





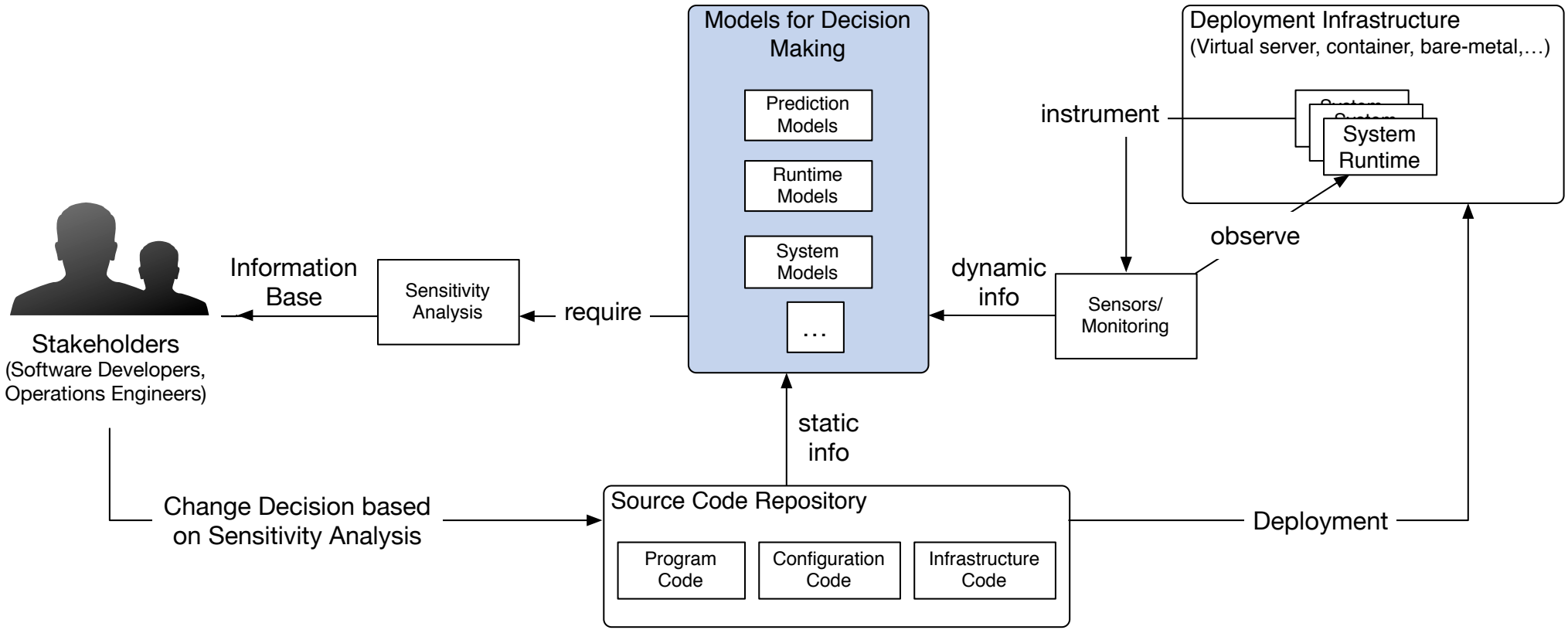



Our first abstraction of the uncertainties

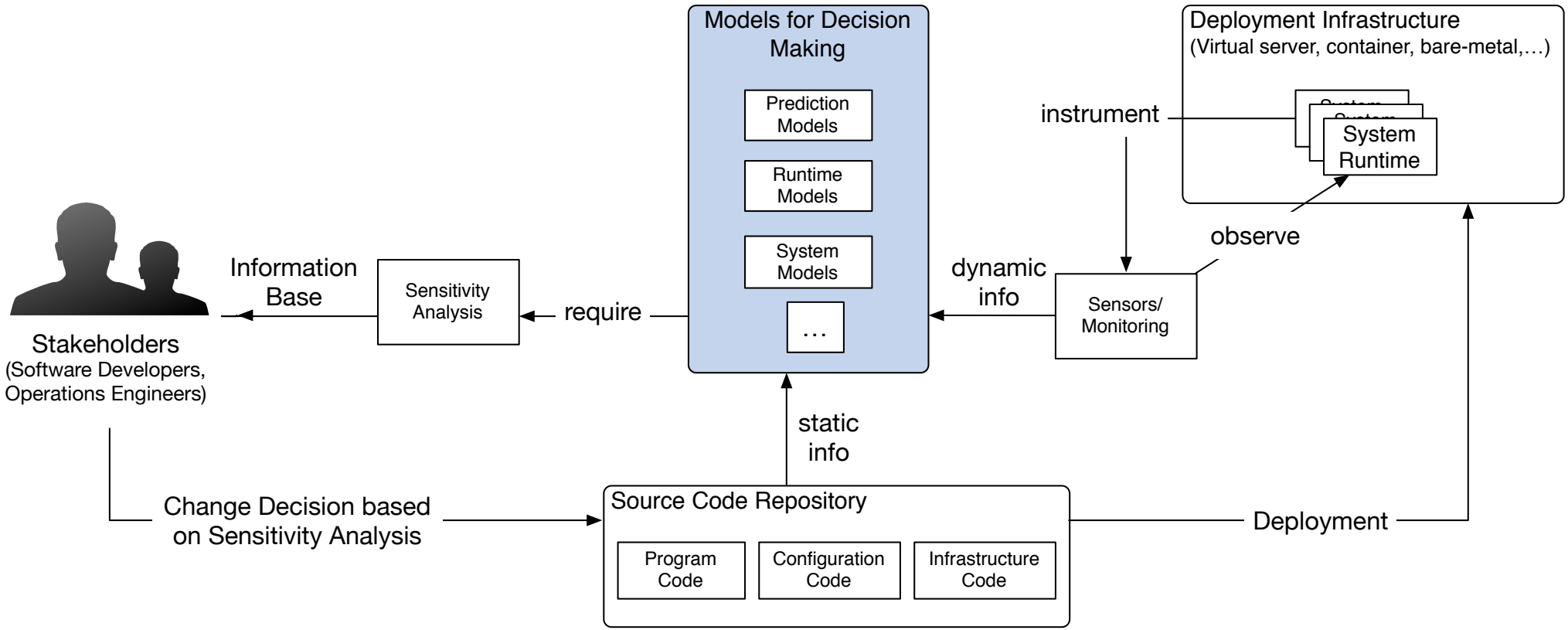


Our second abstraction of the uncertainties

