The understandability challenge in building diagnostic systems for ~~non-experts~~ everyone but the omniscient admin

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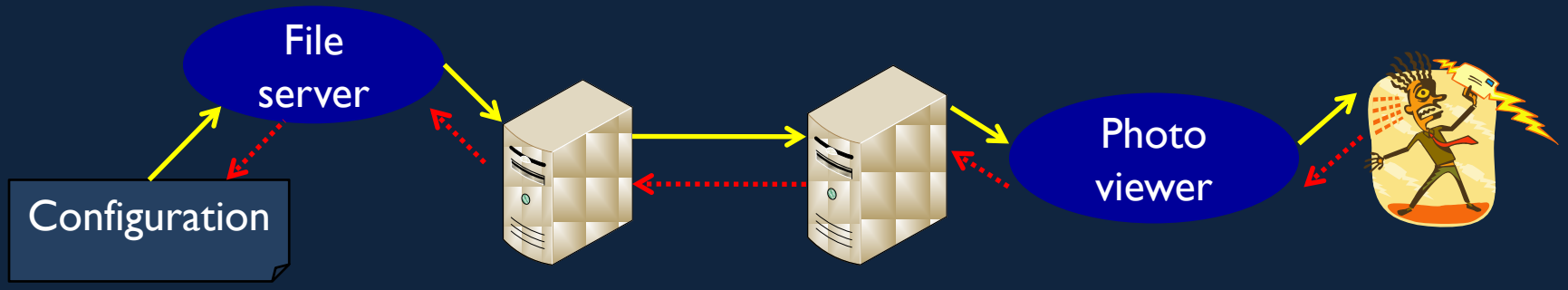
Diagnosis explains faulty behavior

Starts with problem symptoms

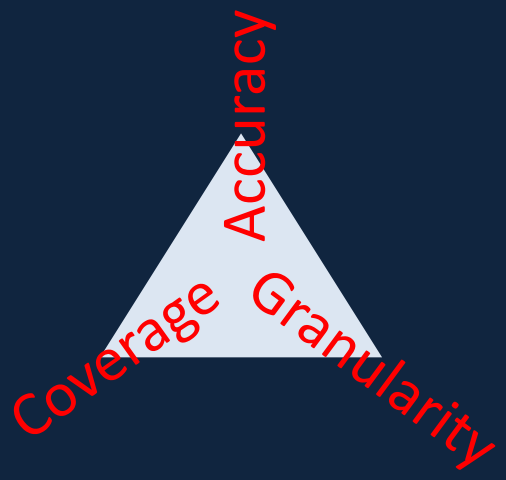
Ends at likely cause(s)

