

Tiered Tragedy

Jeffery Smith

INSPIRED BY TRUE EVENTS.

**THE NAMES AND LOCATIONS HAVE
BEEN CHANGED TO PROTECT THE
INNOCENT**

WHAT ARE WE TALKING ABOUT?

Introduction

The Anatomy of a System

Walkthrough a Real Incident

What did we learn

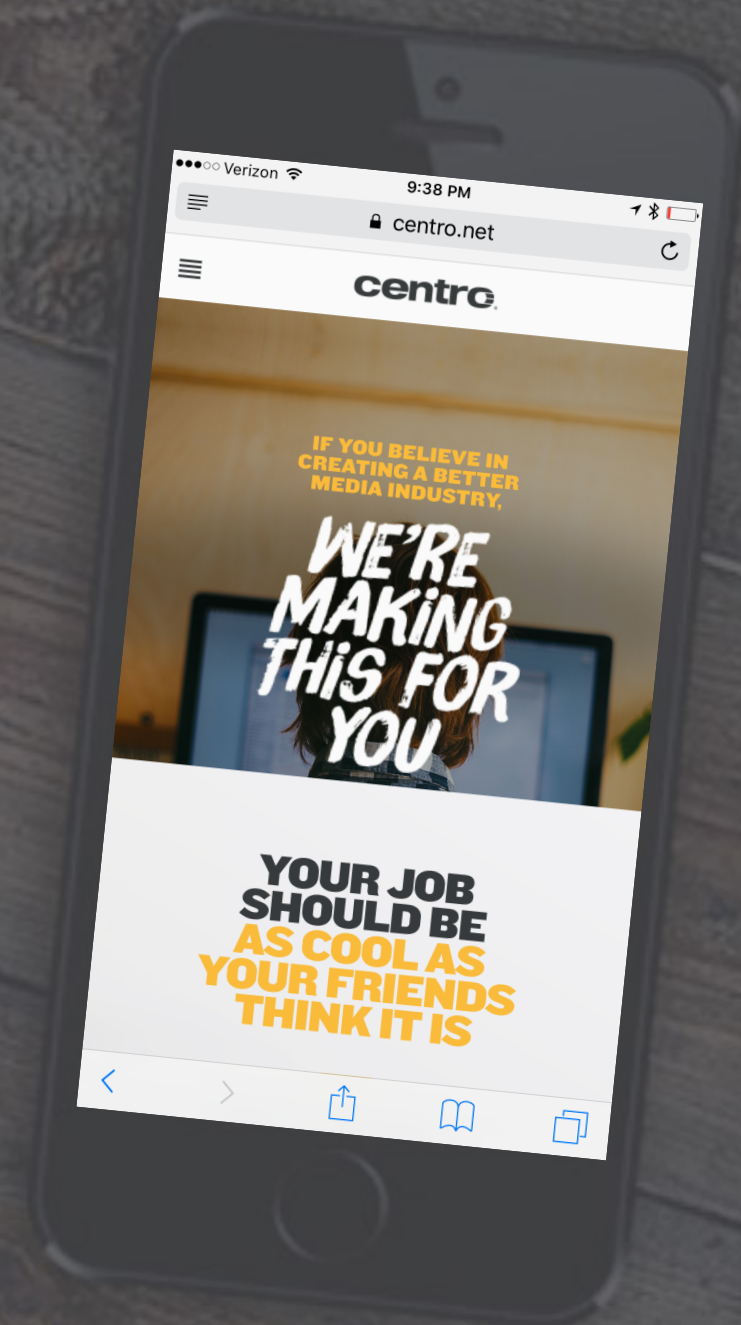


Jeff Smith

Centro

Manager, Production Operations

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- jeff.smith@centro.net
- www.allthingsdork.com



THE ANATOMY OF A SYSTEM

```
63 </body>
64 <script type="text/javascript">
65 <!--
66 var currentImage = "bigImage1";
67 var pages = Math.ceil(photos.length / 9);
68 updatePages();
69 updateAllImages();
```

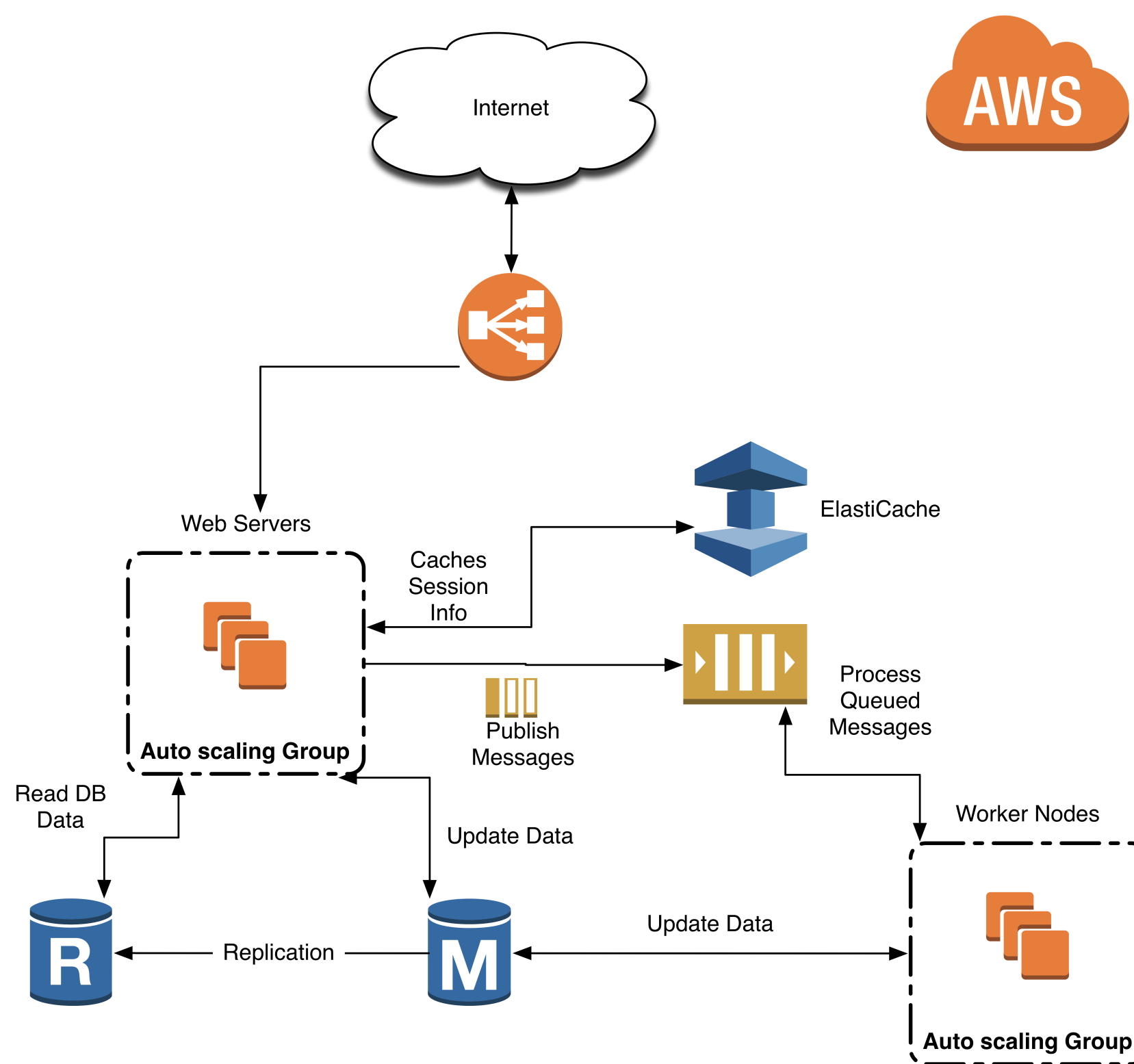
```
170 // document.getElementById("bigImage1").src = currentImage;
171 // document.getElementById("bigImage1").alt = "bigImage1";
172 changePhotoDescription();
173
174 function updatePages() {
175     var j = 0;
176
177     var html = "<table style='width: 330px;' cellspacing='0' cellpadding='0'>";
178     if ( page != 0 ) {
179         | html = html + "<a href='#' onclick='page=0; updatePages(); updateAllImages();'>";
180     }
181     html += "</td><td style='text-align: center;'>";
```


WHAT IS A SYSTEM?