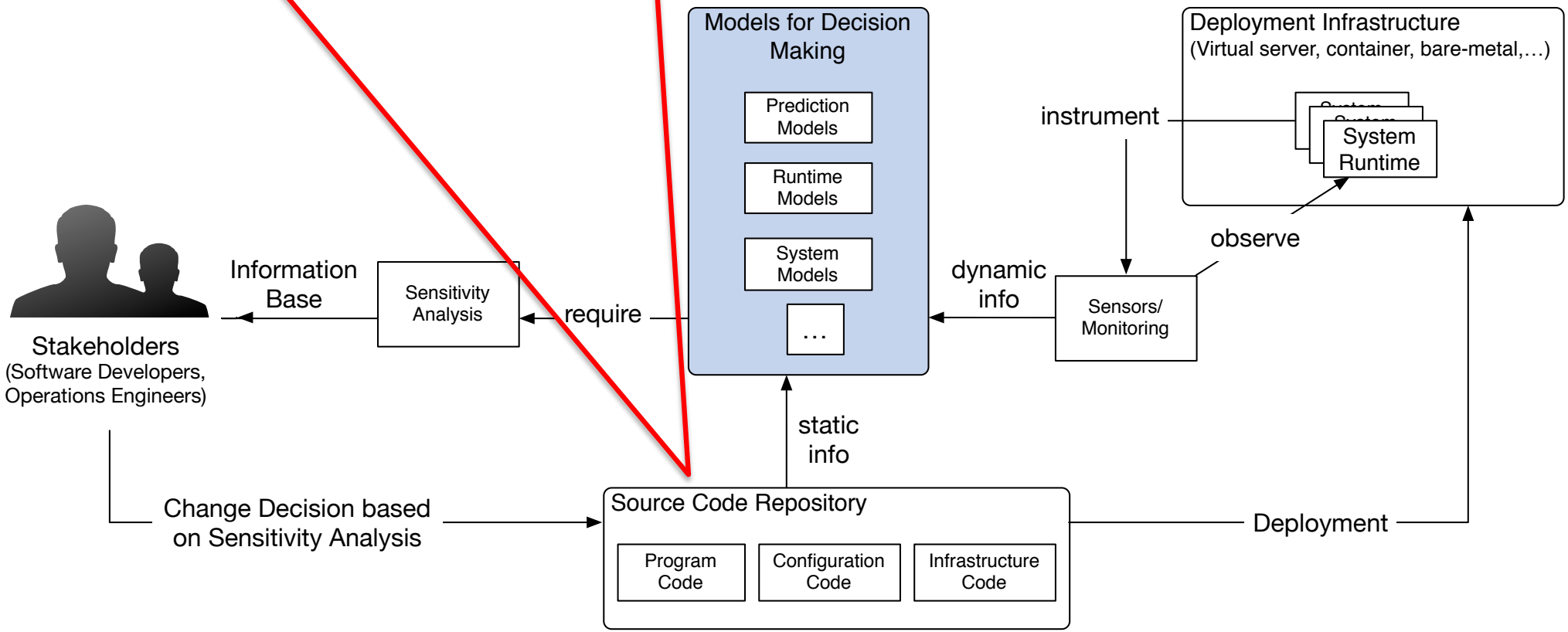
Our final abstraction of the uncertainties



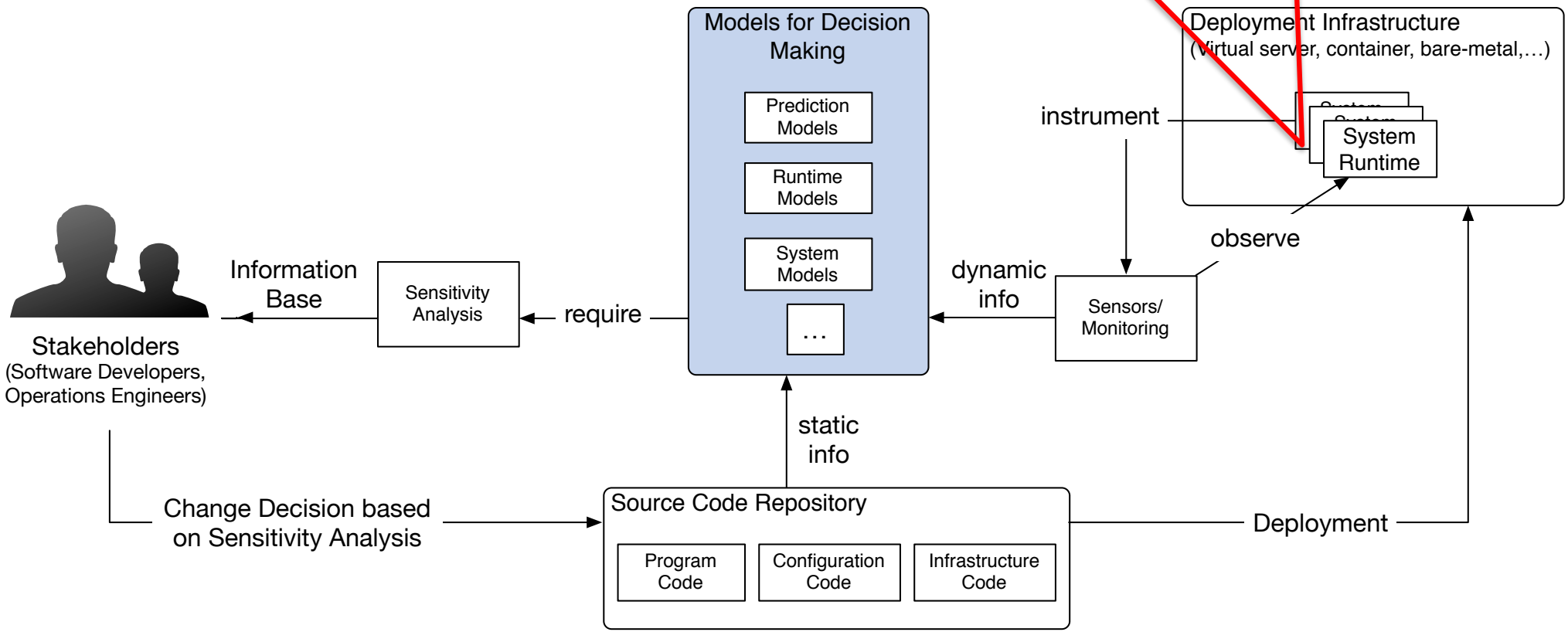
Deployment infrastructure (DI): Physical or virtual, type of nodes...



