

DRACO: TOP-DOWN DIAGNOSIS OF LARGE-SCALE VOIP NETWORKS

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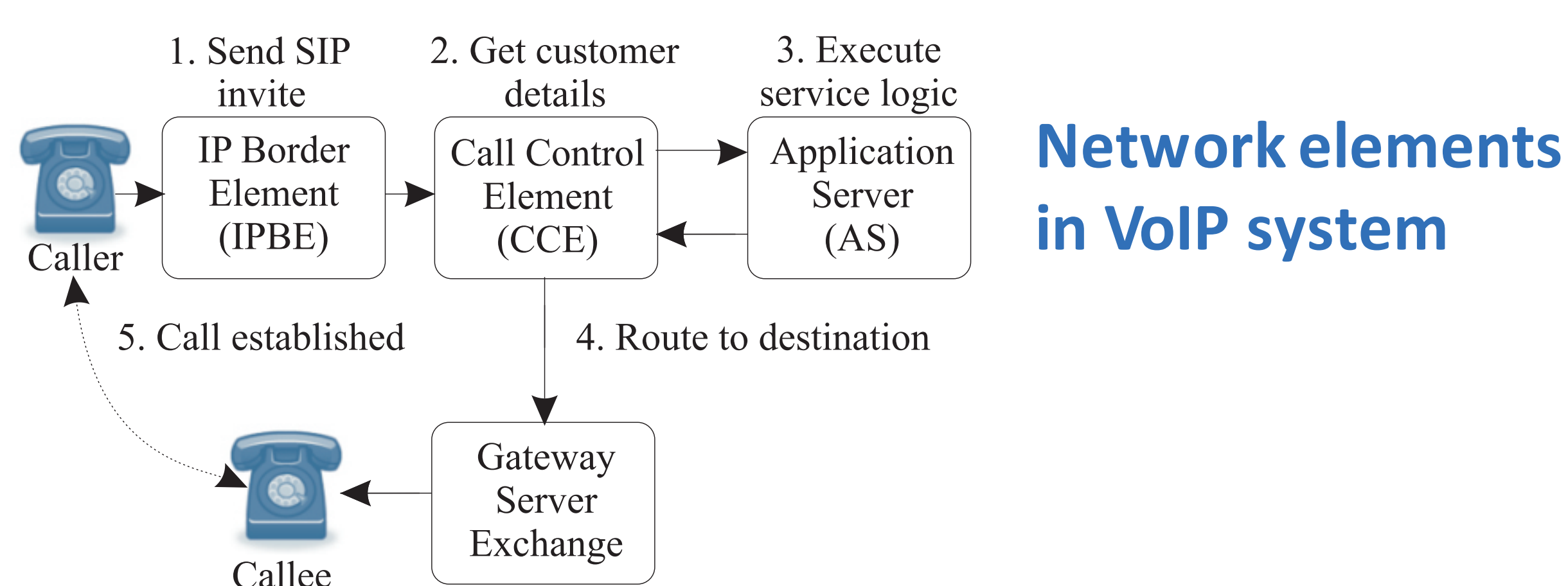
PROBLEM STATEMENT

- Business VoIP services growing rapidly
 - Millions of calls per day
 - Call volumes doubled in last year
- Faults cause call defects (blocked or cut-off calls)
 - Major incidents often occur after failed upgrades
 - Typically misconfigurations, or software bugs

Research question

- How do we diagnose faults that:
 - Have never happened before?