“ A set of connected things or parts forming a complex whole.

A *subsystem* is a set of elements, which is a system itself, and a component of a larger system.

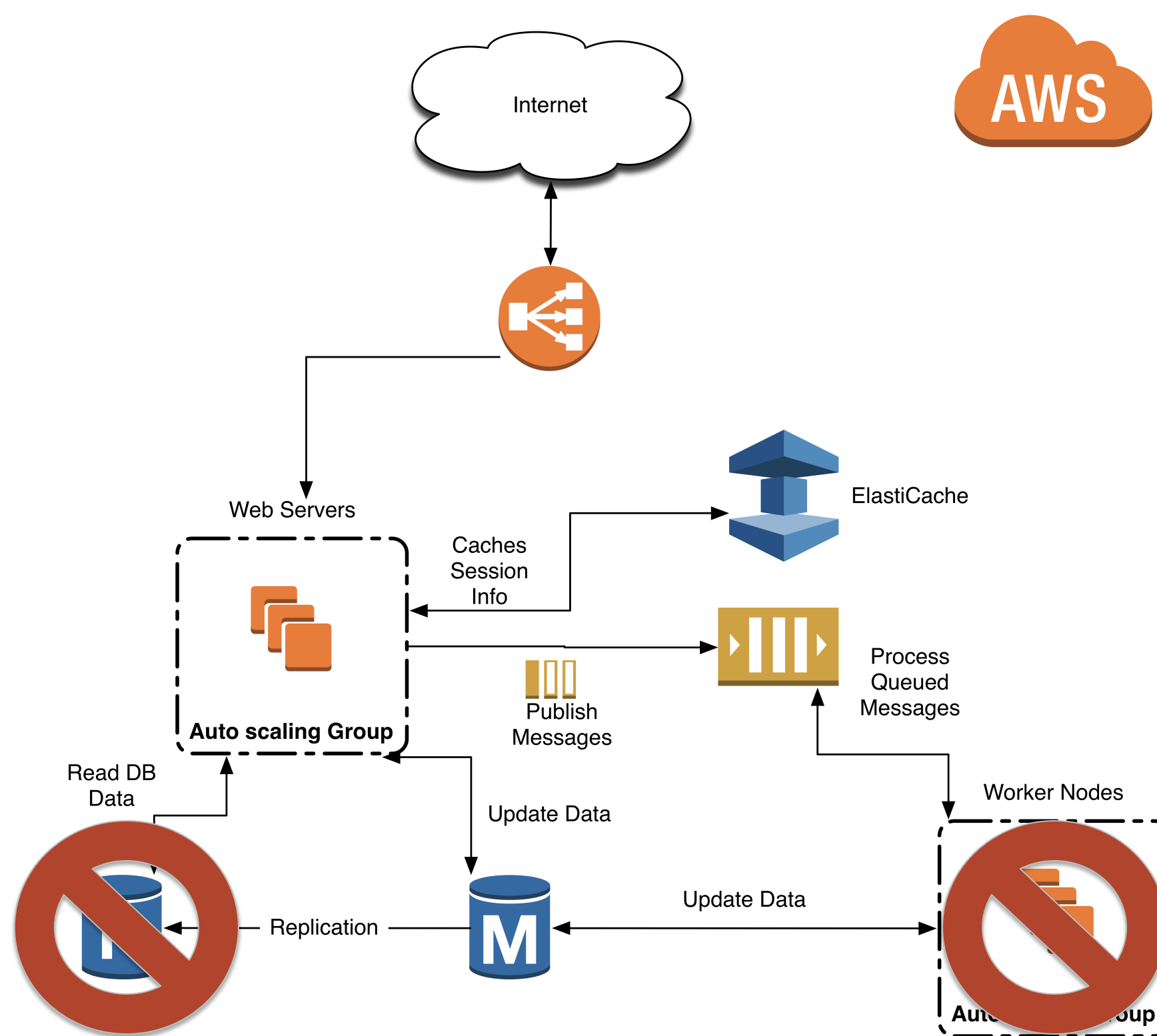
”



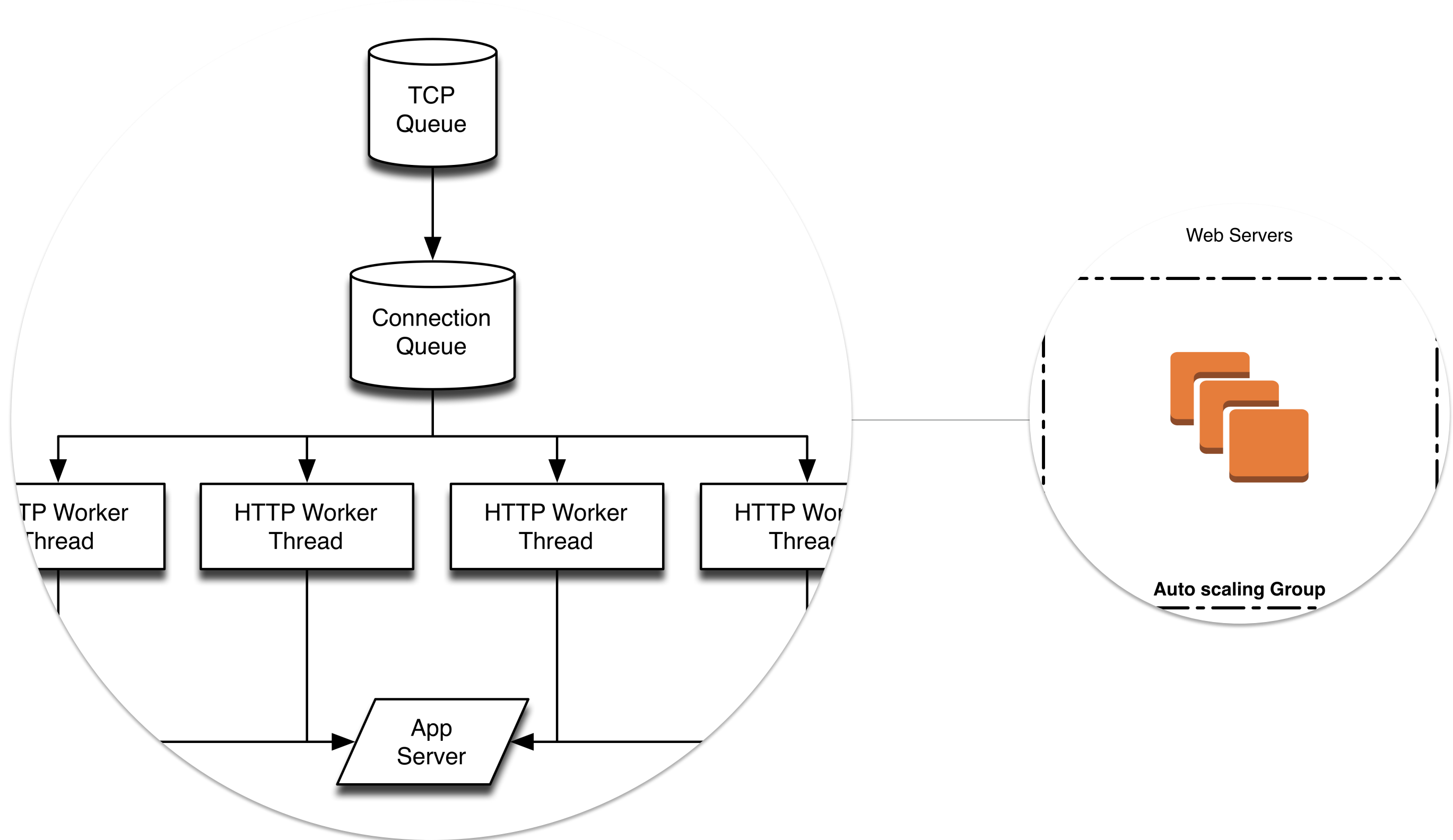
High Level System Diagram

FAILURE MODE

“ The particular way in which a system degrades or ultimately fails to perform as intended or designed. ”