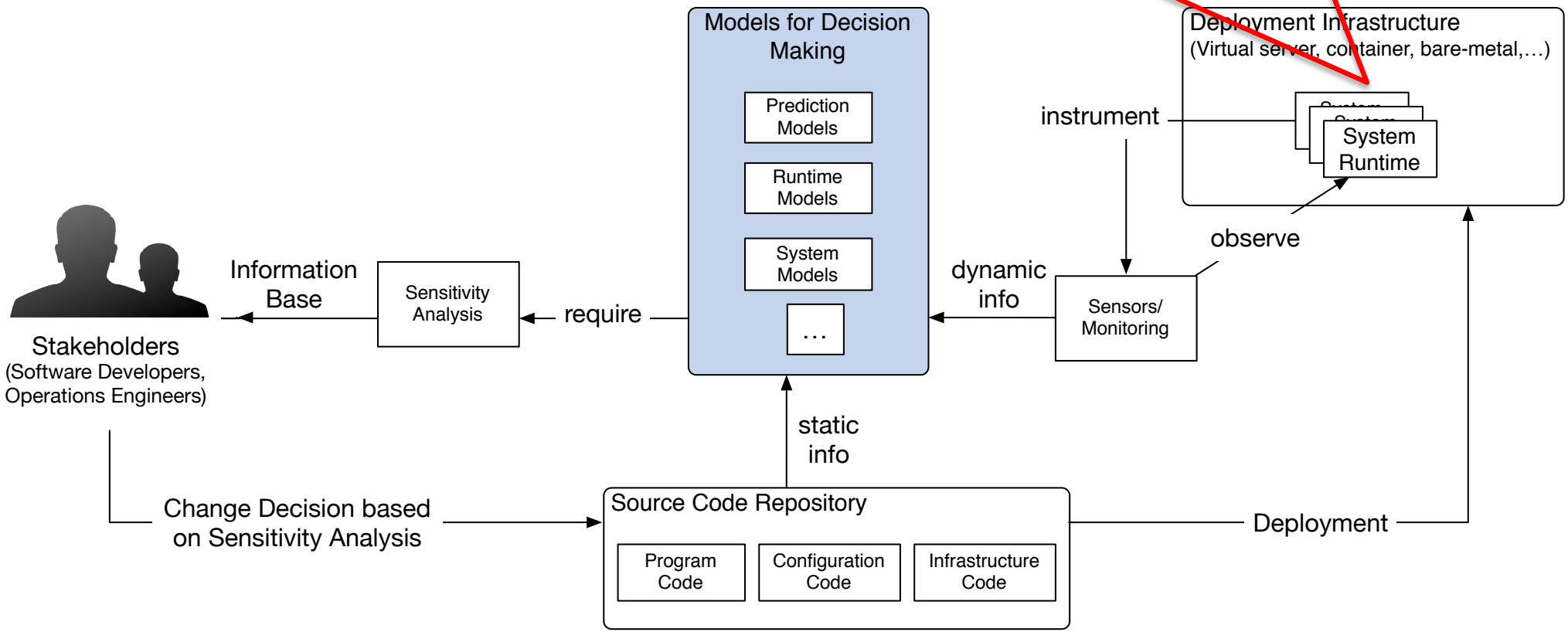
Software versions and code changes (SCs): Code versioning, upgrade, patch



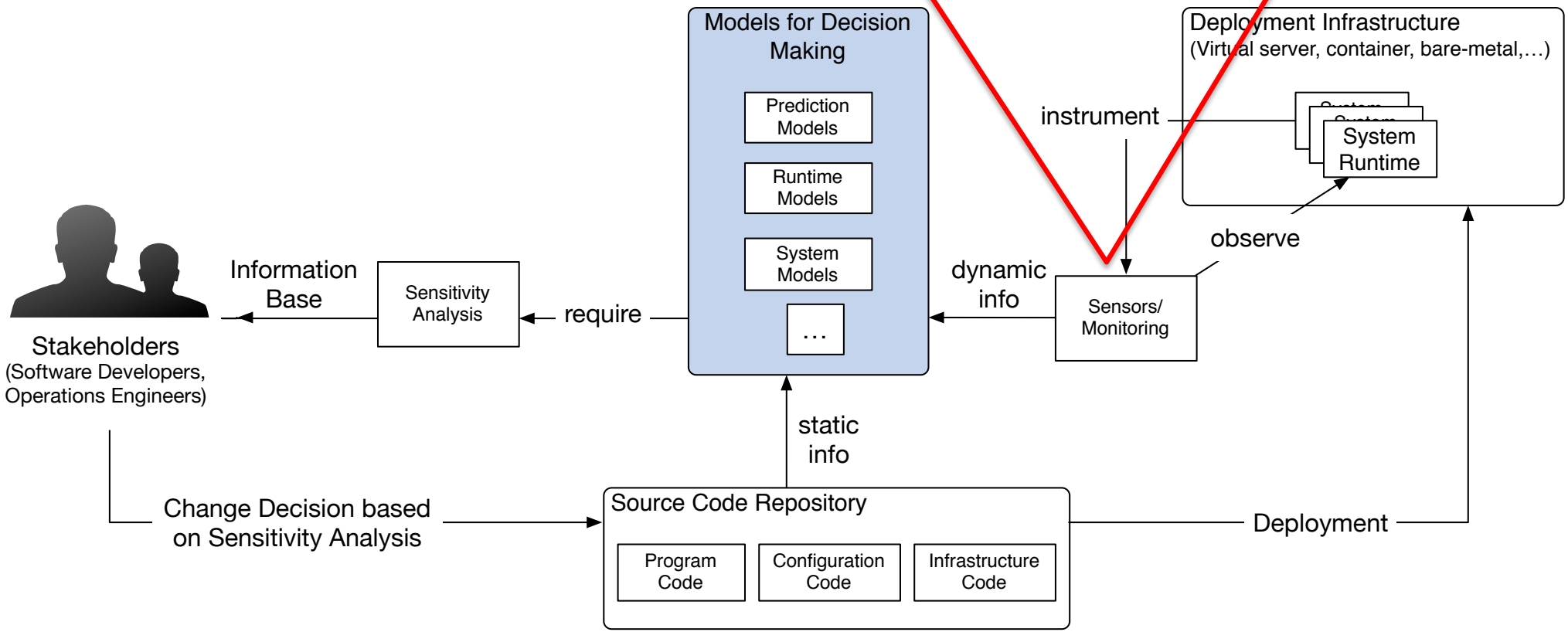
Configuration parameters (CPs):



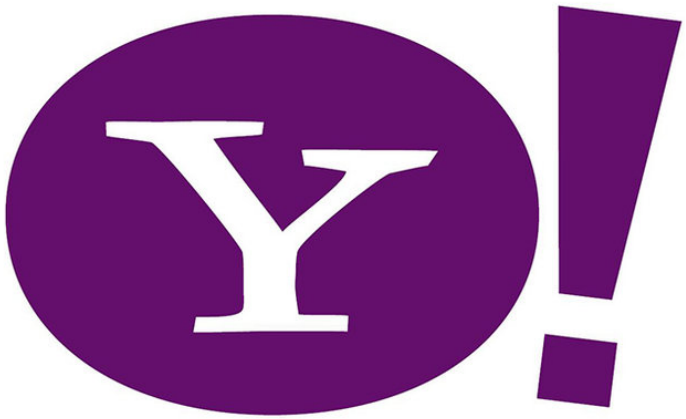
Workload fluctuation(WF): User behavior, benchmark



