

Lessons learned exploring advanced analysis of HL7 log data

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AIRA National Meeting 2019

Disclaimer

- While Envision is an IIS software vendor, this presentation is about the process of discovery.
- Analytics products discussed and/or demonstrated herein are generally available to the public.
- Approach presupposes availability of a variety of log data. Your mileage may vary.

Four years ago...

- Managing HL7 feeds from providers (and their EHR vendors) is a constant, ongoing effort
 - Need vigilant monitoring, especially through automation

Some technology background

- Traditionally, large-scale data analysis has required significant preparation of the data prior to investigation
 - Optimize performance for complex queries
 - Data warehouse or data mart most common elements
 - Helps to know what questions might be asked
- New technologies permitting much more free-form analysis
 - “Big data” tools

A need arises

- Meet Kevin

Scenario 1

- Using Elastic to quickly answer random questions about HL7 activity



<https://www.elastic.co/>

Demo

Scenario 2

- Using Power BI to assess HL7 performance and diagnose system issues



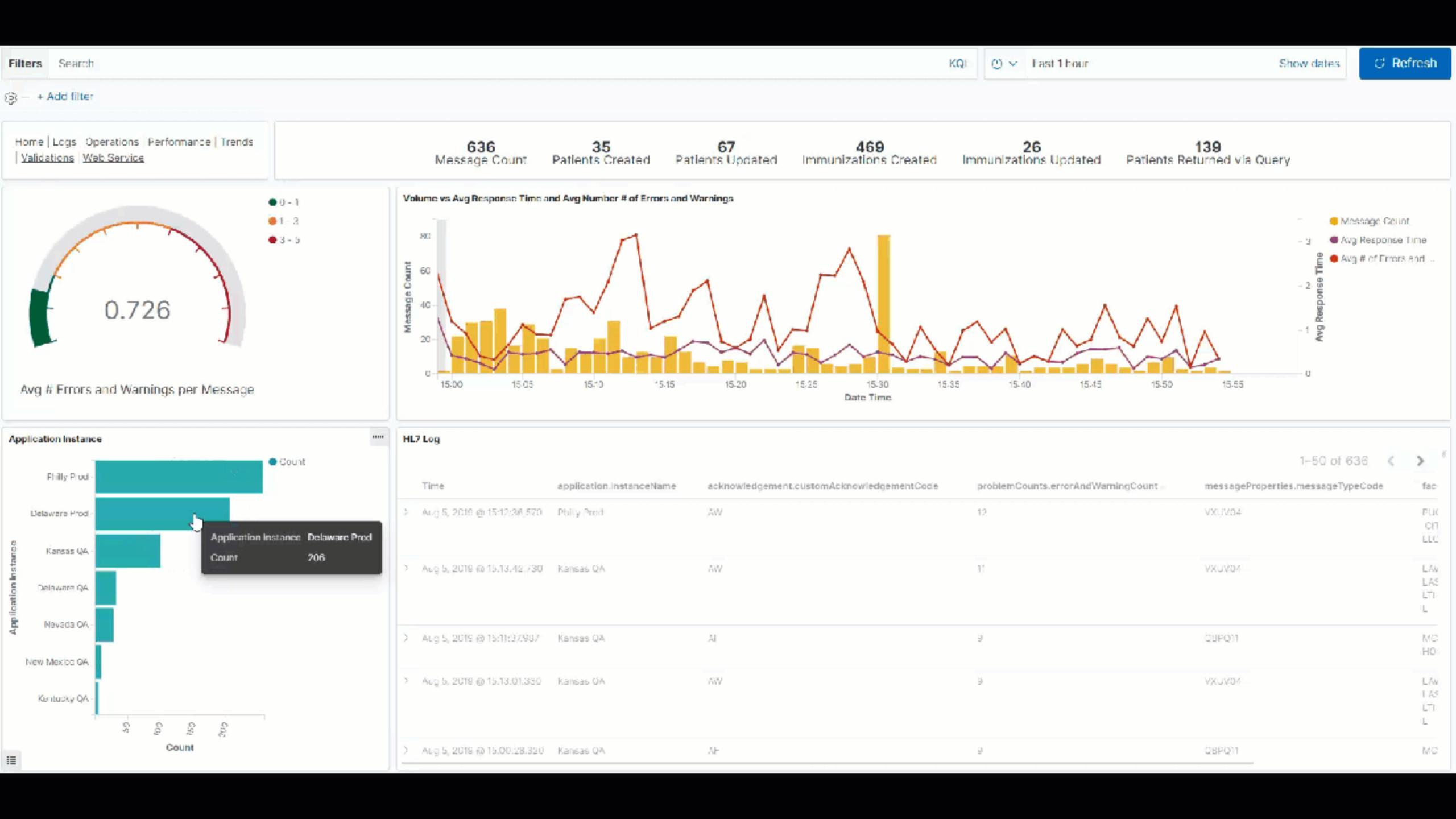
<https://powerbi.microsoft.com>

Demo

Conclusions

- Large number of options available
 - Powerful, inexpensive (at least to get started)
- No one tool serves all needs
 - Different users, different problems
- Logging should be first class citizen

Backup



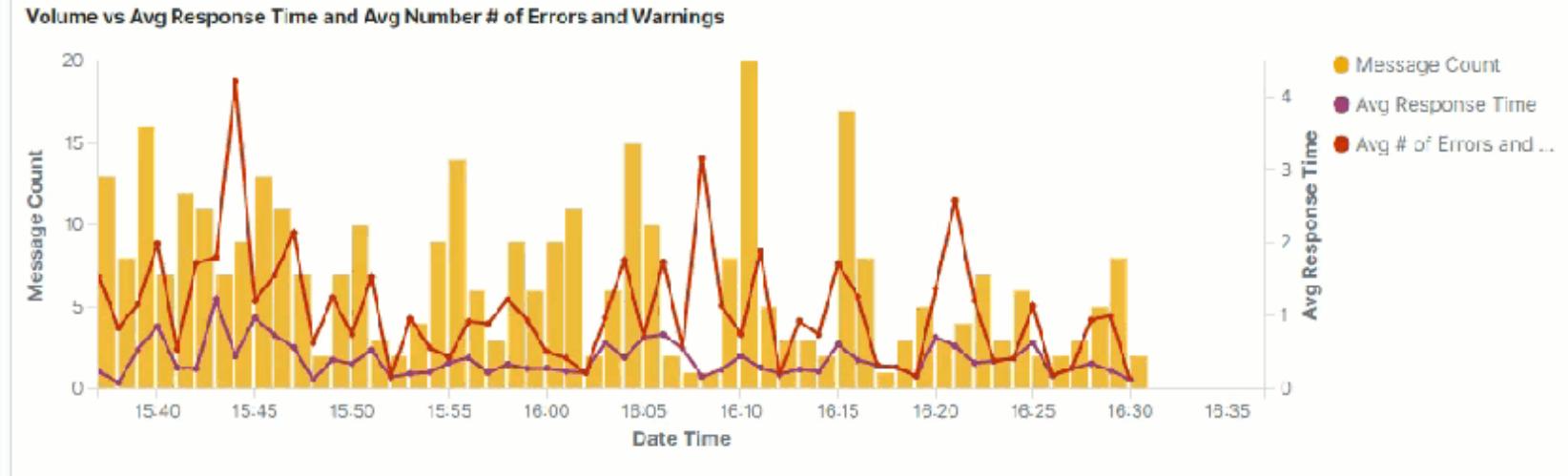
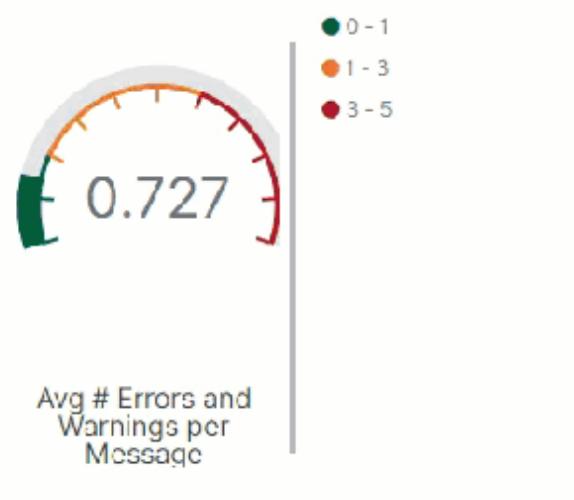
+ Add filter