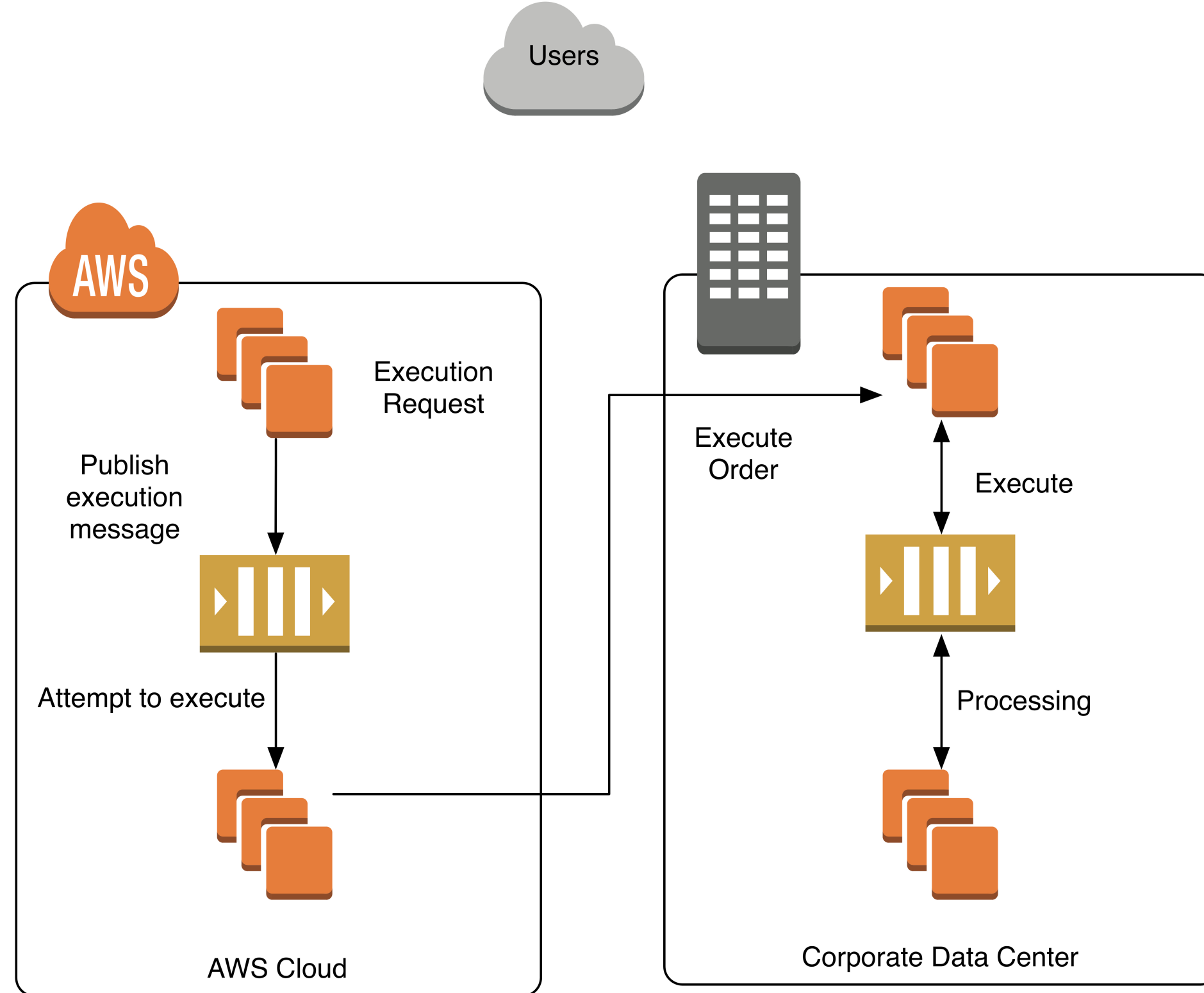
High Level System Diagram



High Level System Diagram

A FAILURE WALK THROUGH

```
63 </body>
64 <script type="text/javascript">
65 <!--
66 var currentImage = "bigImage1";
67 var pages = Math.ceil(photos.length / 9);
68 updatePages();
69 updateAllImages();
70 // document.getElementById("bigImage1").src = currentImage;
71 // document.getElementById("bigImage1").alt = currentImage;
72 changePhotoDescription(1);
73
74 function updatePages() {
75     var j = 0;
76
77     var html = "<table style='width: 330px;' cellspacing='0' cellpadding='0'>";
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```

Troubled System

FIRST SIGN OF TROUBLE

**EXECUTION
REQUESTS ARE
OLDER THAN
THRESHOLD**

PROS AND CONS

You quickly understand the business impact

You don't know what part of the pipeline is problematic

Views

Dashboards

Configure

Help

Admin

ds

maryns

ewary

ucers

ates

Logged in

Tactical Summary

Server	Hosts							Services							
	Up	Down	Unreachable	Pending	Problems	Unhandled	All	Ok	Warning	Critical	Unknown	Pending	Problems	Unhandled	All
Demo Box	35	2	0	0	2	2	37	244	12	58	17	0	87	76	331
Ludmil XI	20	2	0	0	2	2	22	147	7	49	3	1	59	31	207
Scott XI	2	1	0	0	1	1	3	12	0	0	0	0	0	0	12
Dev59 XI	63	14	1	6	15	13	84	208	13	63	26	0	102	73	310
Dev59 Core	63	14	1	6	15	13	84	208	13	63	26	0	102	73	310
Total	183	33	2	12	35	31	230	819	45	233	72	1	350	253	1170

Last Update Time: Thu, 24 May 2012 10:11:13 -0500

Dev59 XI

Status Summary

				Notes [Edit]
Hosts	63 Up 9 Disabled	14 Down 12 Unhandled 2 Acknowledged	1 Unreachable 1 Unhandled 1 Acknowledged 1 Disabled	6 Pending 6 Disabled
				Mikes XI DevBox
Services	208 Ok 16 Disabled	13 Warning 12 Unhandled 1 Disabled	26 Unknown 23 Unhandled 3 On Problem Hosts	63 Critical 38 Unhandled 1 Acknowledged 24 On Problem Hosts
				0 Pending

Settings Monitoring Engine: Enabled Notifications: Enabled Active Checks: Enabled Passive Checks: Enabled Event Handlers: Enabled

Recent Alerts

Server	Host	Service	Type	State	Time	Contact	Output
Dev59 XI	BENCHMARK	Check Total Procs	Service Problem	WARNING	2012-05-24 10:10:18	nagiosadmin	PROCS WARNING: 159 processes
Dev59 Core	BENCHMARK	Check Total Procs	WARNING	WARNING	2012-05-24 10:10:18	nagiosadmin	PROCS WARNING: 159 processes
Dev59 XI	BPI2	BPI Process:Content	Service Problem	UNKNOWN	2012-05-24 10:09:29	nagiosadmin	Unknown BPI Group Index
Dev59 Core	BPI2	BPI Process:Content	UNKNOWN	UNKNOWN	2012-05-24 10:09:29	nagiosadmin	Unknown BPI Group Index
Dev59 Core	localhost	MySQL Open Connections	CRITICAL	CRITICAL	2012-05-24 10:08:50	test2	CRITICAL - 26 client connection threads
Dev59 Core	localhost	MySQL Open Connections	CRITICAL	CRITICAL	2012-05-24 10:08:50	dummy	CRITICAL - 26 client connection threads