Monitoring and sensor accuracy (MS): active monitoring, instrumentation, and sensors



We conduct a case study



Yahoo Cloud Service Benchmark (YCSB)

We measure system performance when altering the system based on different source of uncertainty

Deployment infrastructure: 2
Software versions: 3
Configuration parameters: 6 (1024 possible configurations)
Workload: 6

We first alter configurations and keep others unchanged

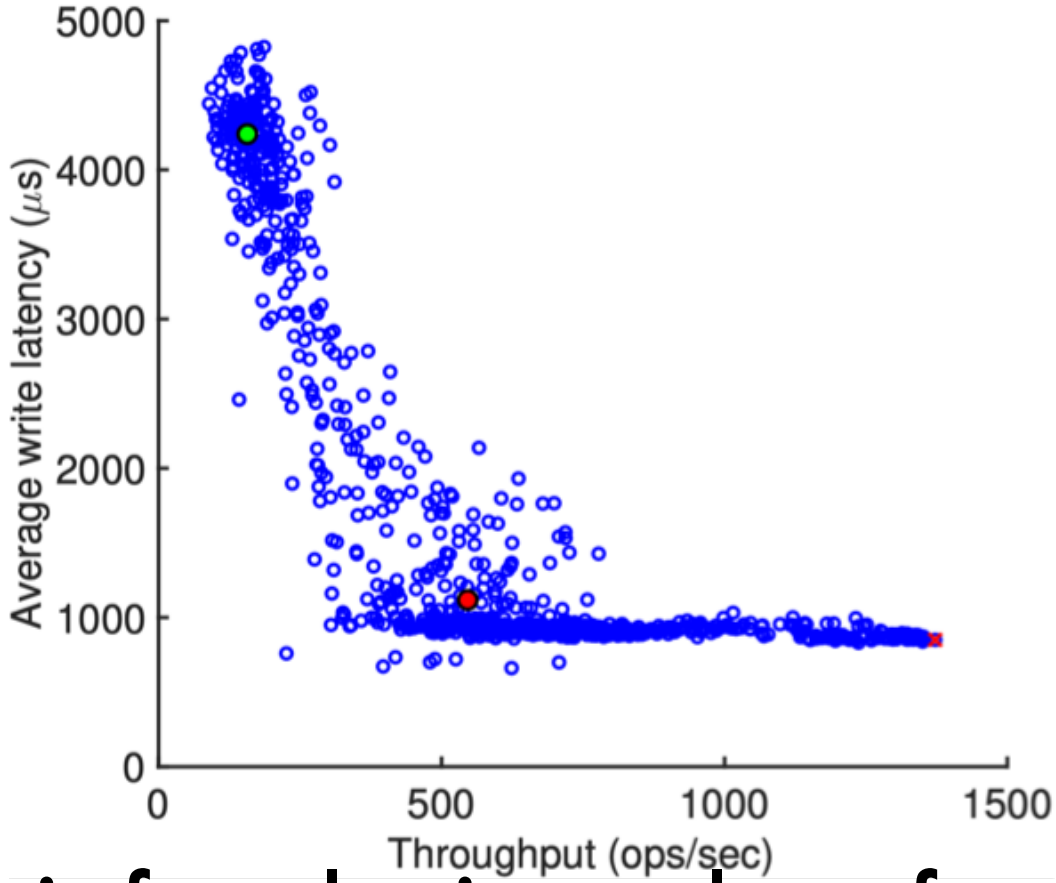
Deployment infrastructure: 2

Software versions: 3

Configuration parameters: 6 (1024 possible configurations)

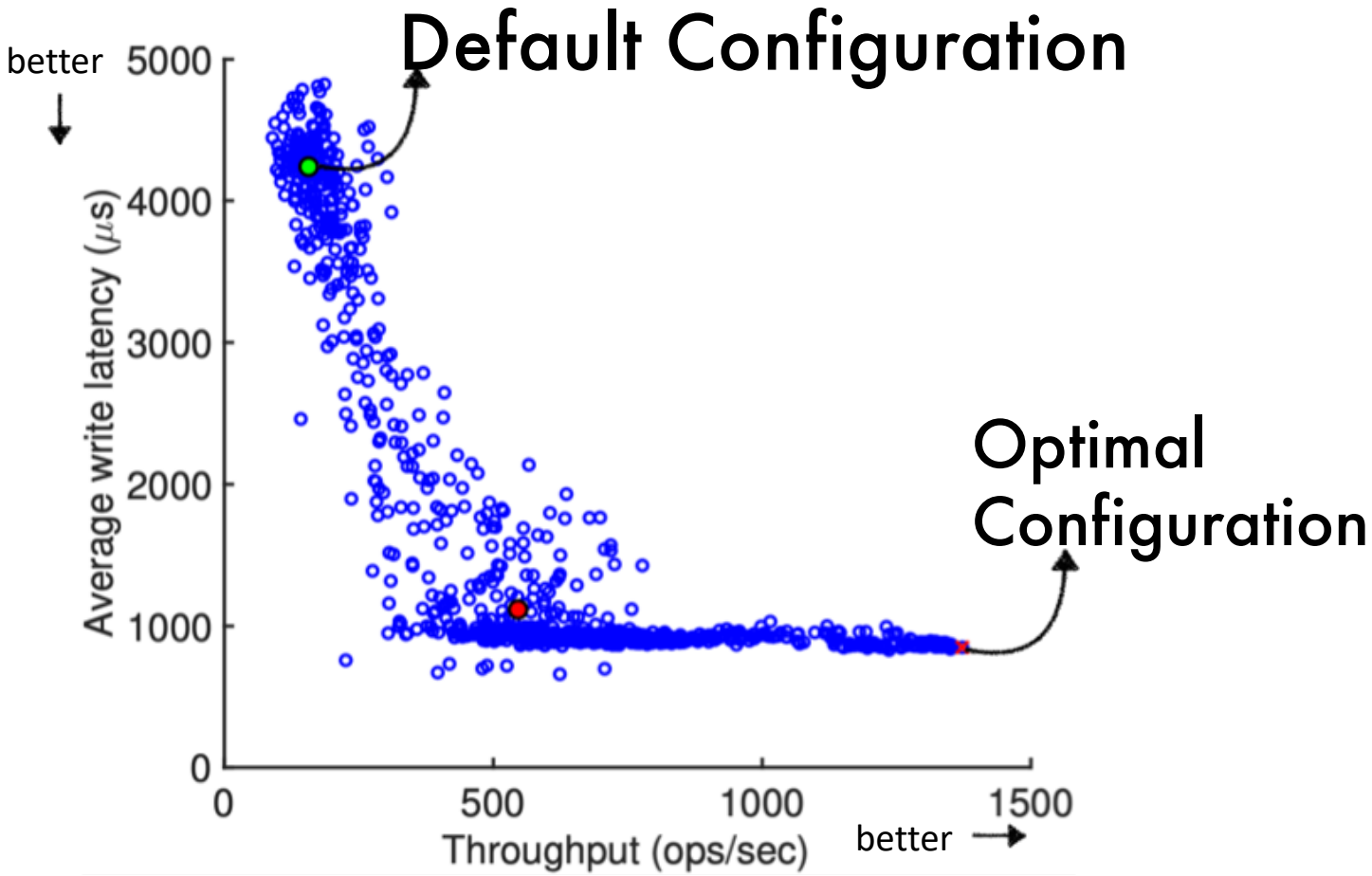
Workload: 6

There exist large uncertainty of performance when varying configurations



The plot is for altering value of configuration parameters when fixing all other aspects