[Home](#) | [Logs](#) | [Operations](#) |
[Performance](#) | [Trends](#) |
[Validations](#) | [Web Service](#)
366
 Message Count

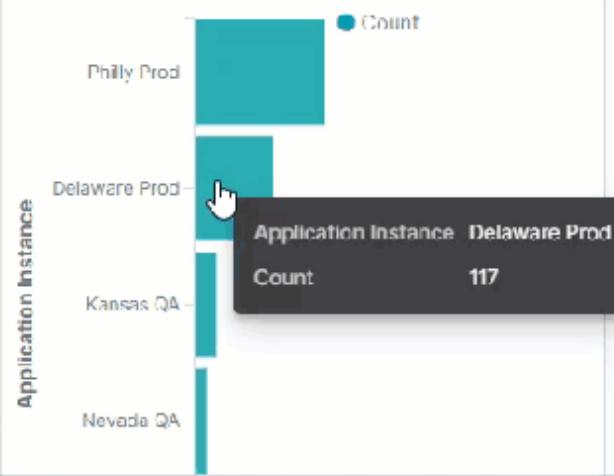
23
 Patients Created

43
 Patients Updated

198
 Immunizations Created

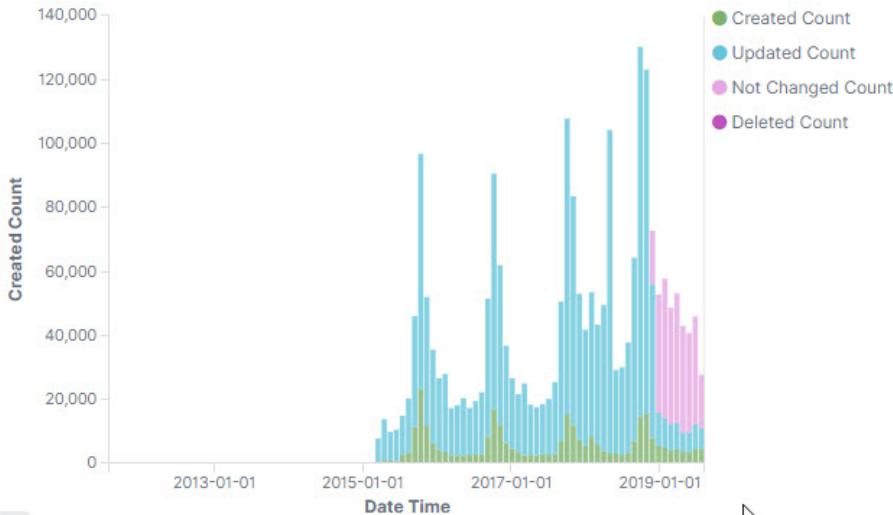
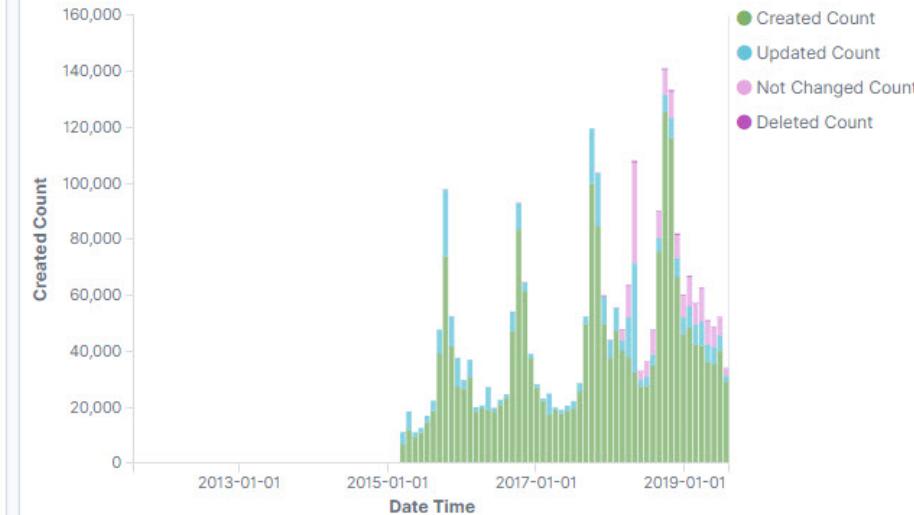
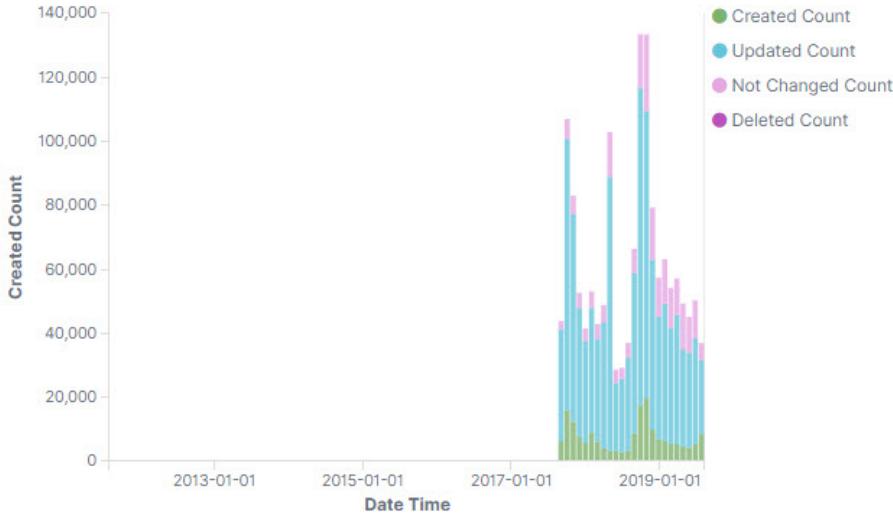
167
 Immunizations Updated


Application Instance



HL7 Log

Time	application.instanceName	acknowledgement.customAcknowledgementCode	problemCounts.errorAndWarning
Aug 5, 2019 @ 15:44:56.673	Kansas QA	AF	27
Aug 5, 2019 @ 15:37:27.583	Kansas QA	AE	13
Aug 5, 2019 @ 15:47:59.170	Kansas QA	AF	9
Aug 5, 2019 @ 15:40:46.547	Kansas QA	AF	8

application.instanceName.keyword: Delaware Prod [+ Add filter](#)[Home](#) | [Logs](#) | [Operations](#) |
[Performance](#) | [Trends](#) | [Validations](#)
[Web Service](#)**4,386,531**
Message Count**311,357**
Patients Created**1,736,510**
Patients Updated**2,105,929**
Immunizations Created**344,938**
Immunizations Updated**Visualization-Immunizations-HL7Log-Operations-Patients****Visualization-Immunizations-HL7Log-Operations-Immunizations****Visualization-Immunizations-HL7Log-Operations-PatientAddress****Visualization-Immunizations-HL7Log-Operations-AdverseEvents**

application.instanceName.keyword: Delaware Prod X

properties.isOnCPhizHubTraffic: true X

[+ Add filter](#)

[Home](#) | [Logs](#) | [Operations](#) |
[Performance](#) | [Trends](#) | [Validations](#)
| [Web Service](#)