Dev59 Core	localhost	MySQL Open Connections	CRITICAL	CRITICAL	2012-05-24 10:08:50	test1	CRITICAL - 26 client connection threads
Dev59 Core	localhost	MySQL Open Connections	CRITICAL	CRITICAL	2012-05-24 10:08:50	nagiosadmin	CRITICAL - 26 client connection threads
Dev59 XI	localhost	MySQL Open Connections	Service Problem	CRITICAL	2012-05-24 10:08:49	dummy	CRITICAL - 26 client connection threads
Dev59 XI	localhost	MySQL Open Connections	Service Problem	CRITICAL	2012-05-24 10:08:49	test2	CRITICAL - 26 client connection threads
Dev59 XI	localhost	MySQL Open Connections	Service Problem	CRITICAL	2012-05-24 10:08:49	tscadmin	CRITICAL - 26 client connection threads
Dev59 XI	localhost	MySQL Open Connections	Service Problem	CRITICAL	2012-05-24 10:08:49	test3	CRITICAL - 26 client connection threads
Dev59 XI	localhost	MySQL Open Connections	Service Problem	CRITICAL	2012-05-24 10:08:49	test	CRITICAL - 26 client connection threads
Dev59 XI	localhost	MySQL Open Connections	Service Problem	CRITICAL	2012-05-24 10:08:49	nagiosadmin	CRITICAL - 26 client connection threads
Dev59 XI	localhost	MySQL Open Connections	Service Problem	CRITICAL	2012-05-24 10:08:49	testingCSS	CRITICAL - 26 client connection threads

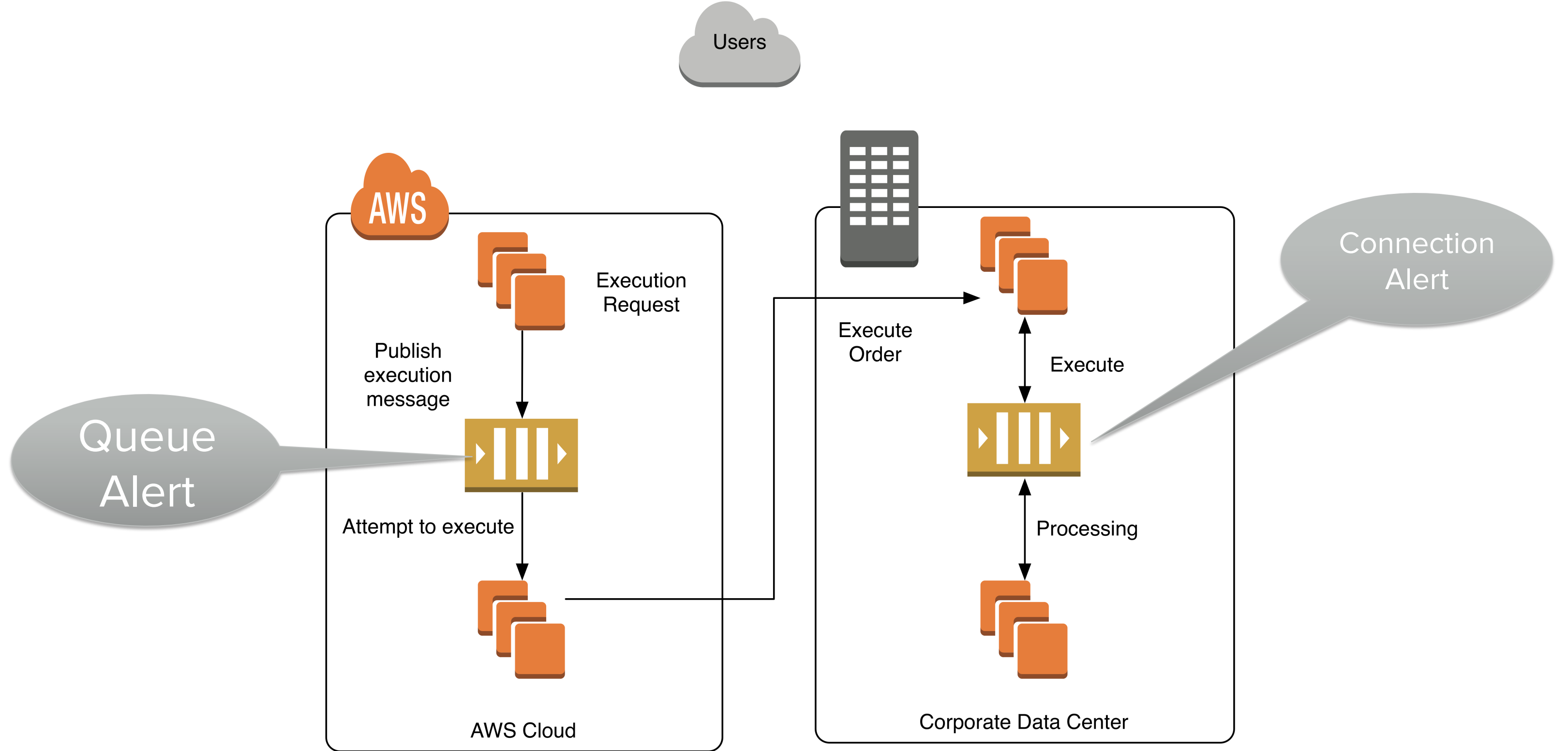
Last Update: Thu, 24 May 2012 10:11:13 -0500

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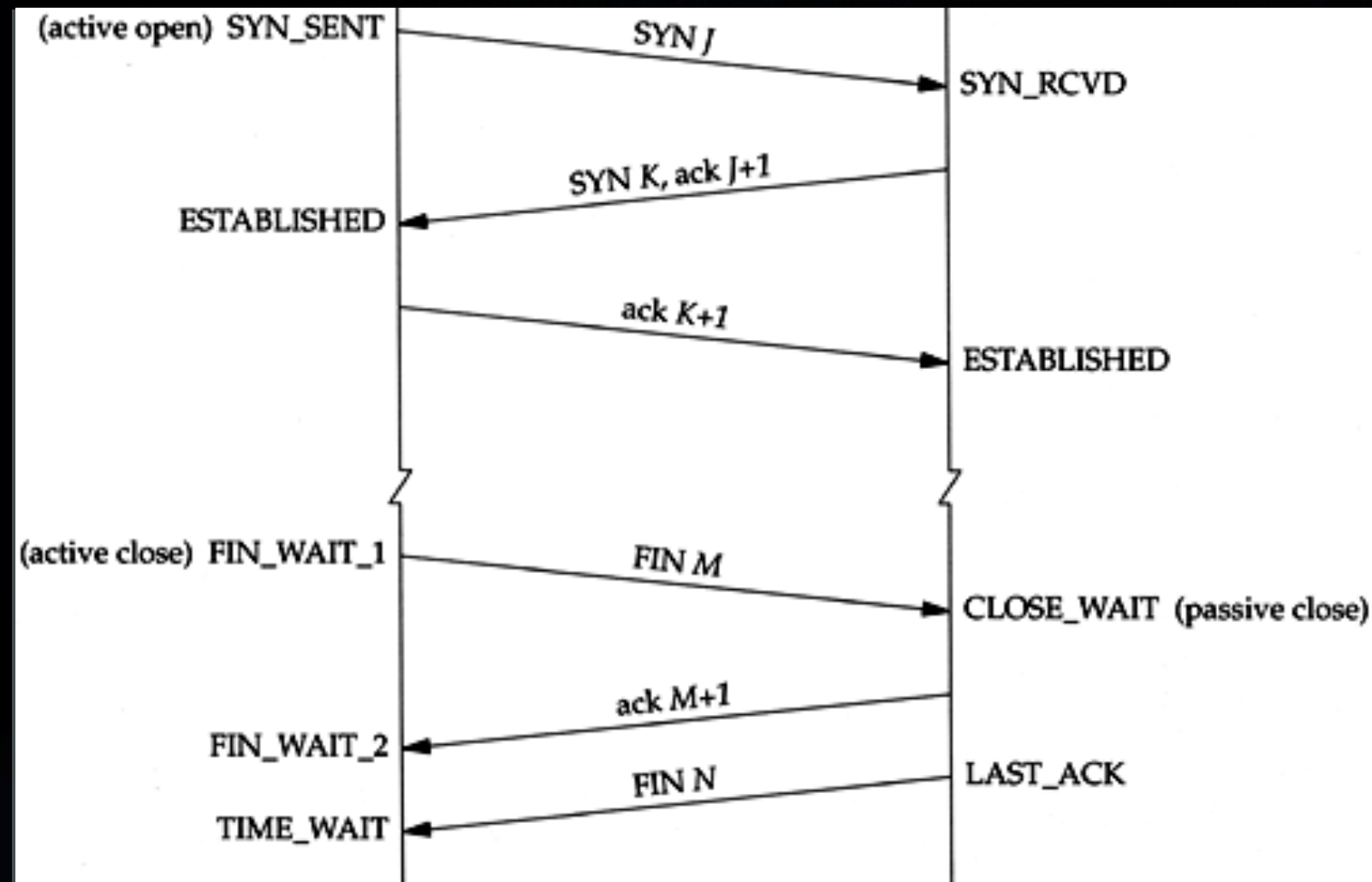
Troubled System

FAILED CONNECTIONS

Lots of CLOSE_WAIT statuses

WHAT IS CLOSE WAIT?

- The client end has finalized the connection
- Waiting for the server to call close() on the socket.



SERVER

CONNECTION STATES

- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT
- CLOSE_WAIT



MEMORY USAGE

- 80%
- 80%
- 82%
- 82%
- 83%
- 85%
- 85%
- 87%
- 87%
- 88%
- 88%
- 89%



WHAT CHANGED?

80%

**OF
OUTAGES**

Caused by changes

CHANGE CONTROL LOG



LOGGING AGGREGATION



FIREWALL RULES CHANGE



LOGO REDESIGN



CHANGE TO MESSAGE QUEUE PROCESS

CHANGE TO MESSAGE QUEUE PROCESS



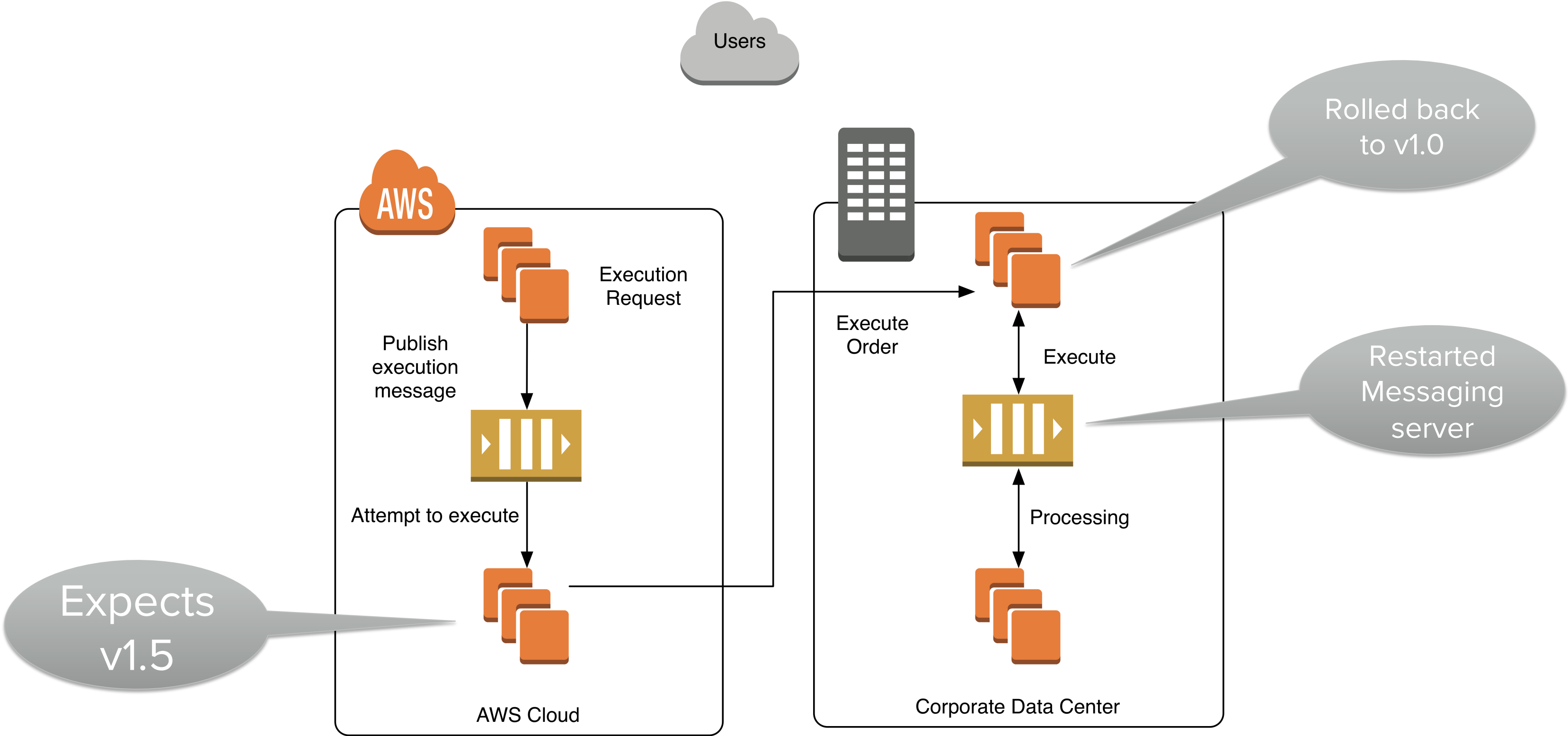
**INCREASE NUMBER OF WORKER THREADS
(10 → 20)**



**REGRESSION WHICH CAUSED NEW TCP
CONNECTIONS FOR EACH MESSAGE
PROCESSED**

OPERATIONS RULE #172

**ROLLING BACK WHAT
CHANGED IS ALWAYS
A GOOD IDEA**



It's Complicated

The background of the entire image is a close-up, high-resolution shot of dark, weathered wooden planks. The planks are arranged horizontally, with visible grain, knots, and some surface wear. The lighting is somewhat uneven, creating subtle shadows and highlights across the wood's texture.

IT'S FIXED!

Or is it?

WHAT DID WE MISS?

In hindsight, things that were important

1

Message server ran
out of memory

Alerts fired, but
missed during outage

2

Bad connections
continued after rollback

Ignored due to
pending restart

3

Message thread
errors

Missed in the mound
of logs

MESSAGE THREAD ERRORS