The default configuration is typically bad and the optimal configuration is noticeably better than median



We start to alter other aspects unchanged

Deployment infrastructure: 2

Software versions: 3

Configuration parameters: 6 (1024 possible configurations)

Workload: 6

We measure the top/bottom configurations that are common between two settings

Decision	ID	Source	Target	Top	Bottom	|Top/bottom|	Correlation	Correlation (10%)
DI	ec_1	h2-A-V3	h1-A-V3	0.0980	0.1569	0.0589	0.0364	−0.0078
SC	ec_2	h1-A-V3	h1-A-V2	0.0490	0.0588	0.0098	−0.1266	−0.0527
	ec_3	h1-A-V3	h1-A-V1	0.1176	0.0376	0.08	0.1424	0.0696
WF	ec_4	h2-A-V3	h2-B-V3	0.0392	0.0686	0.0294	−0.1732	0.0139
	ec_5	h2-A-V3	h2-C-V3	0.1373	0.1275	0.0098	0.0318	0.0381
	ec_6	h2-A-V3	h2-D-V3	0.1471	0.1176	0.0295	0.0088	0.0172
	ec_7	h2-A-V3	h2-E-V3	0.0490	0.0686	0.0196	−0.0704	0.0127
	ec_8	h2-A-V3	h2-F-V3	0.0686	0.1373	0.0687	0.0217	0.0078
SC-WF	ec_9	h1-A-V3	h1-B-V1	0.1078	0.1765	0.0687	0.1001	−0.0302
DI-SC-WF	ec_{10}	h2-A-V3	h1-B-V1	0.1078	0.1176	0.0098	−0.0327	0.0192

Before altering

After altering

Potion of common top configuration before/after altering

What is altered

Decision	ID	Source	Target	Top	B
DI	ec_1	h2-A-V3	h1-A-V3	0.0980	0
SC	ec_2	h1-A-V3	h1-A-V2	0.0490	0
	ec_3	h1-A-V3	h1-A-V1	0.1176	0
WF	ec_4	h2-A-V3	h2-B-V3	0.0392	0
	ec_5	h2-A-V3	h2-C-V3	0.1373	0

Correlation of each configuration's performance before/after altering

Top	Bottom	|Top/bottom|	Correlation	Correlation (10%)
0.0980	0.1569	0.0589	0.0364	–0.0078
0.0490	0.0588	0.0098	–0.1266	–0.0527
0.1176	0.0376	0.08	0.1424	0.0696
0.0392	0.0686	0.0294	–0.1732	0.0139
0.1373	0.1275	0.0098	0.0318	0.0381
0.1471	0.1176	0.0295	0.0088	0.0172

The percentage of top/bottom common configurations between two settings are low

	Top	Bottom	|To		10%)
	0.0980	0.1569	0.0		
	0.0490	0.0588	0.0		
	0.1176	0.0376	0.0		
	0.0392	0.0686	0.0		
	0.1373	0.1275	0.0		
	0.1471	0.1176	0.0		
	0.0490	0.0686	0.0196	−0.0704	0.0127

The best/worst configuration of one setting typically do not apply for another setting.

The correlation of configurations performance between two settings decreases with noise

	Top	Bottom	|Top/bottom|	Correlation	Correlation (10%)
				0.0364	–0.0078
				–0.1266	–0.0527
				0.1424	0.0696
				–0.1732	0.0139
				0.0318	0.0381
				0.0088	0.0172
				–0.0704	0.0127

The same configuration typically have different performance for different settings.

Correlation of with injected white noise as Monitoring and sensor accuracy (MS) uncertainty

Motoring noise worsen the uncertainty

Top			Correlation	Correlation (10%)
0.09			0.0364	−0.0078
0.04			−0.1266	−0.0527
0.1176	0.0376	0.08	0.1424	0.0696
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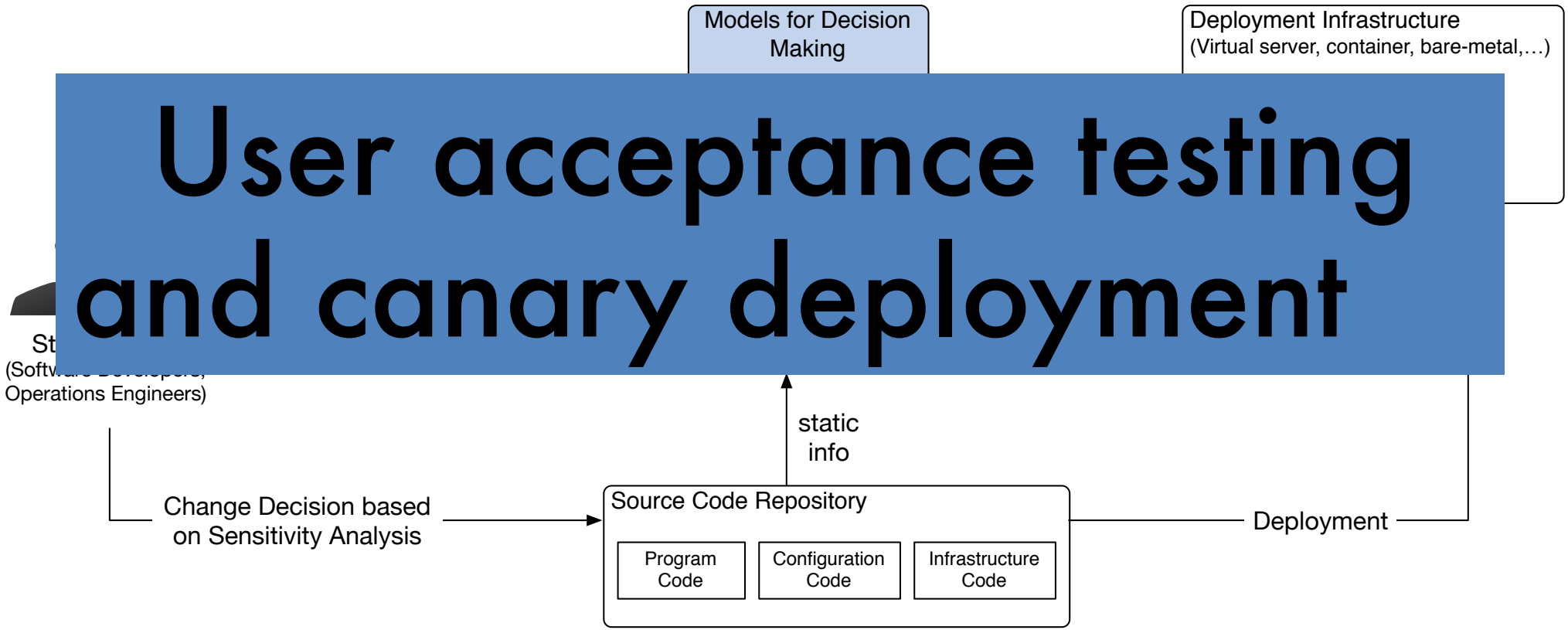
What should practitioners do?