4,525
Message Count

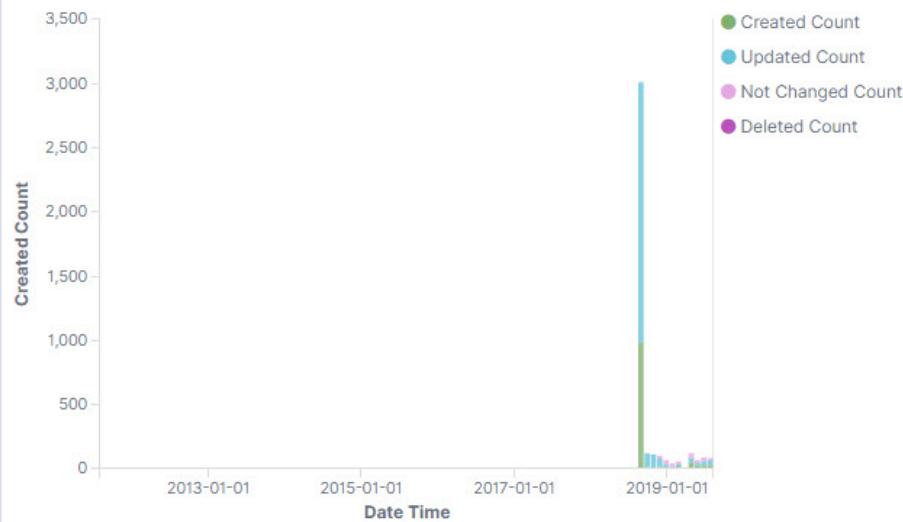
1,199
Patients Created

2,472
Patients Update

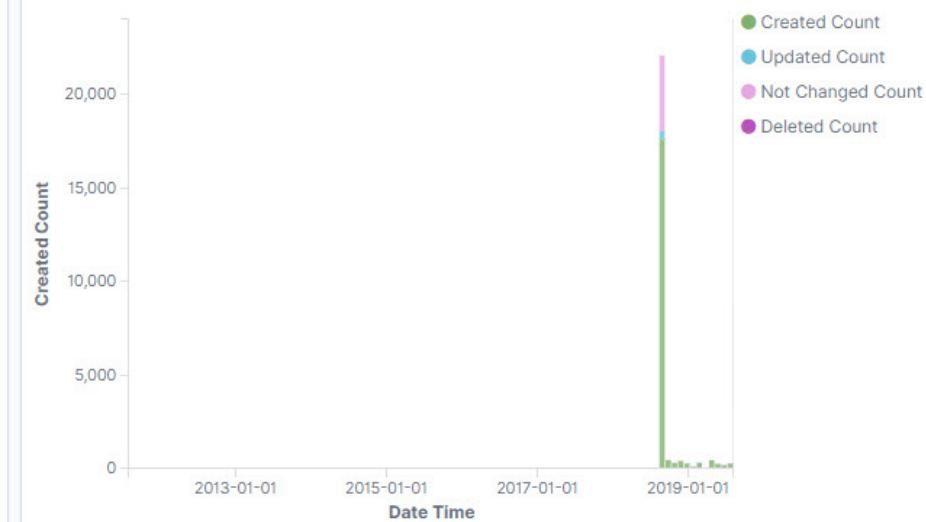
20,835
Immunizations Cr

498 Immunizations Updated

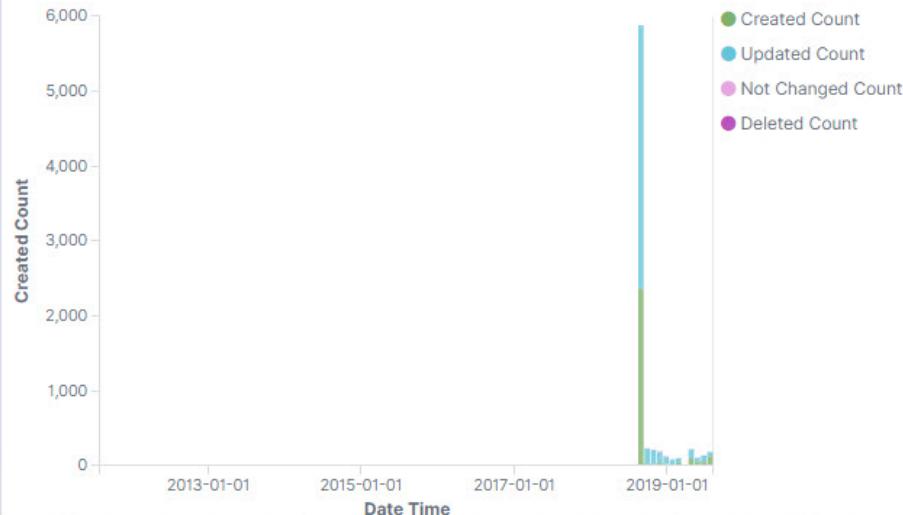
Visualization-Immunizations-HL7Log-Operations-Patients



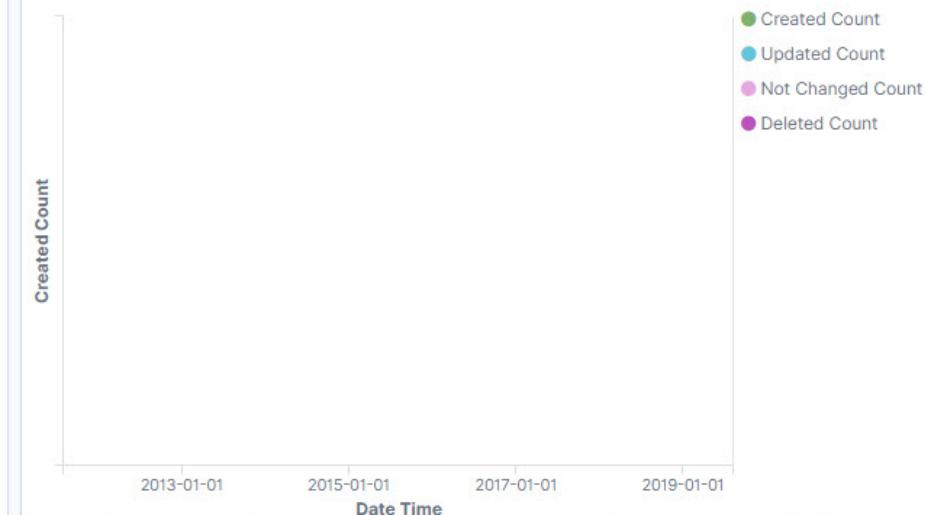
Visualization-Immunizations-HL7Log-Operations-Immunization