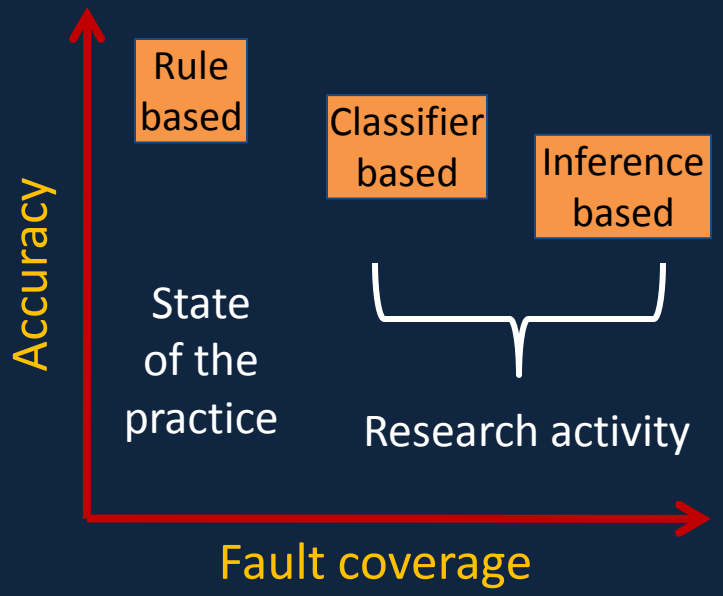


Configuration change denies permission

User cannot access a remote folder

Common considerations for a diagnostic system





Accuracy: How often the real culprit is identified

Coverage: Fraction of failures covered

Granularity: The detail at which culprit are identified

NetMedic: A detailed diagnostic system

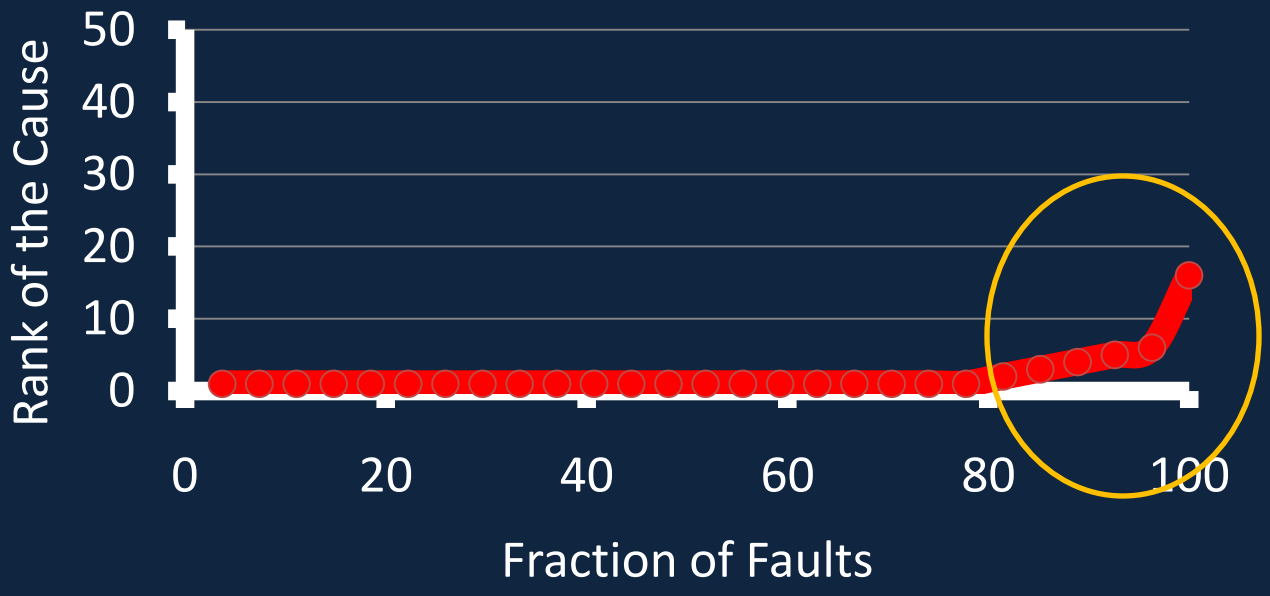
Focus on small enterprises as a starting point

Inference based:

- Views the network as a dependency graph of fine-grained components (e.g., applications, services)
- Produces a ranked list of likely culprit components using statistical and learning techniques

[Detailed diagnosis in enterprise networks, SIGCOMM 2009]