```
▼ activemq-broker/ 1159
  ▼ src/           1160
    ▼ main/        1161
      ▼ java/org/apache/activemq/ 1162
        ▼ advisory/ 1163
          ▼ broker/ 1164
            ▼ cluster/ 1165
              ▼ inteceptor/ 1166
                ▼ jmx/ 1167
                  ▼ region/ 1168
                    ▼ scheduler/ 1169
                      ▼ util/ 1170
                        ▼ view/ 1171
                          AbstractLocker.java 1172
                          Broker.java 1173
                          BrokerBroadcaster.java 1174
                          BrokerContext.java 1175
                          BrokerContextAware.java 1176
                          BrokerFactory.java 1177
                          BrokerFactoryHandle.java 1178
                          BrokerFilter.java 1179
                          BrokerPlugin.java 1180
                          BrokerPluginSupport.java 1181
                          BrokerRegistry.java 1182
                          BrokerService.java 1183
                          BrokerServiceAware.java 1184
                          BrokerStoppedException.java 1185
                          CompositeDestination.java 1186
                          Connection.java 1187
                          ConnectionContext.java 1188
                          Connector.java 1189
                          ConsumerBrokerExchange.java 1190
                          DefaultBrokerFactory.java 1191
                          EmptyBroker.java 1192
                          ErrorBroker.java 1193
                          InsertableMutableBroker.java 1194
                          Lockable.java 1195
                          LockableServiceSupport.java 1196
                          Locker.java 1197
                          MapTransportConnector.java 1198
                          MutableBrokerFilter.java 1199
                          package.html* 1200
                          ProducerBrokerExchange.java 1201
                          PropertiesBrokerFactory.java 1202
                          PublishedAddressPolicy.java 1203
                          SingleTransportConnector.java 1204
                          SslBrokerService.java 1205
                          SuppressReplyException.java 1206
                          TransactionBroker.java 1207
                          TransportConnection.java 1208
                          TransportConnectionContext.java 1209