Visualization-Immunizations-HL7Log-Operations-PatientAddress



Visualization-Immunizations-HL7Log-Operations-AdverseEvent



application.instanceName.keyword: Delaware Prod + Add filter

Home | Logs | Operations |
Performance | Trends |
Validations | Web Service

4,386,534
Message Count

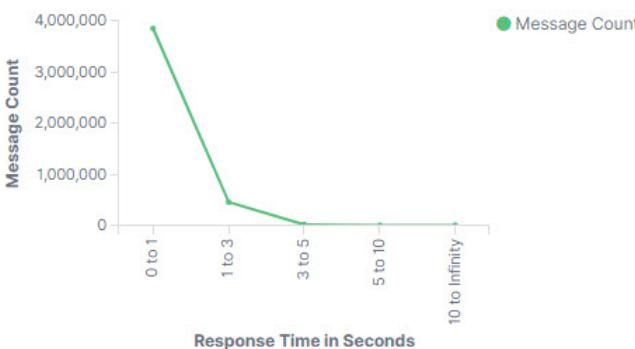
311,357
Patients Created

1,736,510
Patients Updated

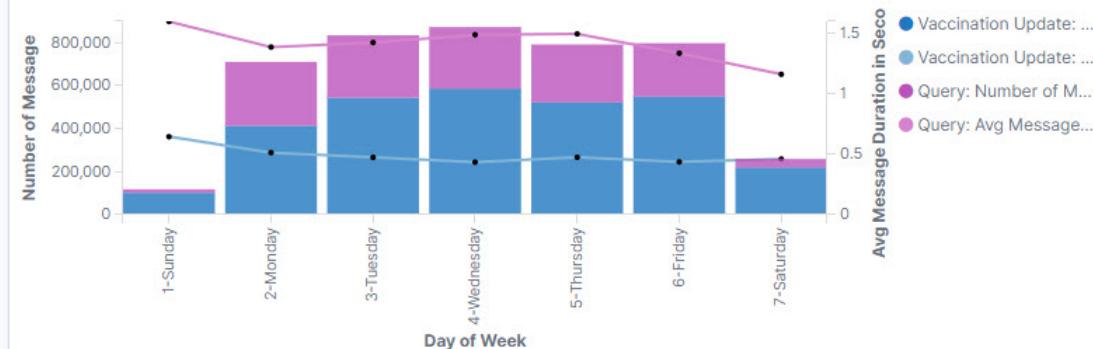
2,105,929
Immunizations Created

344,938
Immunizations Updated

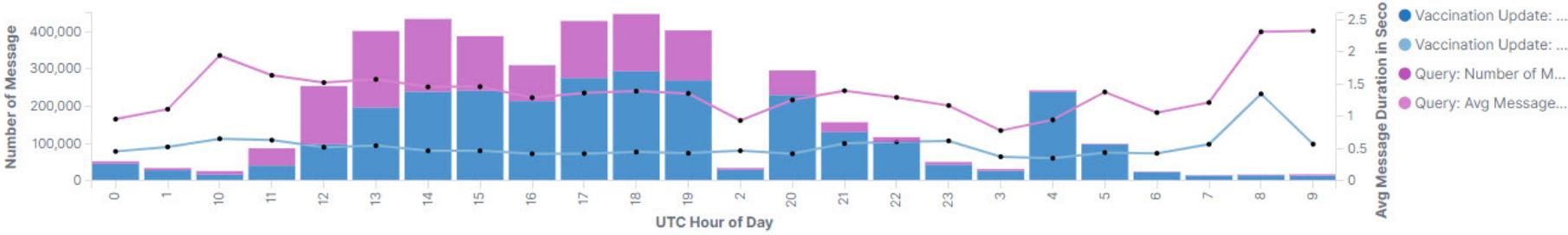
Volume of Response Time Ranges



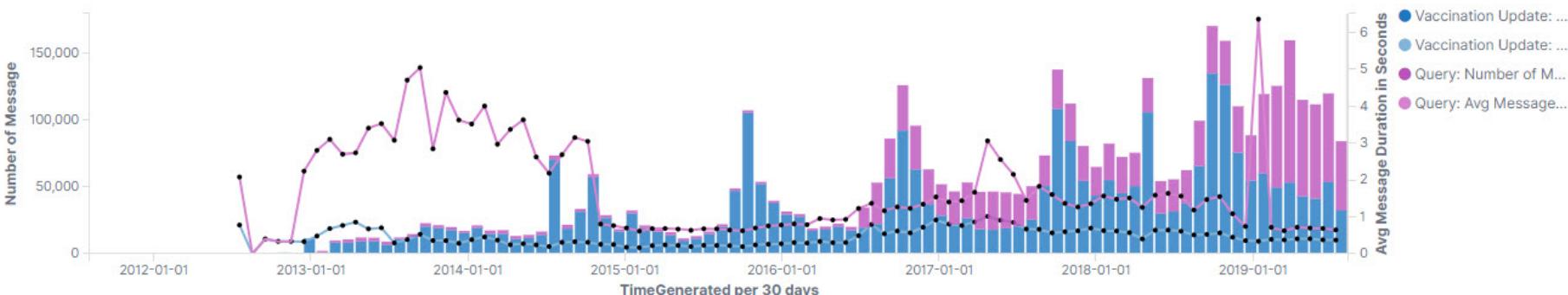
Volume and Response Time by Day of Week



Volume and Response Time by UTC Hour of Day



Visualization-Immunizations-HL7Log-Performance-OverTime

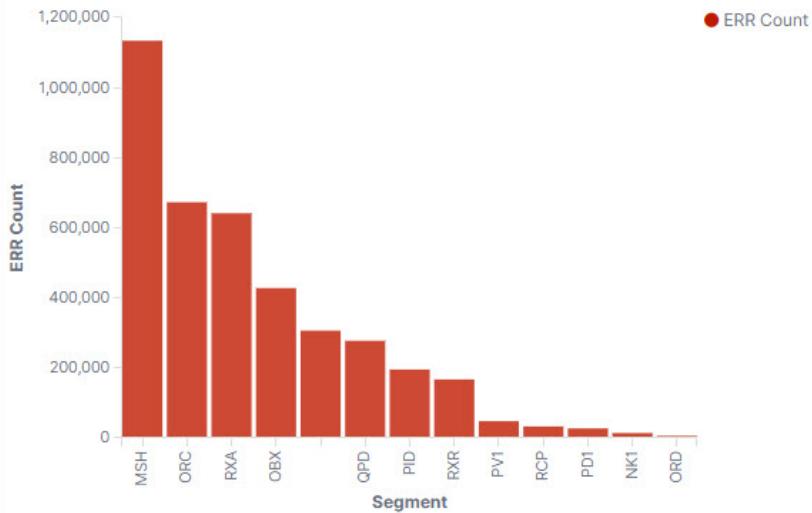


application.instanceName.keyword: Delaware Prod

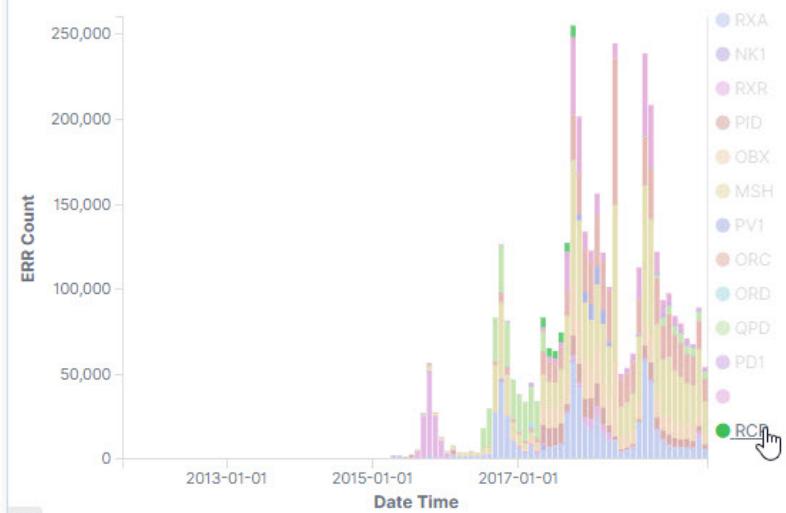
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[Validations](#) | [Web Service](#)
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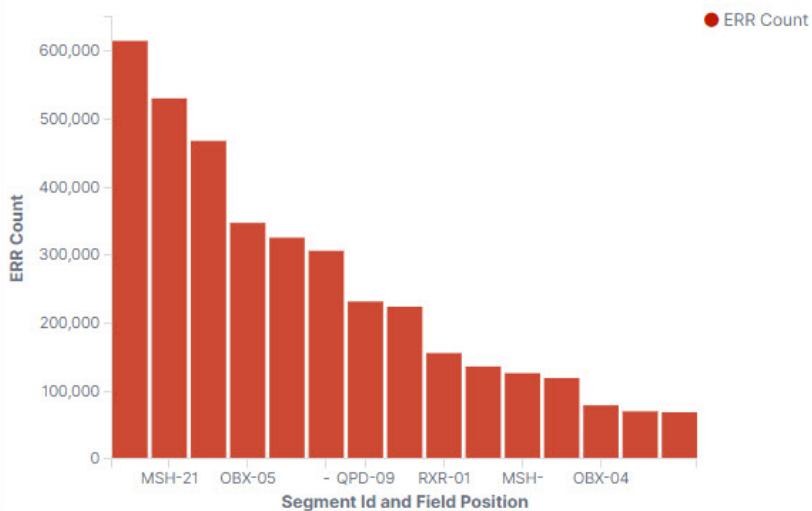
Visualization-Immunizations-HL7Log-Validation-ErrorVolumeBySegment



Visualization-Immunizations-HL7Log-Validation-ErrorVolumeBySegmentOverTime



Visualization-Immunizations-HL7Log-Validation-ErrorVolumeBySegmentAndField



Visualization-Immunizations-HL7Log-Validation-TagCloudByErrorVolumeBySegmentAndField



Segment Id and Field Position - Count

What we've seen so far...