Effectiveness of NetMedic



Identifies the real culprit as the most likely 80% of the time but not always

Unleashing NetMedic-like systems on users

Understandability became a key hurdle

- How to present the analysis to the user?
- Impacts mean time to recovery

Two sub-problems at the intersection of systems and HCI

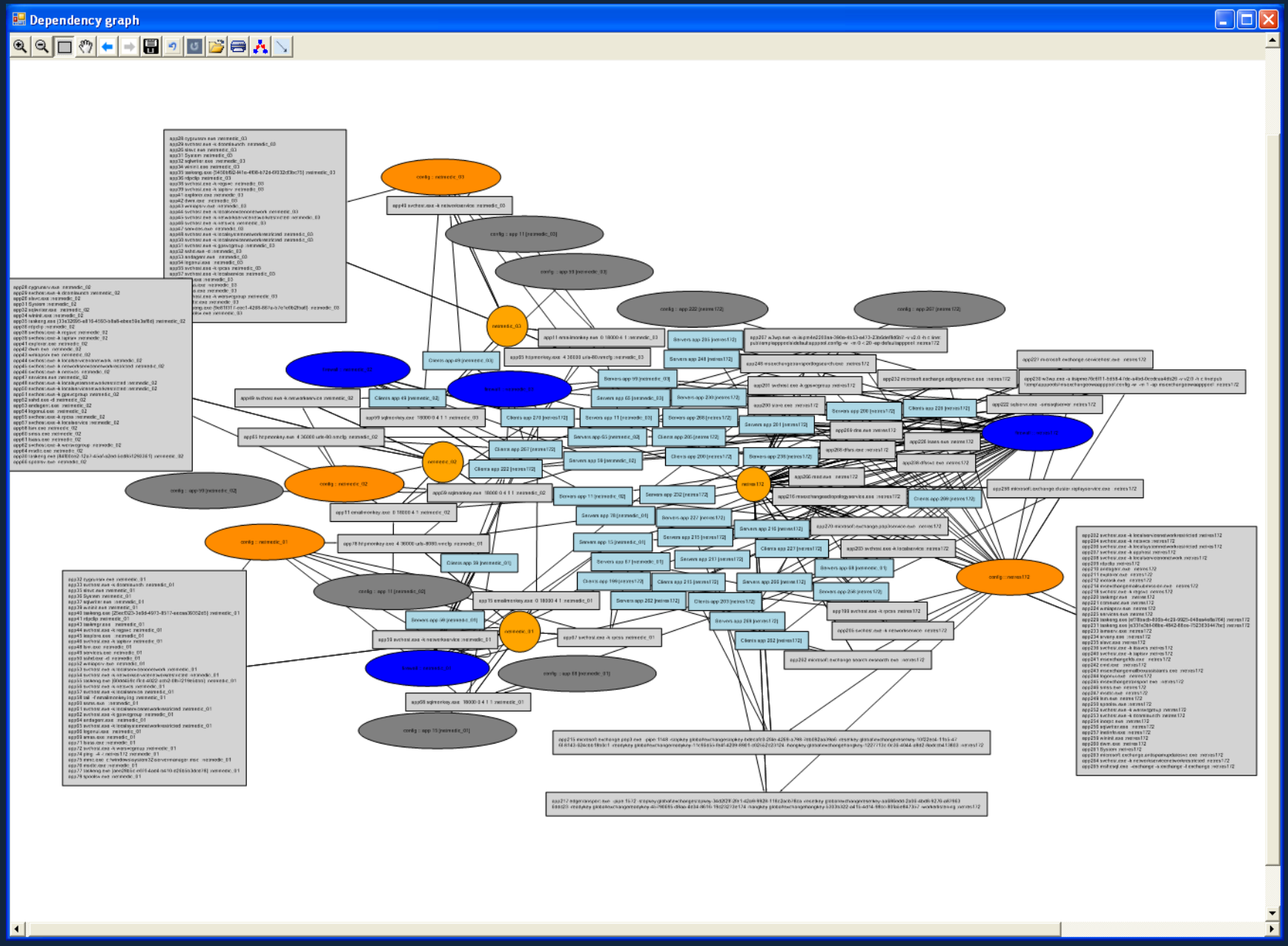
- Uncertainty visualization
- Intuitiveness of analysis