OVERVIEW OF VoIP SYSTEMS



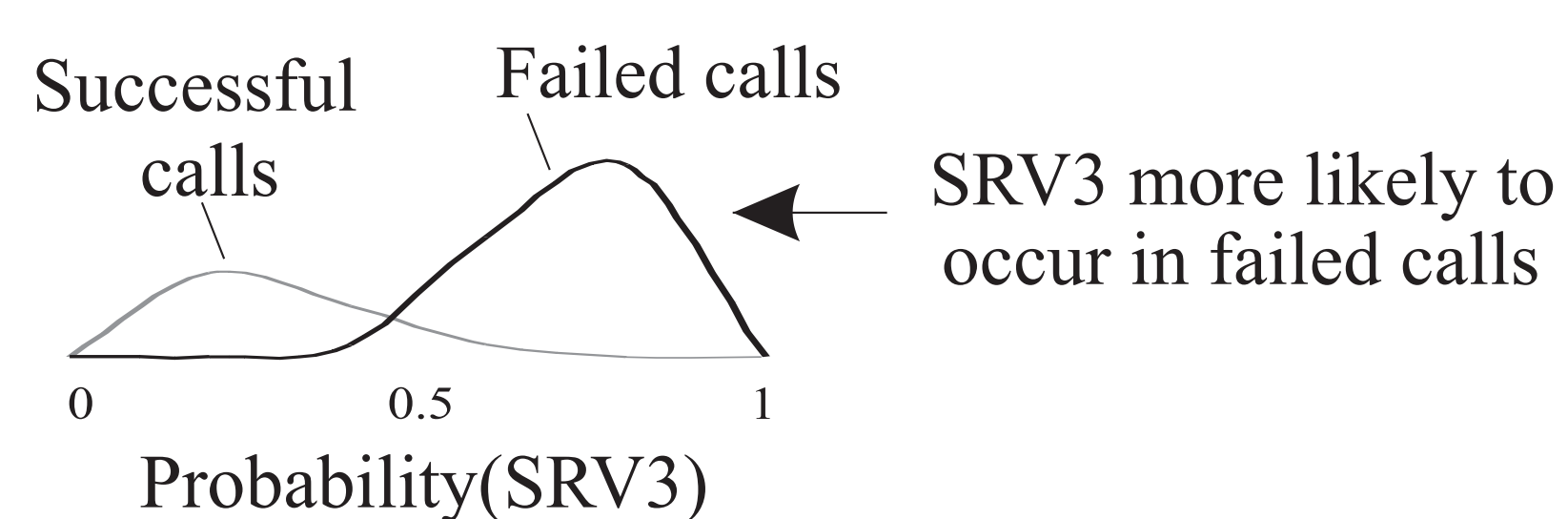
- Network elements record call outcome
 - Timestamp, name of network element, service type
 - Outcome of call (successful, blocked, or cut-off)