doStop();
} catch (Throwable e) {
    LOG.debug("Error occurred while shutting down a connection {}", this, e);
} finally {
    stopped.countDown();
    serviceLock.writeLock().unlock();
}
}
}
} catch (Throwable t) {
    LOG.warn("Cannot create async transport stopper thread. This exception is ignored. Not waiting for stop to complete", t);
    stopped.countDown();
}
}
}

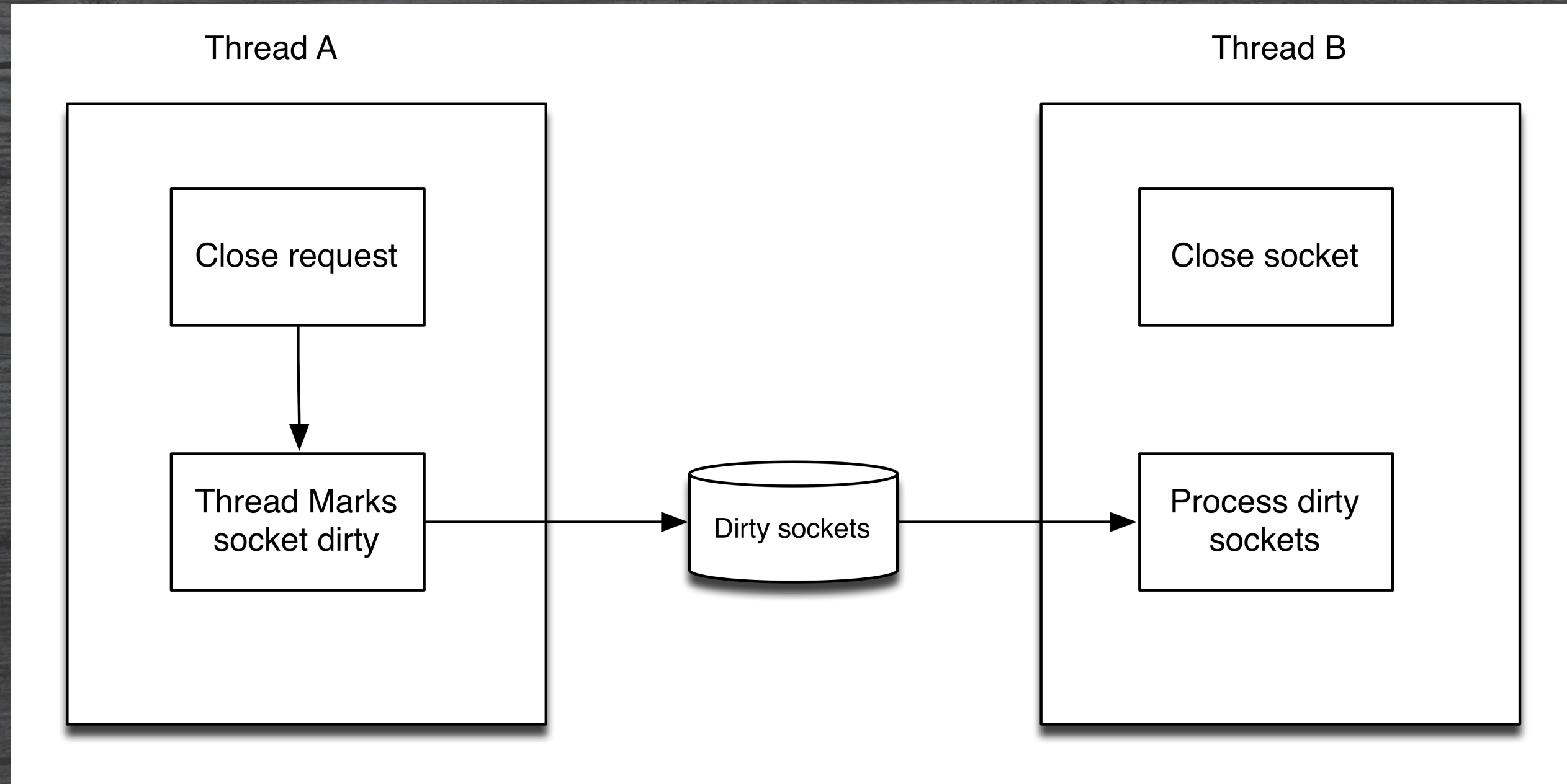
@Override
public String toString() {
    return "Transport Connection to: " + transport.getRemoteAddress();
}

protected void doStop() throws Exception {
    LOG.debug("Stopping connection: {}", transport.getRemoteAddress());
    connector.onStopped(this);
    try {
        synchronized (this) {
            if (duplexBridge != null) {
                duplexBridge.stop();
            }
        }
    } catch (Exception ignore) {
        LOG.trace("Exception caught stopping. This exception is ignored.", ignore);
    }
    try {
        transport.stop();
        LOG.debug("Stopped transport: {}", transport.getRemoteAddress());
    } catch (Exception e) {
        LOG.debug("Could not stop transport to {}. This exception is ignored.", transport.getRemoteAddress(), e);
    }
    if (taskRunner != null) {
        taskRunner.shutdown(1);
        taskRunner = null;
    }
    active = false;
    // Run the MessageDispatch callbacks so that message references get
    // cleaned up.
    synchronized (dispatchQueue) {
        for (Iterator<Command> iter = dispatchQueue.iterator(); iter.hasNext(); ) {
            Command command = iter.next();
            if (command.isMessageDispatch()) {
                MessageDispatch md = (MessageDispatch) command;
            }
        }
    }
}
```

EXCEPTIONS GIVE CLUES

- Open source products give you the chance to search source code
- Helped us to identify what the thread was responsible for

ASYNC SOCKET CLOSES



CAPACITY PLANNING 101

**HOW MANY
CONNECTIONS CAN
WE SUPPORT?**

MAXIMUM CONNECTIONS