Conduct additional experiments that further reduce the uncertainty

Identify and handle the root cause of the uncertainty

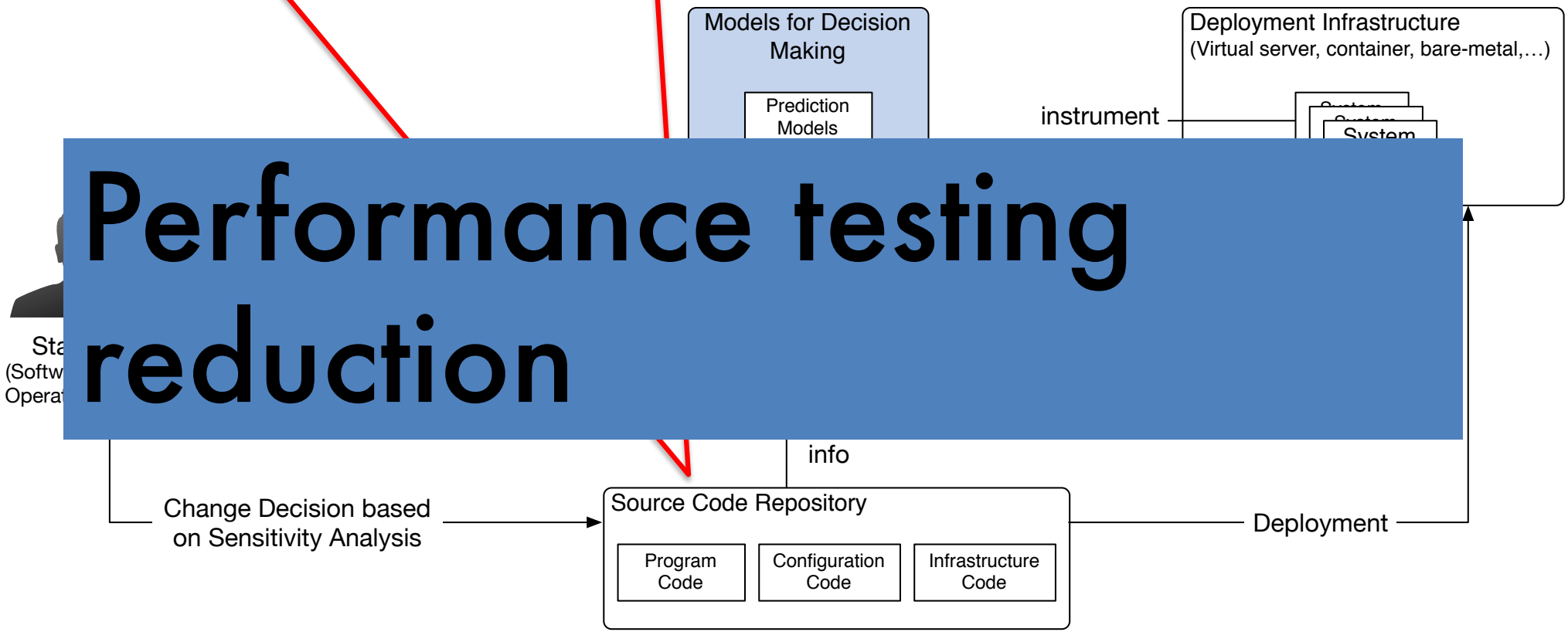
If the uncertainty cannot be easily reduced or handled, uncertainty quantification approaches should be considered.

Deployment infrastructure (DI): Physical or virtual, type of nodes...



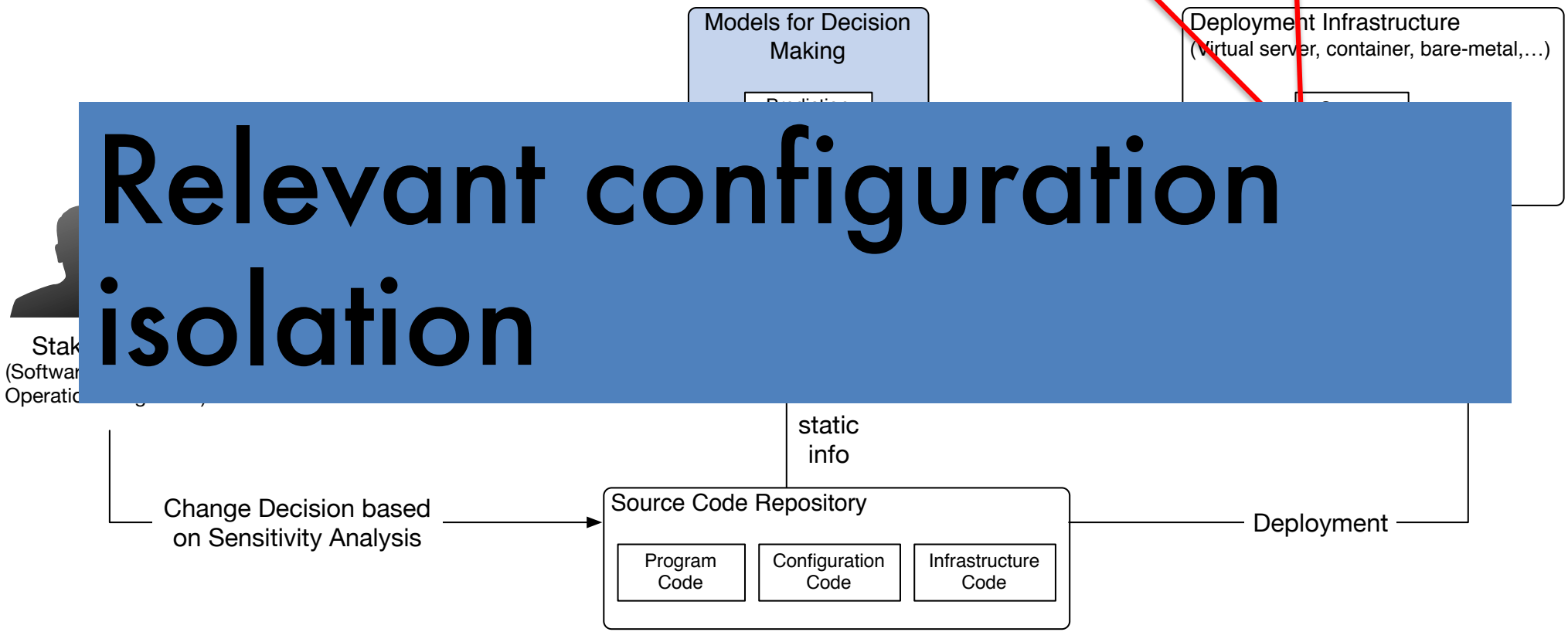
User acceptance testing and canary deployment