DRACO: TOP-DOWN DIAGNOSIS

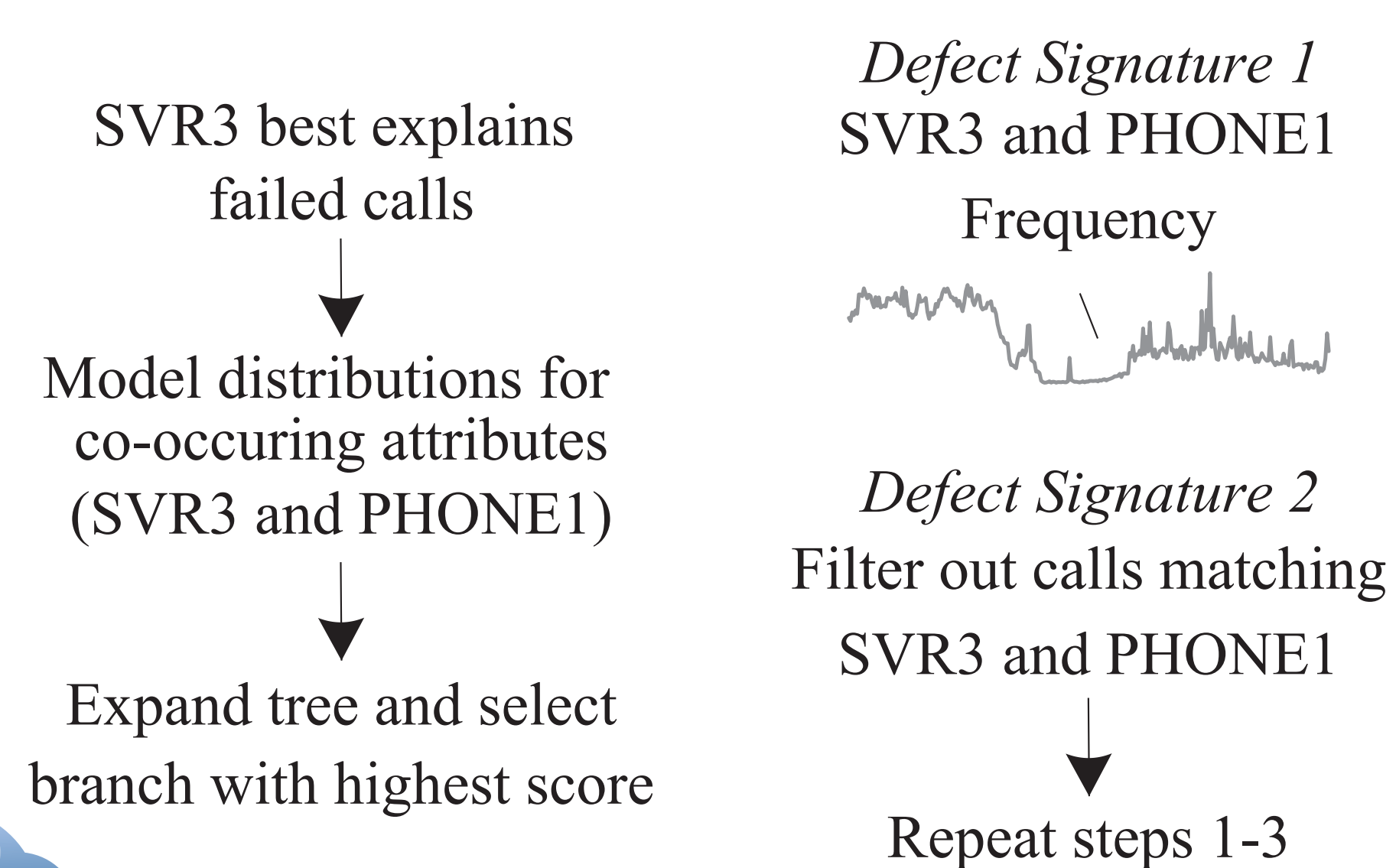
1. Represent calls as truth table

SVR1	SVR2	SVR3	PHONE1	OUTCOME
1	1	0	0	SUCCESS