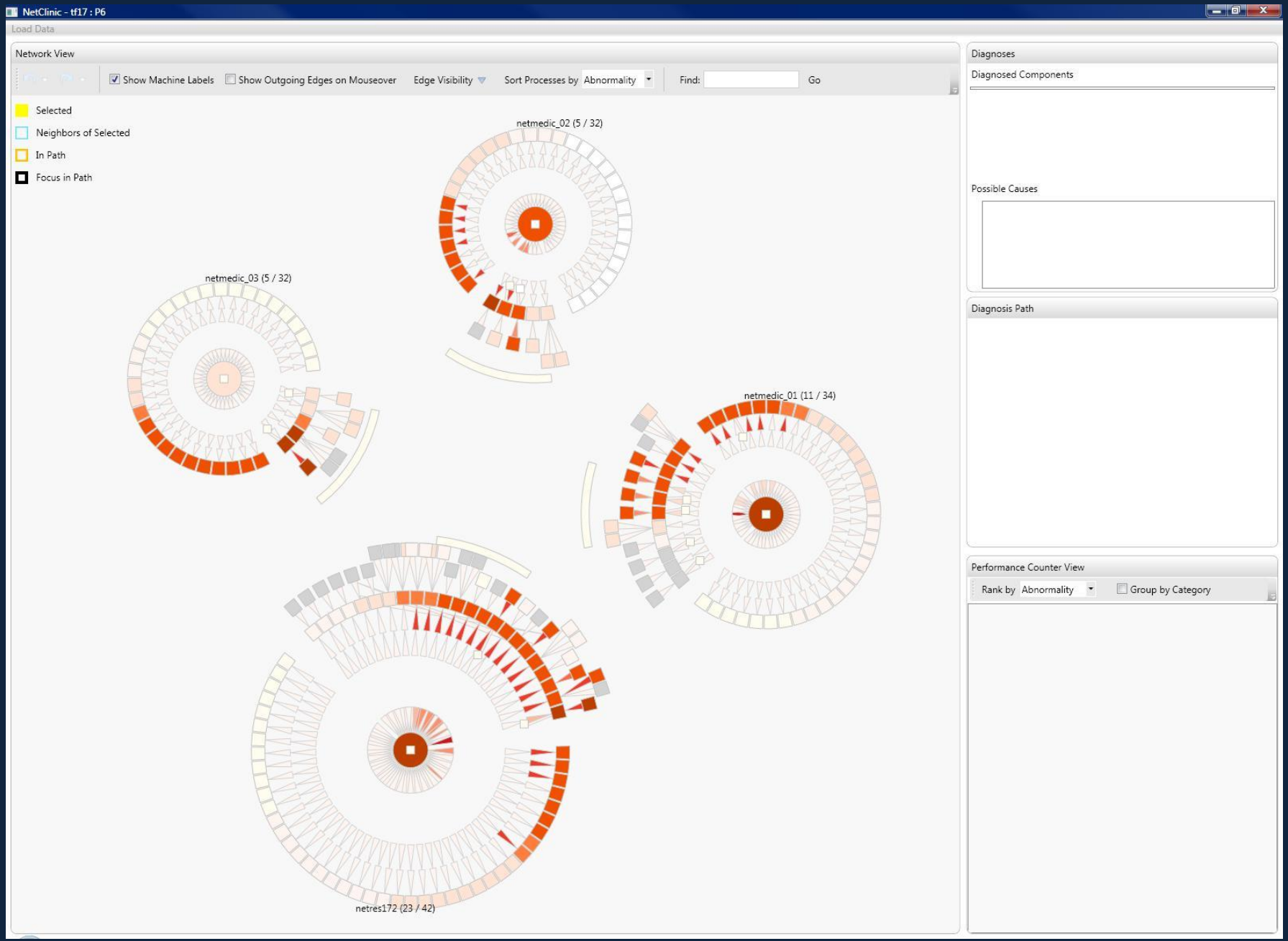
Uncertainty visualization