Software versions and code changes (SCs):
Code versioning, upgrade, patch



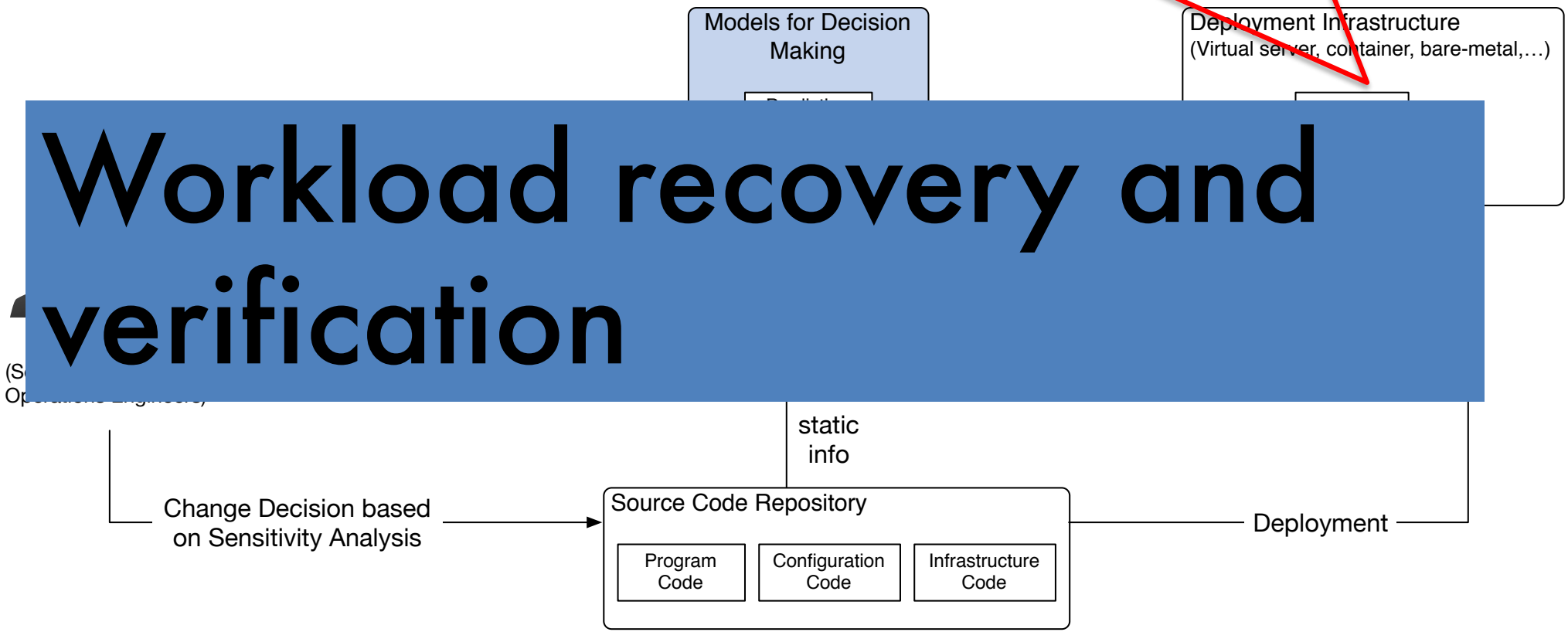
Performance testing reduction

Configuration parameters (CPs):



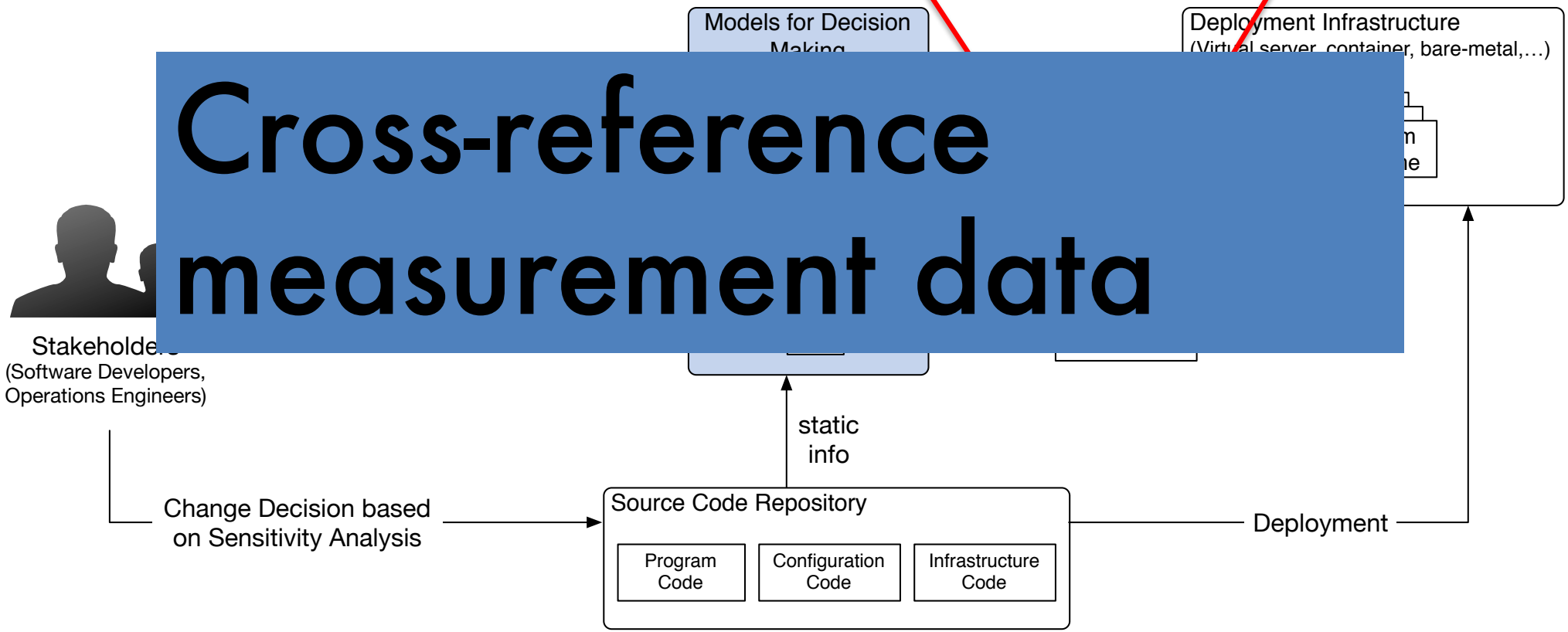
Relevant configuration isolation

Workload fluctuation(WF): User behavior, benchmark



Workload recovery and verification

Monitoring and sensor accuracy (MS): active monitoring, instrumentation, and sensors