0	0	1	1	FAIL

2. Model distribution of each call attribute



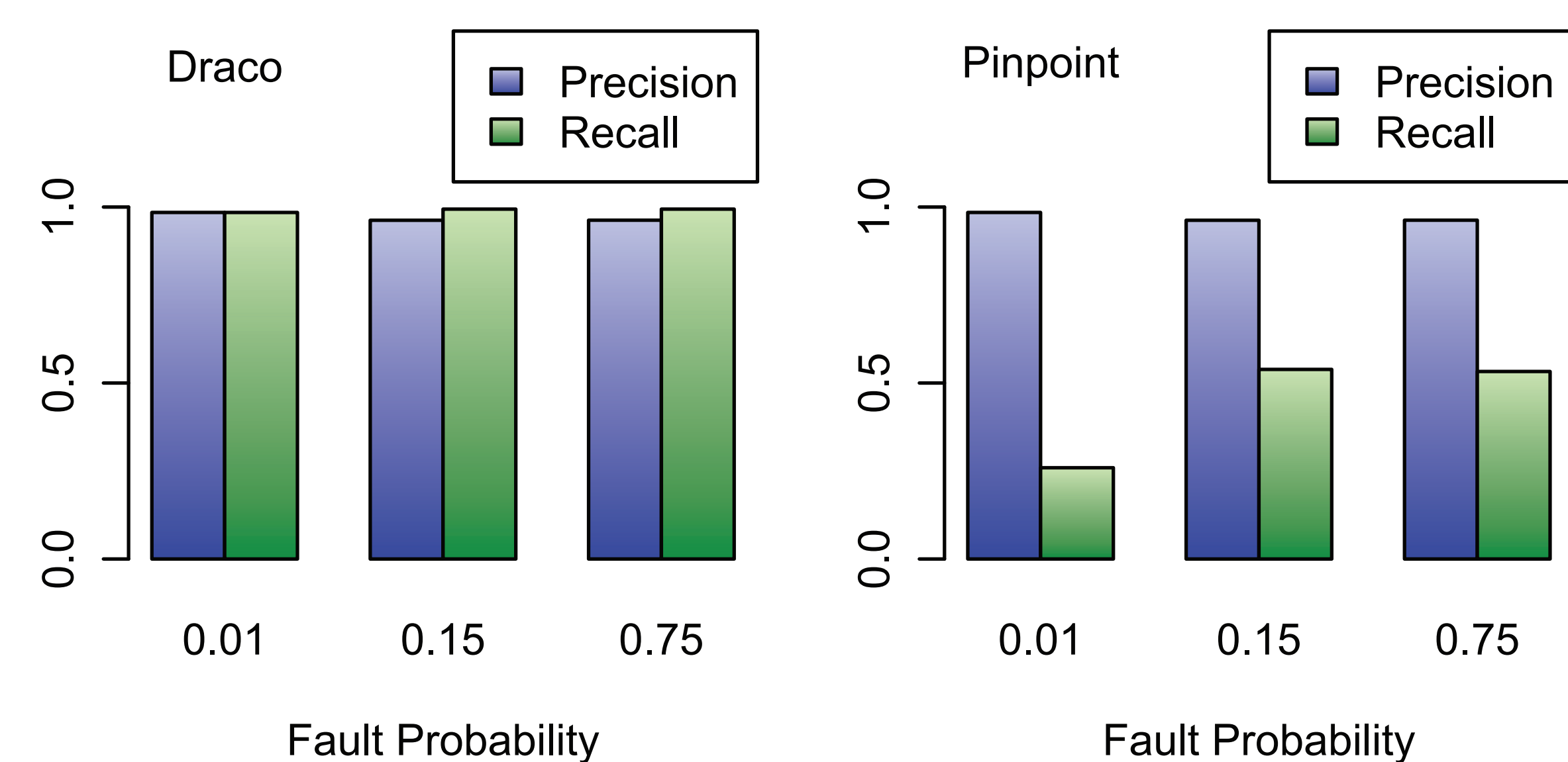
3. Build diagnostic tree and rank output