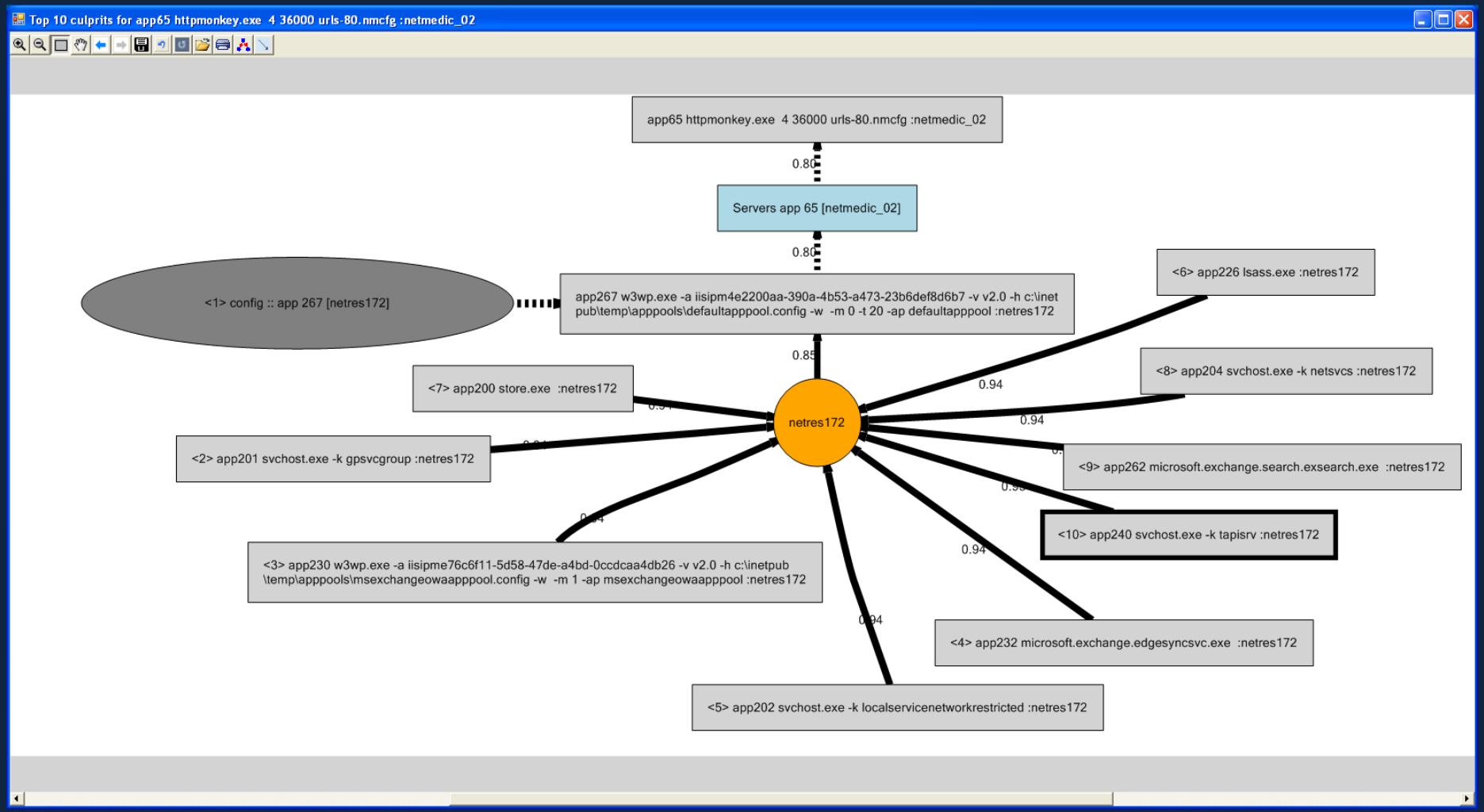
Presenting the results of statistical analysis