Cross-reference measurement data

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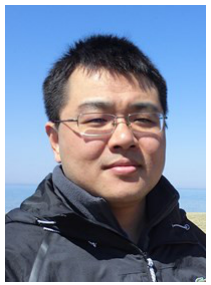
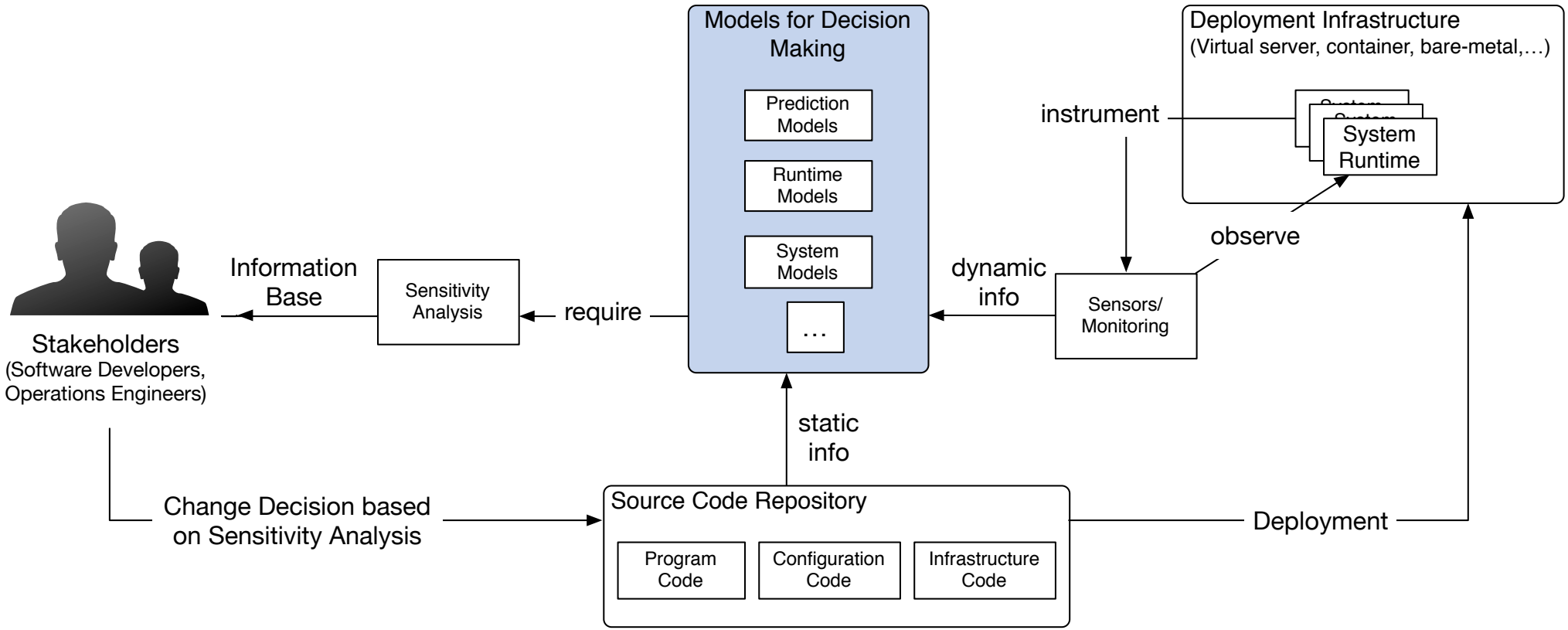



Our final abstraction of the uncertainties



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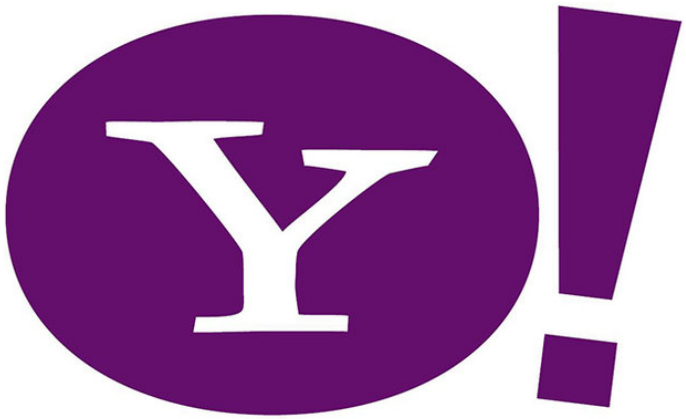

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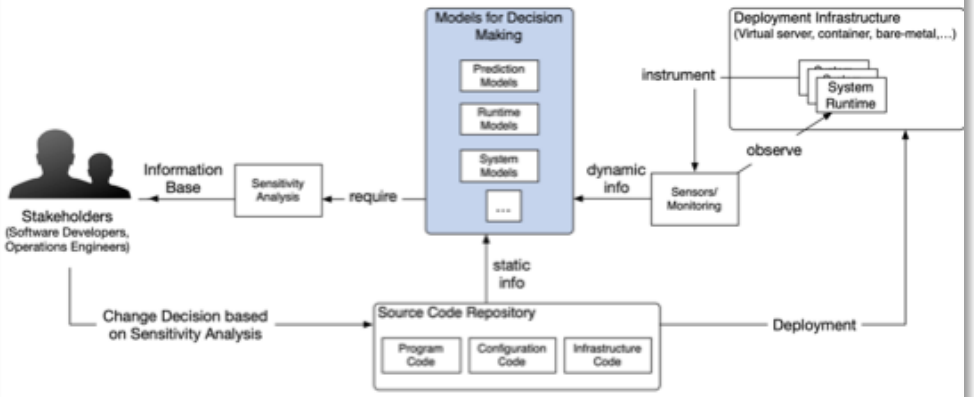

We conduct a case study

cassandra

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