```
/**  
 * The maximum number of sockets allowed for this server  
 */  
protected int maximumConnections = Integer.MAX_VALUE;
```




**WHAT DID WE
LEARN?**

ROOT CAUSES?

Message Queue
Changes

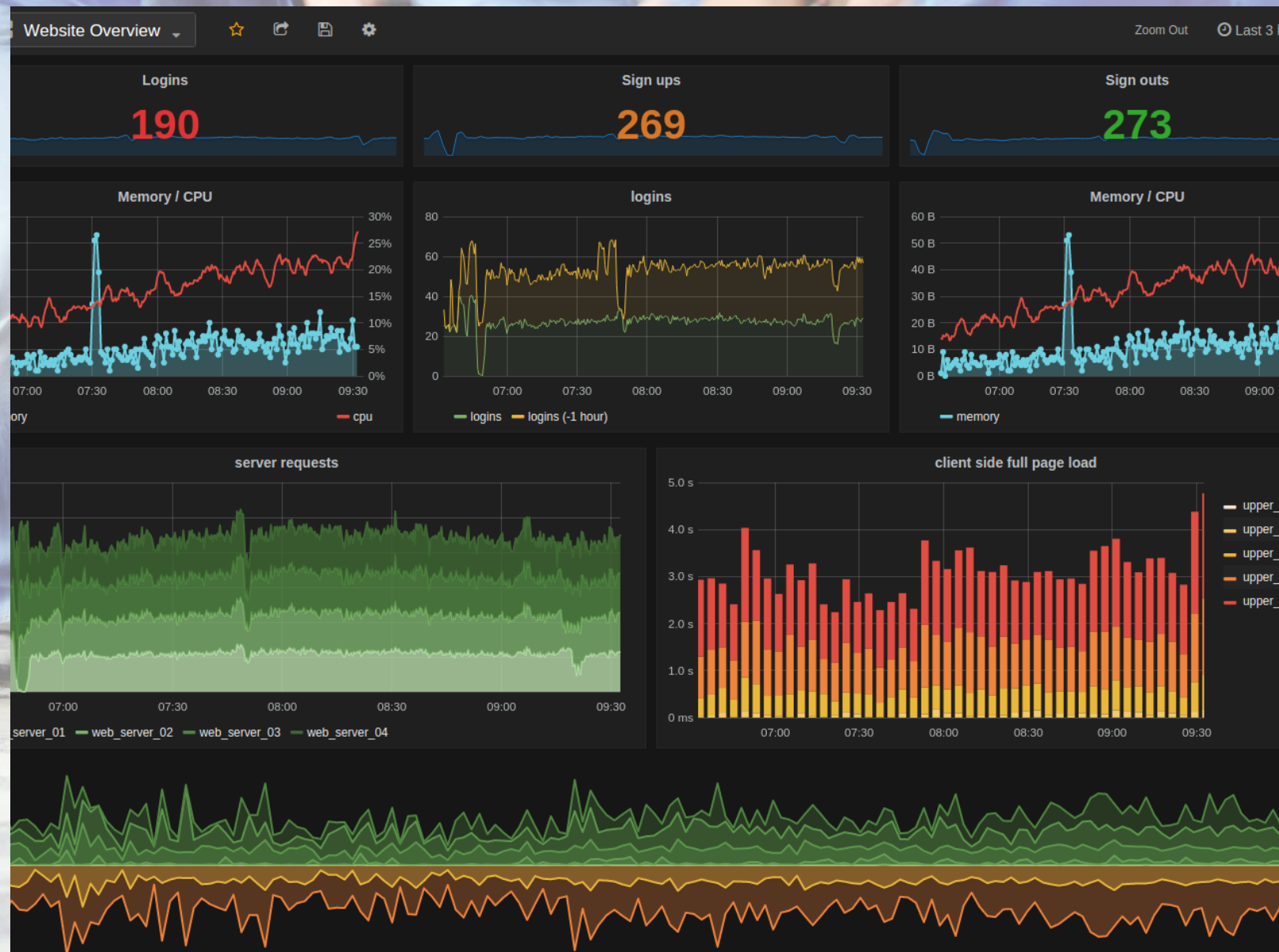
Low Memory on
the Message
Server

Lack of Max
Connections
Setting

Random 4th cause
to fit this template

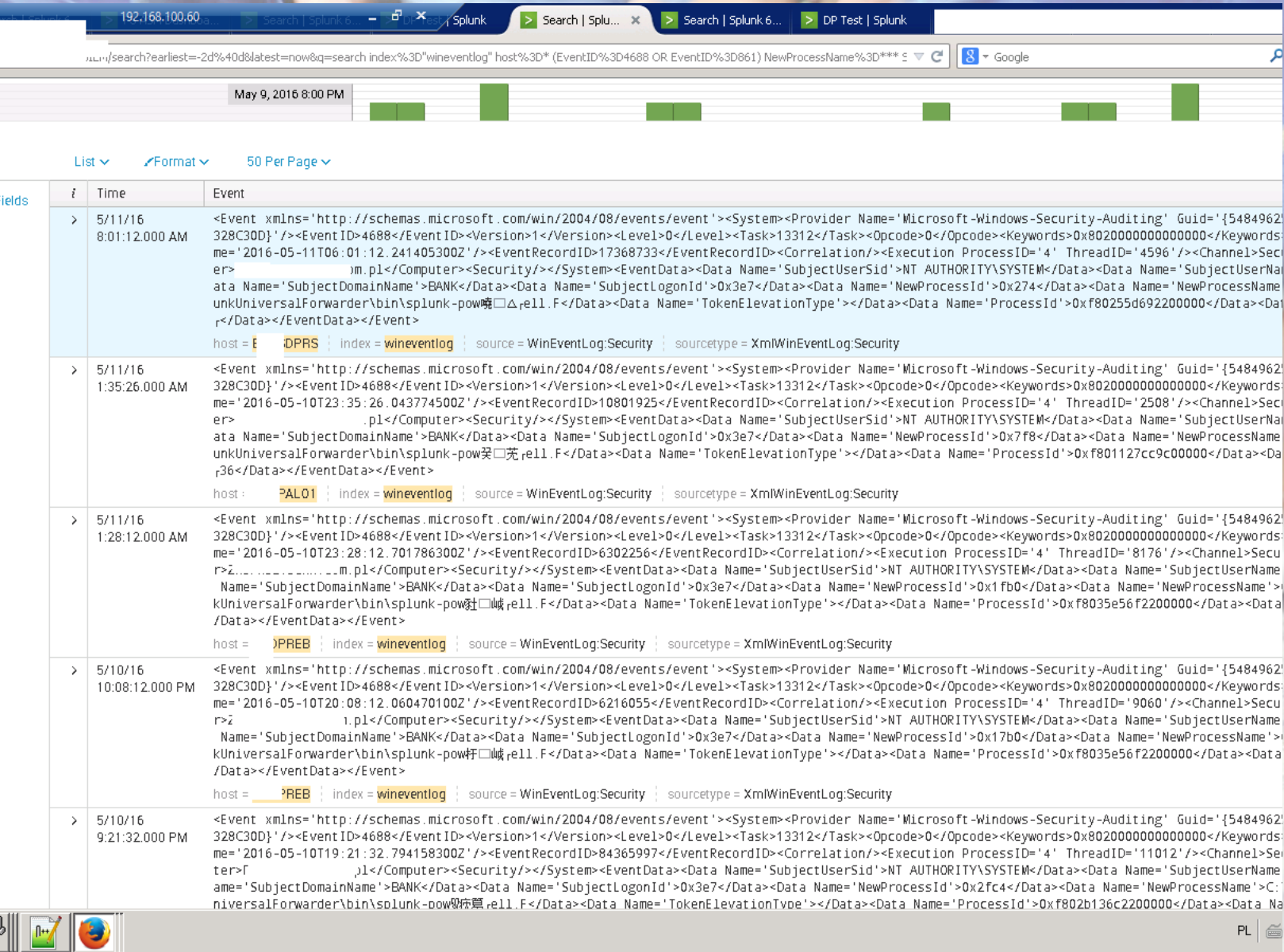
A collection of
individual failure
states that
created a unique
system state

METRICS NEED CONTEXT



- Sometimes data points need further clarifying data
- It's helpful if Dashboards operate at different system level views

LOGS, LOGS, LOGS, LOGS LOGS



Time	Event
5/11/16 8:01:12.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Security-Auditing' Guid='{5484962328C30D}' /><Event ID>4688</Event ID><Version>1</Version><Level>0</Level><Task>13312</Task><Opcode>0</Opcode><Keywords>0x8020000000000000</Keywords>me='2016-05-11T06:01:12.241405300Z' /><EventRecordID>17368733</EventRecordID><Correlation/><Execution ProcessID='4' ThreadID='4596' /><Channel>Security</Channel><Computer>m.pl</Computer><Security/></System><EventData><Data Name='SubjectUserSid'>NT AUTHORITY\SYSTEM</Data><Data Name='SubjectUserName'>BANK</Data><Data Name='SubjectDomainName'>BANK</Data><Data Name='SubjectLogonId'>0x3e7</Data><Data Name='NewProcessId'>0x274</Data><Data Name='NewProcessName'>unkUniversalForwarder\bin\splunk-pow...ell.F</Data><Data Name='TokenElevationType'></Data><Data Name='ProcessId'>0xf8025d692200000</Data><Data Name='ProcessName'>...ell.F</Data></EventData></Event> host = ...DPRS index = wineventlog source = WinEventLog:Security sourcetype = XmlWinEventLog:Security
5/11/16 1:35:26.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Security-Auditing' Guid='{5484962328C30D}' /><Event ID>4688</Event ID><Version>1</Version><Level>0</Level><Task>13312</Task><Opcode>0</Opcode><Keywords>0x8020000000000000</Keywords>me='2016-05-10T23:35:26.043774500Z' /><EventRecordID>10801925</EventRecordID><Correlation/><Execution ProcessID='4' ThreadID='2508' /><Channel>Security</Channel><Computer>m.pl</Computer><Security/></System><EventData><Data Name='SubjectUserSid'>NT AUTHORITY\SYSTEM</Data><Data Name='SubjectUserName'>BANK</Data><Data Name='SubjectDomainName'>BANK</Data><Data Name='SubjectLogonId'>0x3e7</Data><Data Name='NewProcessId'>0x7f8</Data><Data Name='NewProcessName'>unkUniversalForwarder\bin\splunk-pow...ell.F</Data><Data Name='TokenElevationType'></Data><Data Name='ProcessId'>0xf801127cc9c00000</Data><Data Name='ProcessName'>...ell.F</Data></EventData></Event> host = ...AL01 index = wineventlog source = WinEventLog:Security sourcetype = XmlWinEventLog:Security
5/11/16 1:28:12.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Security-Auditing' Guid='{5484962328C30D}' /><Event ID>4688</Event ID><Version>1</Version><Level>0</Level><Task>13312</Task><Opcode>0</Opcode><Keywords>0x8020000000000000</Keywords>me='2016-05-10T23:28:12.701786300Z' /><EventRecordID>6302256</EventRecordID><Correlation/><Execution ProcessID='4' ThreadID='8176' /><Channel>Security</Channel><Computer>m.pl</Computer><Security/></System><EventData><Data Name='SubjectUserSid'>NT AUTHORITY\SYSTEM</Data><Data Name='SubjectUserName'>BANK</Data><Data Name='SubjectDomainName'>BANK</Data><Data Name='SubjectLogonId'>0x3e7</Data><Data Name='NewProcessId'>0x1fb0</Data><Data Name='NewProcessName'>unkUniversalForwarder\bin\splunk-pow...ell.F</Data><Data Name='TokenElevationType'></Data><Data Name='ProcessId'>0xf8035e56f2200000</Data><Data Name='ProcessName'>...ell.F</Data></EventData></Event> host = ...PREB index = wineventlog source = WinEventLog:Security sourcetype = XmlWinEventLog:Security