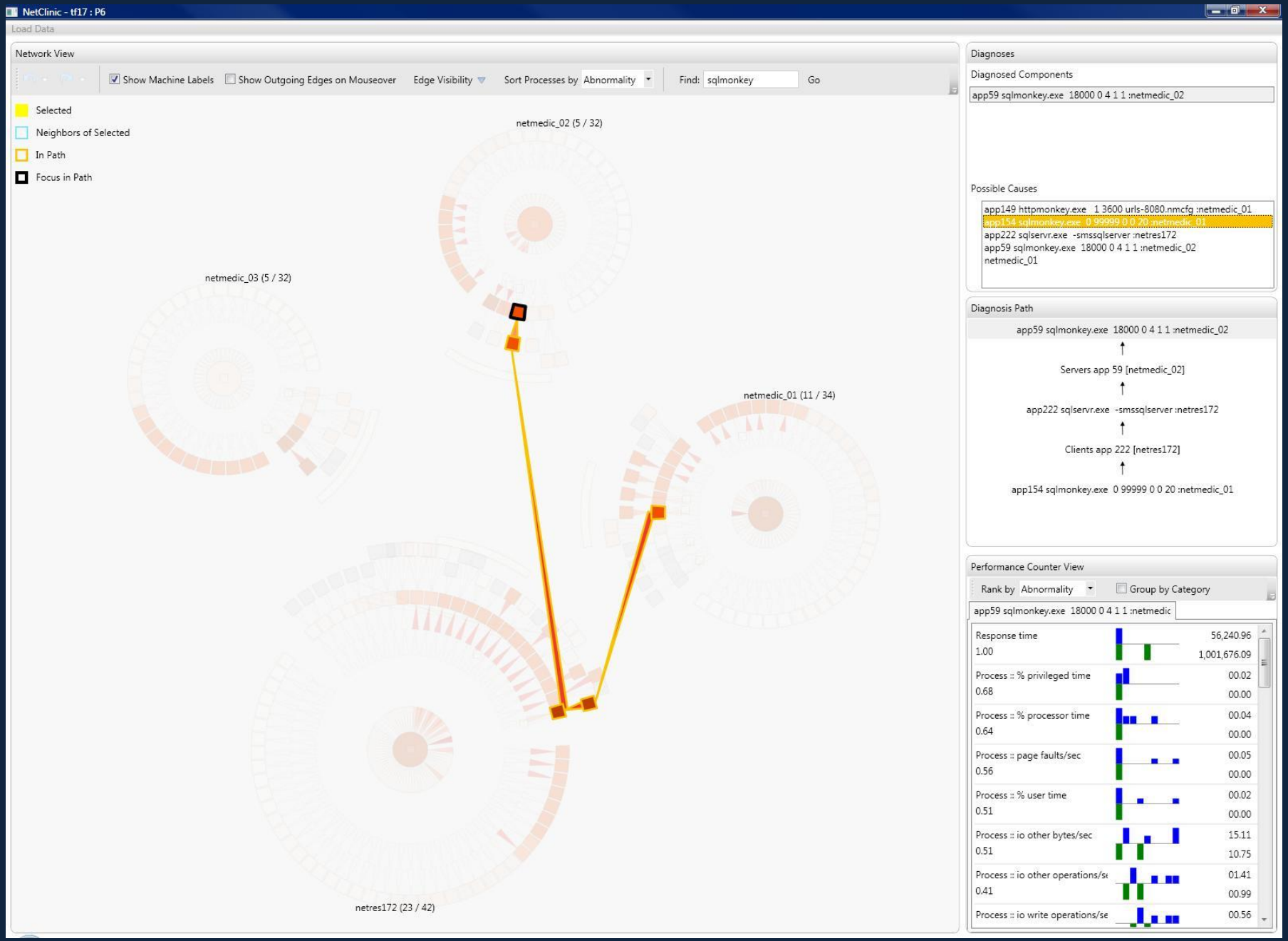
- Not much existing work; this uncertainty differs from that of typical scientific data
- Underlying assumption: humans can double check analysis if information is presented appropriately

An “HCI issue” that needs to be informed significantly by the underlying system structure