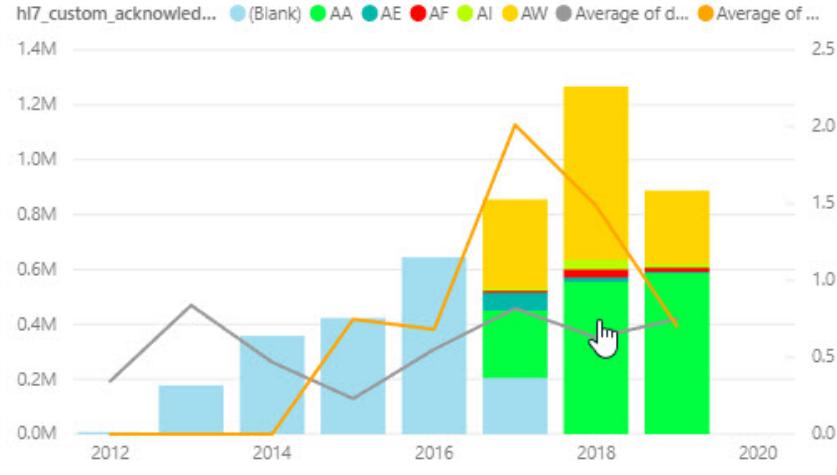
- Pros
- Cons

Ask a question about your data

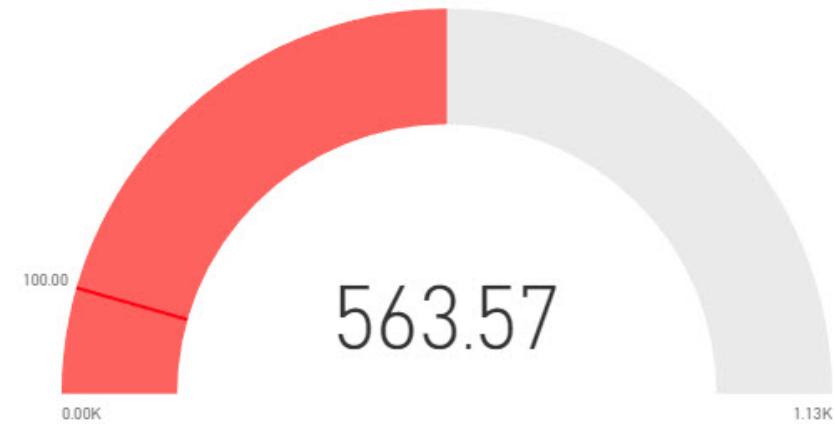
Global Production HL7: Avg Number of ERRs per Message Today
IN ALL THE TRACKED PRODUCTION ENVIRONMENTS WHAT IS THE AVERAGE NUMBER ...



Global All Environments HL7: Custom Ack Codes over Time



Global All Environments WebIZ: Number of Application Errors Today
WHAT IS THE TOTAL NUMBER OF WEBIZ ERRORS TODAY IN ALL ENVIRONMENTS OF A...



Global All Environments HL7: Availability Tests

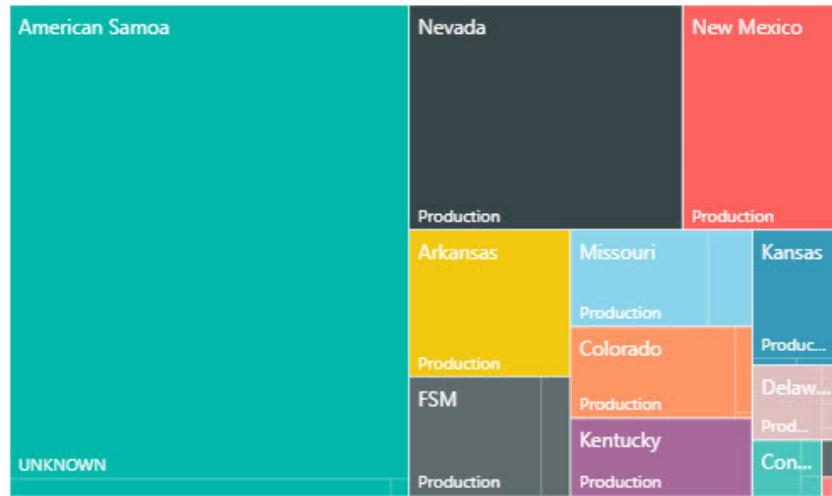
TEST ALL METHODS OF ALL WEB SERVICE ENDPOINTS EVERY 5 MINUTES FOR AVAIL...

TestResult • Failure • Success • Average of ResponseTimeInSeconds

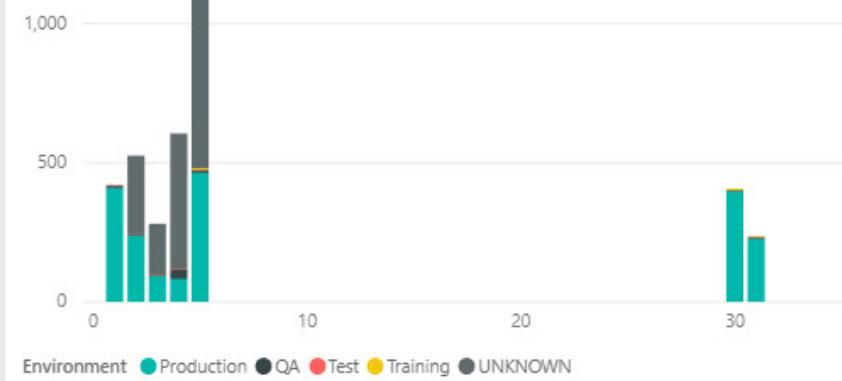


Ask a question about your data

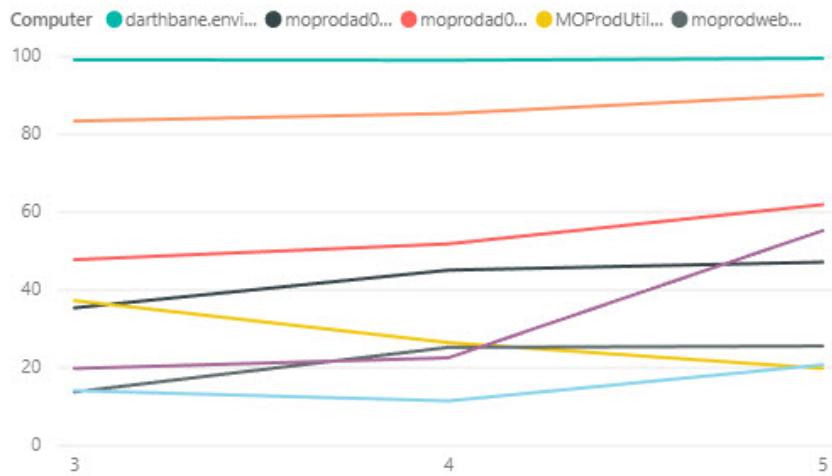
Distribution of Errors by Client and Environment Type



Number of Errors by Environment over Time



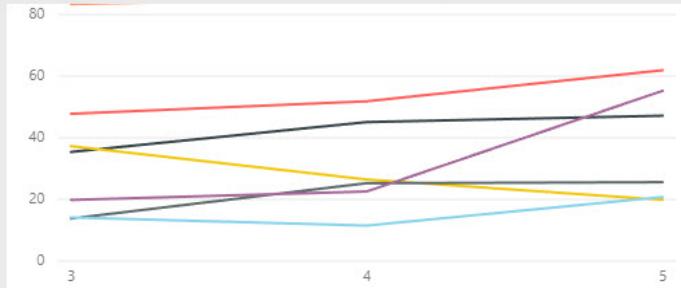
Max CPU % Processor Time



% Free Disk Space



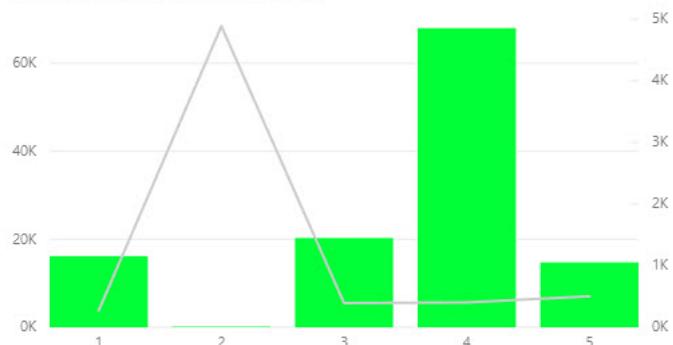
Ask a question about your data



Http Status Codes and Response Time Over Time

scStatus

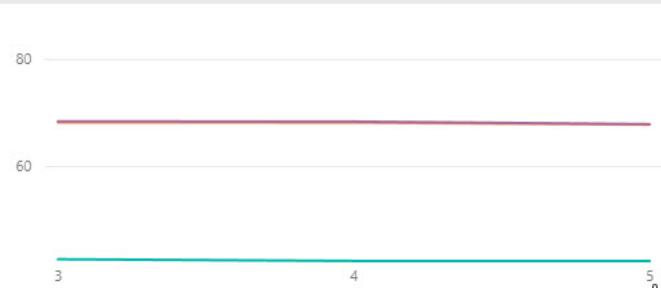
● 200 ● 500 ● Average of TimeTaken



Count of Event Source by Day

Source

● .NET Runti... ● Application ... ● ASP.NET 4.... ● AzureDiag... ● Desktop Wi... ● ESENT