5/10/16 10:08:12.000 PM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Security-Auditing' Guid='{5484962328C30D}' /><Event ID>4688</Event ID><Version>1</Version><Level>0</Level><Task>13312</Task><Opcode>0</Opcode><Keywords>0x8020000000000000</Keywords>me='2016-05-10T20:08:12.060470100Z' /><EventRecordID>6216055</EventRecordID><Correlation/><Execution ProcessID='4' ThreadID='9060' /><Channel>Security</Channel><Computer>m.pl</Computer><Security/></System><EventData><Data Name='SubjectUserSid'>NT AUTHORITY\SYSTEM</Data><Data Name='SubjectUserName'>BANK</Data><Data Name='SubjectDomainName'>BANK</Data><Data Name='SubjectLogonId'>0x3e7</Data><Data Name='NewProcessId'>0x17b0</Data><Data Name='NewProcessName'>unkUniversalForwarder\bin\splunk-pow...ell.F</Data><Data Name='TokenElevationType'></Data><Data Name='ProcessId'>0xf8035e56f2200000</Data><Data Name='ProcessName'>...ell.F</Data></EventData></Event> host = ...REB index = wineventlog source = WinEventLog:Security sourcetype = XmlWinEventLog:Security
5/10/16 9:21:32.000 PM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Security-Auditing' Guid='{5484962328C30D}' /><Event ID>4688</Event ID><Version>1</Version><Level>0</Level><Task>13312</Task><Opcode>0</Opcode><Keywords>0x8020000000000000</Keywords>me='2016-05-10T19:21:32.794158300Z' /><EventRecordID>84365997</EventRecordID><Correlation/><Execution ProcessID='4' ThreadID='11012' /><Channel>Security</Channel><Computer>m.pl</Computer><Security/></System><EventData><Data Name='SubjectUserSid'>NT AUTHORITY\SYSTEM</Data><Data Name='SubjectUserName'>BANK</Data><Data Name='SubjectDomainName'>BANK</Data><Data Name='SubjectLogonId'>0x3e7</Data><Data Name='NewProcessId'>0x2fc4</Data><Data Name='NewProcessName'>C:\Program Files\Internet Explorer\iexplore.exe</Data><Data Name='TokenElevationType'></Data><Data Name='ProcessId'>0xf802b136c2200000</Data><Data Name='ProcessName'>...ell.F</Data></EventData></Event> host = ...REB index = wineventlog source = WinEventLog:Security sourcetype = XmlWinEventLog:Security

- Dead in the water without centralized logging
- Signal from the noise. Easy way to generate a list of classes of errors

ALERTS

Views

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S

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Dev59 XI

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Dev59 XI	localhost	MySQL Open Connections	Service Problem	CRITICAL	2012-05-24 10:08:49	test3	CRITICAL - 26 client connection threads
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lates

- Easy to lose new alerts that come in during a major outage.
- Constant paging
- Services like Big Panda hope to solve this

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WHAT WE TALKED ABOUT

The Anatomy of a System

- Systems within systems
- Complexity increases with number of systems

Walkthrough a System Failure

- Most failures are caused by a change, rollback!
- Root cause analysis is difficult

Things we Learned

- Give you alerts context
- Aggregated logging is table stakes
- Manage your alerts so you don't miss out on state changes

THANK YOU.

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[@DarkAndNerdy](#)