Dependency graph


NetClinic - tf17 : P6
Load Data
Network View
Show Machine Labels
Show Outgoing Edges on Mouseover
Edge Visibility
Sort Processes by Abnormality
Find:
Go
Selected
Neighbors of Selected
In Path
Focus in Path
netmedic_02 (5 / 32)
netmedic_03 (5 / 32)
netmedic_01 (11 / 34)
netres172 (23 / 42)
Diagnoses
Diagnosed Components
Possible Causes
Diagnosis Path
Performance Counter View
Rank by Abnormality
Group by Category

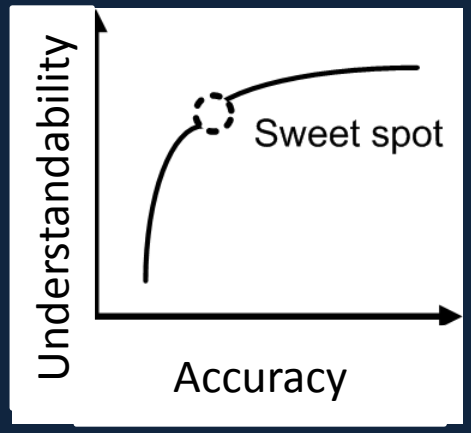

Top 10 culprits for app65 httpmonkey.exe 4 36000 urls-80.nmcfg :netmedic_02
app65 httpmonkey.exe 4 36000 urls-80.nmcfg :netmedic_02
0.80
Servers app 65 [netmedic_02]
0.80
<1> config :: app 267 [netres172]
app267 w3wp.exe -a iisipm4e2200aa-390a-4b53-a473-23b6def8d6b7 -v v2.0 -h c:\inetpub\temp\apppools\defaultapppool.config -w -m 0 -t 20 -ap defaultapppool :netres172
0.85
<6> app226 lsass.exe :netres172
<8> app204 svchost.exe -k netsvcs :netres172
<7> app200 store.exe :netres172
0.94
0.94
netres172
<2> app201 svchost.exe -k gpsvcgroup :netres172
<9> app262 microsoft.exchange.search.exsearch.exe :netres172
<10> app240 svchost.exe -k tapisrv :netres172
0.94
<3> app230 w3wp.exe -a iisipme76c6f11-5d58-47de-a4bd-0ccdcaa4db26 -v v2.0 -h c:\inetpub\temp\apppools\msexchangeowaapppool.config -w -m 1 -ap msexchangeowaapppool :netres172
<4> app232 microsoft.exchange.edgesyncsvc.exe :netres172
<5> app202 svchost.exe -k localservicenetworkrestricted :netres172


NetClinic - tf17 : P6
Load Data
Network View
Show Machine Labels
Show Outgoing Edges on Mouseover
Edge Visibility
Sort Processes by Abnormality
Find: sqlmonkey
Go
Selected
Neighbors of Selected
In Path
Focus in Path
netmedic_02 (5 / 32)
netmedic_03 (5 / 32)
netmedic_01 (11 / 34)
netres172 (23 / 42)
Diagnoses
Diagnosed Components
app59 sqlmonkey.exe 18000 0 4 1 1 :netmedic_02
Possible Causes
app149 httpmonkey.exe 1 3600 urls-8080.nmcfg :netmedic_01
app154 sqlmonkey.exe 0 99999 0 0 20 :netmedic_01
app222 sqlservr.exe -smssqlserver :netres172
app59 sqlmonkey.exe 18000 0 4 1 1 :netmedic_02
netmedic_01
Diagnosis Path
app59 sqlmonkey.exe 18000 0 4 1 1 :netmedic_02
Servers app 59 [netmedic_02]
app222 sqlservr.exe -smssqlserver :netres172
Clients app 222 [netres172]
app154 sqlmonkey.exe 0 99999 0 0 20 :netmedic_01
Performance Counter View
Rank by Abnormality
Group by Category
app59 sqlmonkey.exe 18000 0 4 1 1 :netmedic
Response time
1.00
56,240.96
1,001,676.09
Process :: % privileged time
0.68
00.02
00.00
Process :: % processor time
0.64
00.04
00.00
Process :: page faults/sec
0.56
00.05
00.00
Process :: % user time
0.51
00.02
00.00
Process :: io other bytes/sec
0.51
15.11
10.75
Process :: io other operations/s
0.41
01.41
00.99
Process :: io write operations/se
00.56