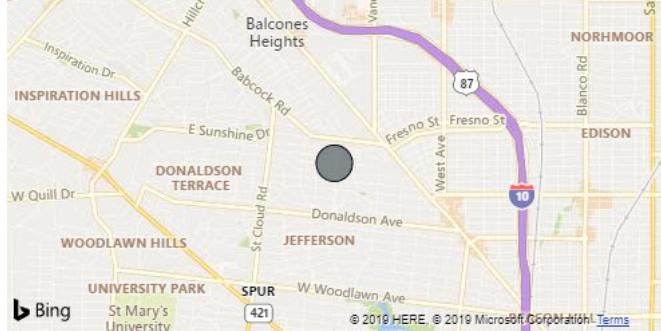


Remote IP Lat and Long of Web Service Log Calls

*TEXAS CALLS ARE DUE TO DATA CENTER LOCATION

RemoteIPCountry

● United States



Application Errors

Date

timestamp

 Last Weeks

7/30/2019 - 8/5/2019

Avg Number Of Errors Per Day

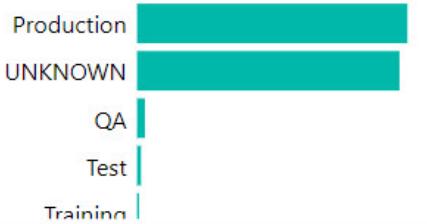
Avg Number Of Errors Per Hour

Number of Errors
3945

Count of timestamp

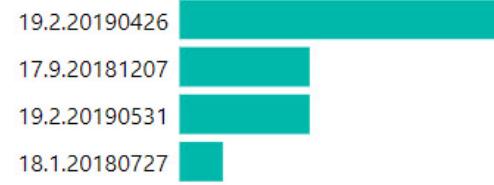
Environment

Search

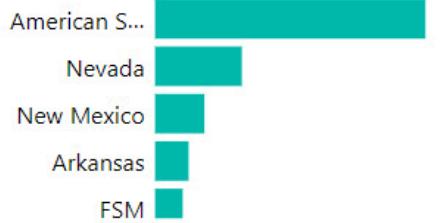

Number of Errors by Environment over Time

WebIZ Version

Search

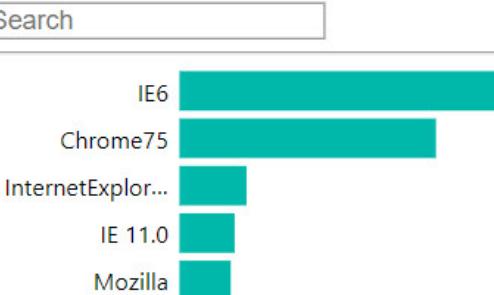

Jurisdiction

Search

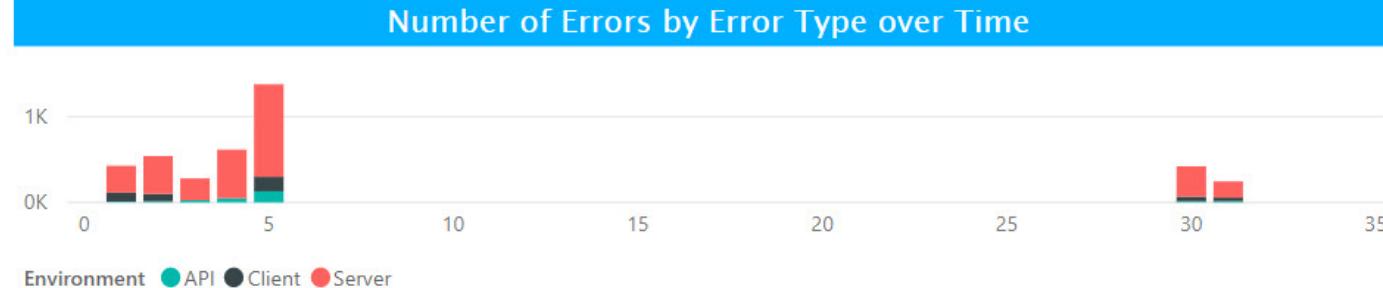

Number of Errors by Jurisdiction over Time

Browser

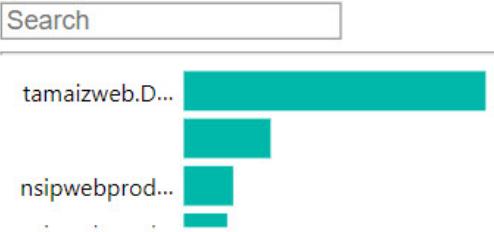
Search


Error Type over Time

Search


Number of Errors by Error Type over Time

Machine Name

Search



Ack Code and Message Type over Time

Message Count

4.62M

Jurisdiction

Delaware

Environment

Production

Message Date

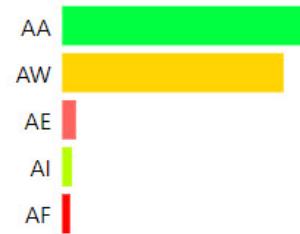
7/20/2012

7/29/2019



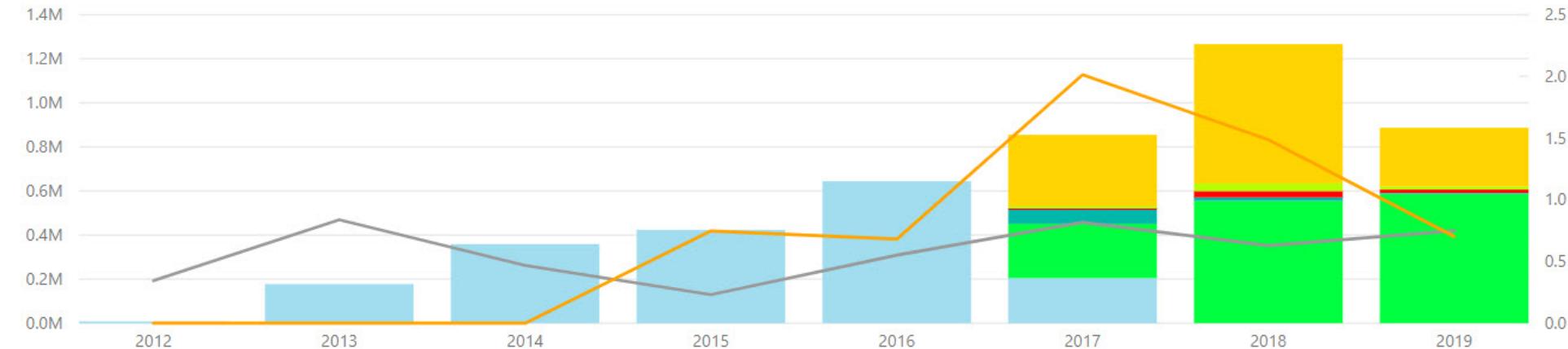
Custom Ack Code

Search



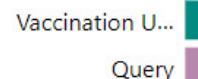
Custom Ack Codes Over Time

hl7_custom_acknowledgement_code (Blank) AA AE AF AI AW Average of duration_seconds_hl7 Average of count_err_errors_and_warnings_combined