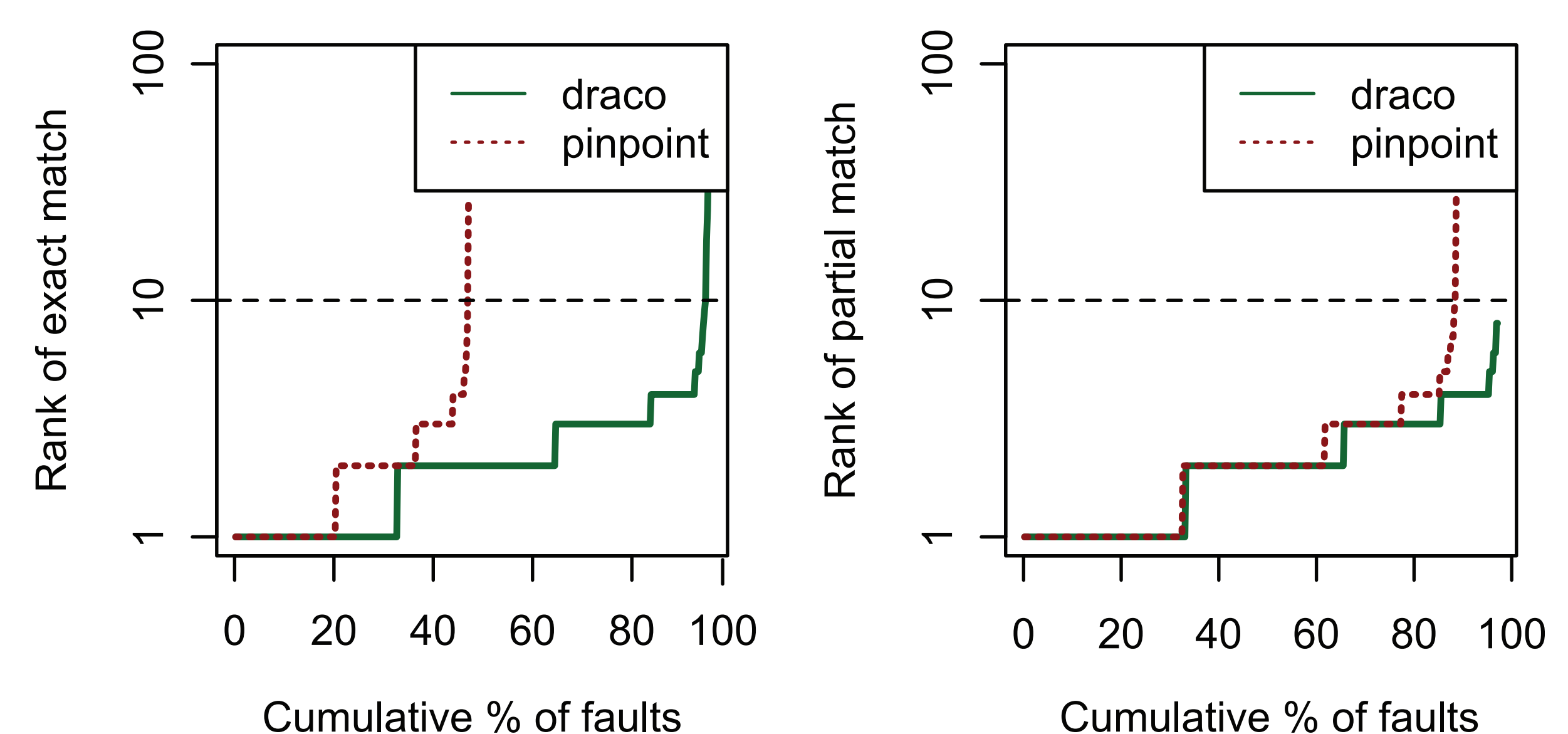
RESULTS OF SIMULATION STUDY

- Simulated faults using one week's worth of traces
- Randomly failed calls with certain attributes
- Analyzed 1176 simulated faults
- Compared Draco against Pinpoint (Kiciman 2005)

Draco performs better than Pinpoint, and is relatively unaffected by fault probability.



Draco is effective at diagnosing problems due to a combination of unexpected events.



DIAGNOSIS OF REAL WORLD INCIDENTS

- Draco correctly diagnosed 8 out of 10 incidents
- 2 incidents not diagnosed were due to brief outages
- Currently working on online version of algorithm

Ranking of correct root-cause by Draco

Examples of real-world incidents	Rank
Configuration problem incorrectly routes calls from a certain make of phones.	3
Bug in third-party software causes call rejection.	1
Server overload leads to blocked calls.	1
Race condition leads to blocked calls.	10
Application server run out of memory.	1
Customers use wrong codec to send faxes.	1-4
Debug logs overload servers during peak traffic.	15
Blocked circuit ID codes on trunk group.	1-8
Server crash causes brief outage.	-
Intermittent problem due to software bug.	-