Intuitiveness of analysis

The ability to reason about the system's analysis

- A non-traditional dimension of system effectiveness
- Counters the tendency of optimizing the system for incremental accuracy



A "systems issue" that needs to be informed significantly by HCI

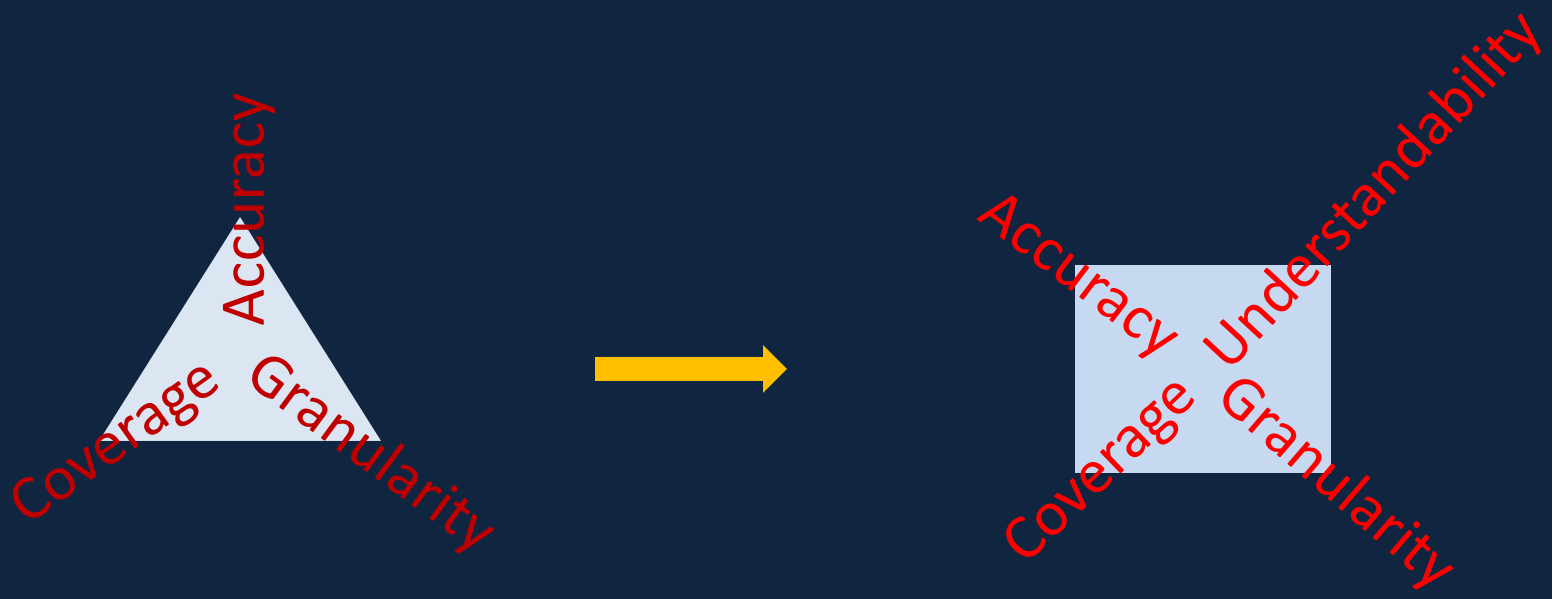
Intuitiveness of analysis (2)

Goal: Go from mechanical measures to more human centric measures

- Example: MoS measure for VoIP

Factors that should be considered

- What information is used?
  - E.g., Local vs. global
- What operations are used?
  - E.g., arithmetic vs. geometric means



Considerations for diagnostic systems