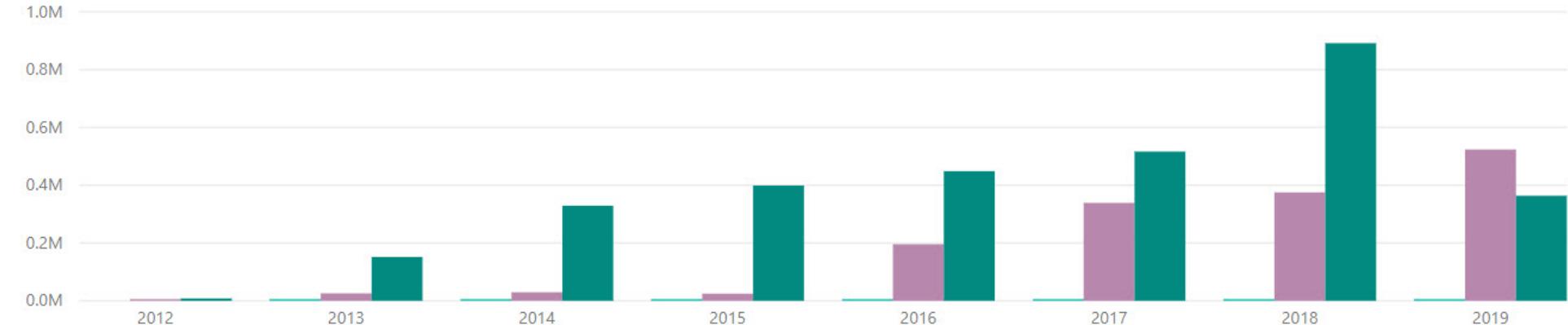
Message Type Category

Search



Message Type Category Over Time

hl7_message_type_category_code (Blank) Query Vaccination Update



TECHNOLOGY PARTNERS

Heat Map of Provider Volume and Quality

Provider Count

39.50K

Jurisdiction

Delaware

Environment

Production

Message Date

7/20/2012

7/29/2019

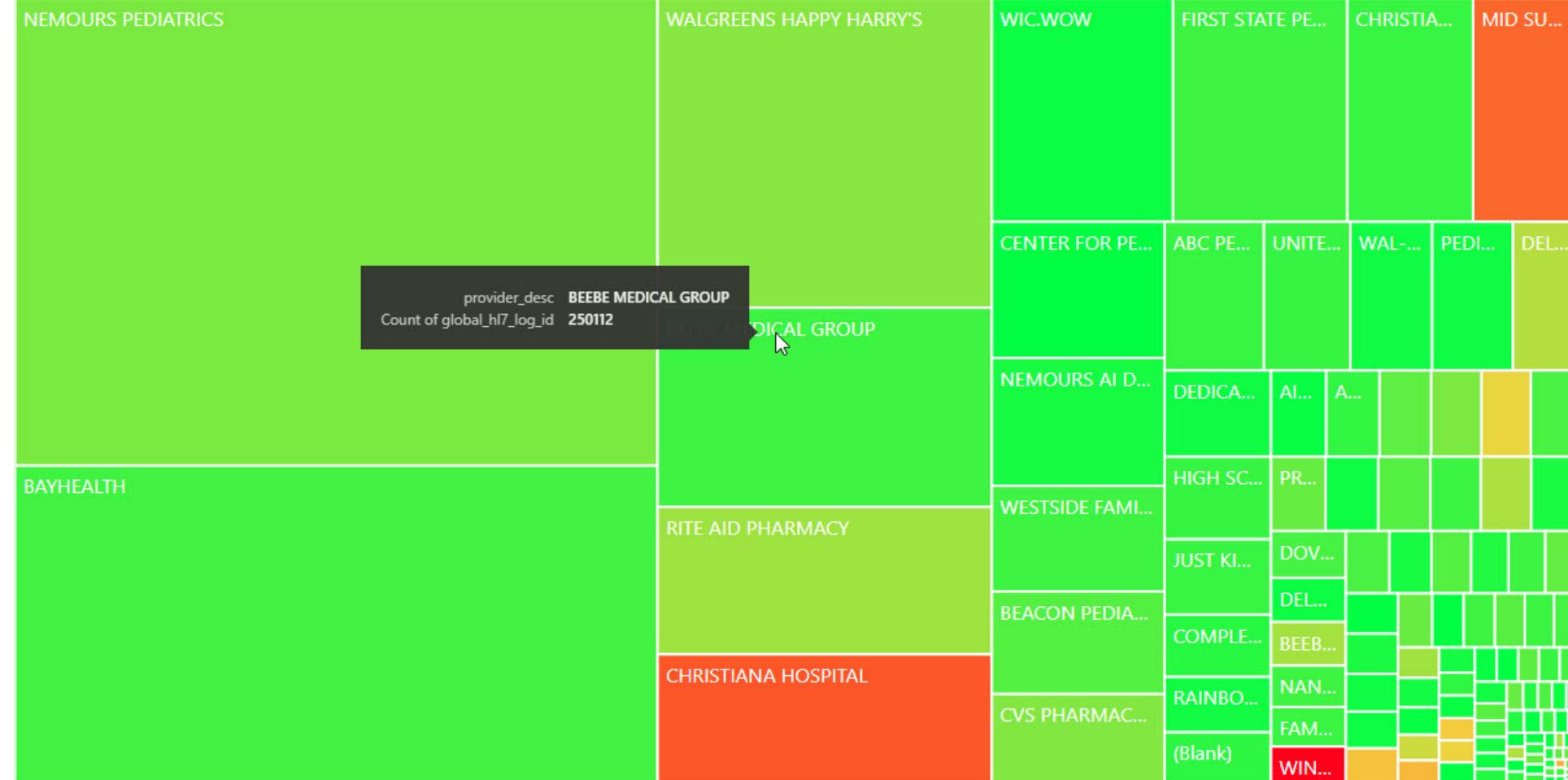


Application Instance

Search

Delaware Prod

Provider Volume and Message Quality



Message Type Category

Search

Vaccination U...

Query

Key Influencers for Performance

Message Count
1.24M

Jurisdiction: Nevada

Environment: QA

Message Date: 11/26/2017 - 7/29/2019

Application Instance: Nevada QA

Execution Duration: 0.00 - 1,905.98

Message Type Category: Search, Query, Vaccination U...

Key Influences for Performance

Key influencers Top segments

What influences duration_seconds_hl7 to ?

When...

- Time is 1:04:00 AM - 1:12:00 PM → 1.58
- Hour is 12:00:00 AM - 12:00:00 PM → 1.49
- Month Name is June → 1.05
- provider_desc is ST ROSE DOMINICAN HOSPITAL - DE LIMA → 1.02
- clinic_desc is ST ROSE DOMINICAN HOSP - DE LIMA → 1.02

...the average of duration_seconds_hl7 increases by

duration_seconds_hl7 is more likely to increase when Time is 1:04:00 AM - 1:12:00 PM than otherwise (on average).

Average of duration_seconds_hl7

Time (bins): 1:04:00 AM or less, 1:04:00 AM - 1:12:00 PM, 1:12:00 PM - 2:45:00 PM, more than 2:45:00 PM

Only show values that are influencers



Key Influencers for Performance



Error Count

10.13M

Jurisdiction

All

Environment

All

Message Date

7/20/2012

7/29/2019

Search User Message

Search



...

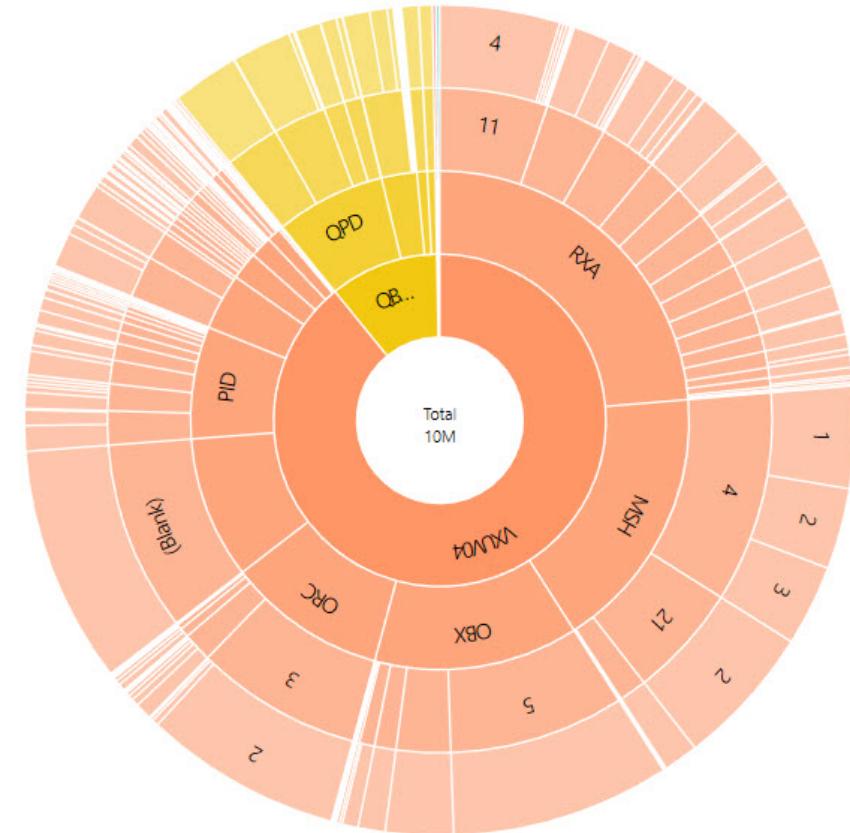
ERR User Message

user_message	Count of global_hl7_log_error_segment_value_id
ORC-3 (FillerOrderNumber): Has a conditionally required element [NamespaceID]. Expectation: value El.2 is required when El.1 is present.	779497
MSH-21 (MessageProfileIdentifier[1]): Has a conditionally required element [NamespaceID]. Expectation: value El.2 is required when El.1 is present.	559663
If RXA-20 is valued "CP" or "PA" and the first occurrence of RXA-9.1 (Administration Note code) is valued "00" then the message SHALL include an OBX segment associated with the RXA where OBX-3.1 shall equal "30963-3" indicating the Funding Source.	486662
MSH-4 (SendingFacility): Has a conditionally required element [UniversalIDType]. Expectation: value HD.3 is required when HD.2 is present.	387960
OBX-5 (ObservationValue): Has a conditionally required element [ObservationValue]. Expectation: value in CE-3 (NameOfCodingSystem) is required when CE is populated.	381416
PID-8 (PatientAddress)-Physical : Country [US] is not in the list of known countries.	234559
QPD-9 (QPD/HomePhoneNumber[0]/TelecommunicationUseCode) : Field value not found in validation table	232835
OBX-4 (ObservationSubID): Unrecognized/unsupported value: []. Expectation: value is a positive integer.	225729
Total	10127111

Show ERR Over Time

ERR Source

hl7_message_type_code (Blank) BATCH ORUR01 QBPQ11 RSPK11 VXQV01 VXUV04



Key Influencers for Performance

Message Count

4.36M

Jurisdiction

All

Environment

All

Message Date

11/26/2017

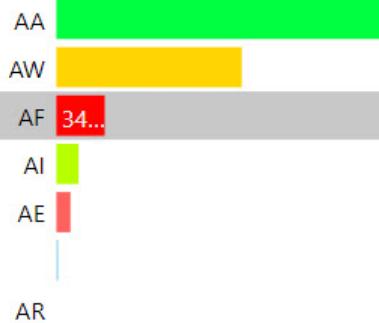
7/29/2019



Custom Ack Code

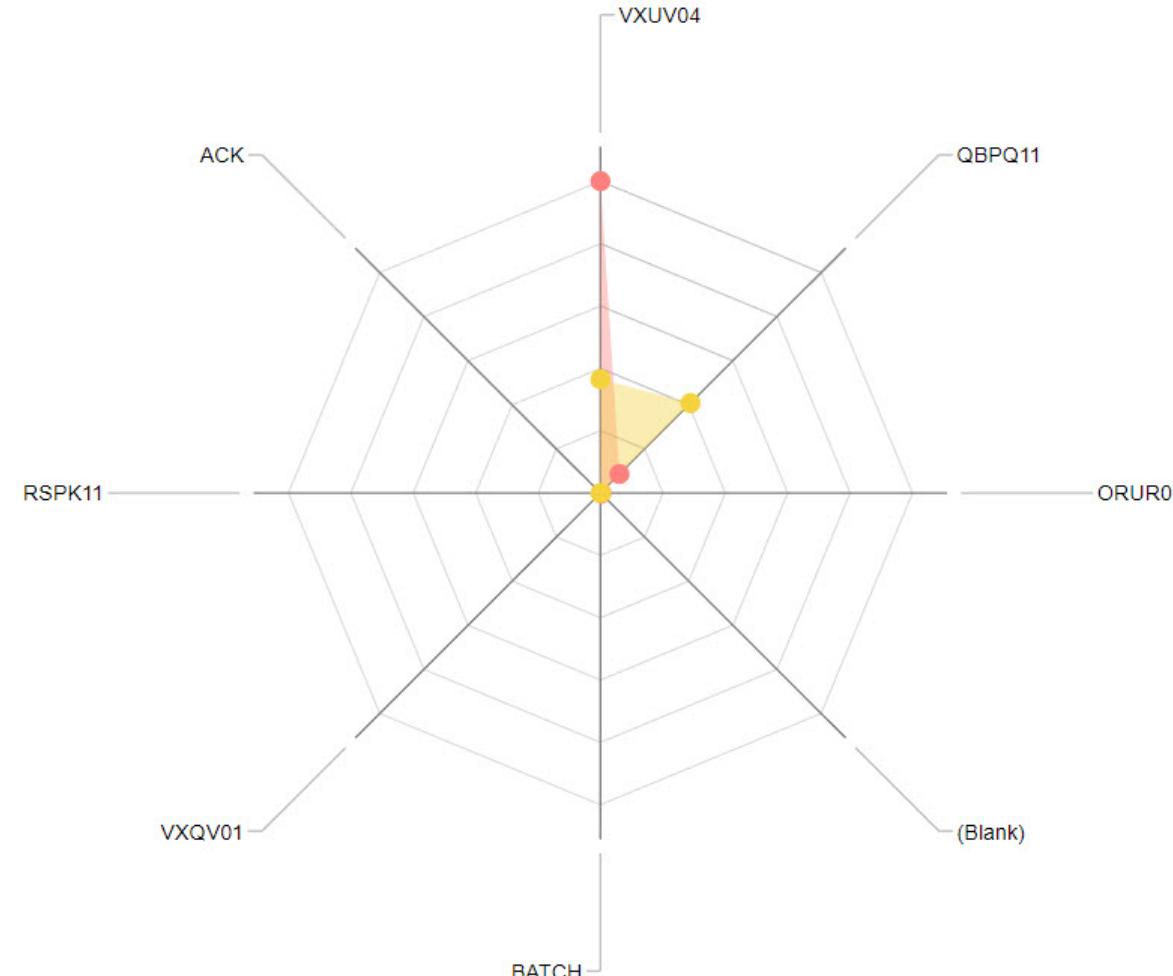


Search



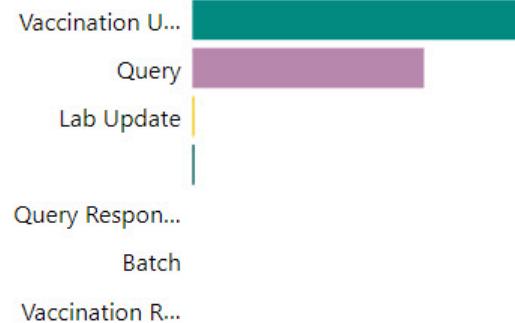
Message Type relationships to performance and ERRs

● count_err_errors_and_warnings_combined ● duration_seconds_hl7



Message Type Category

Search



More features...

Manage alerts

+ Add alert rule

^ Alert for Global Production HL...

Active

 On

Alert title

Alert for Global Production HL7: Avg Number of ER

Set alerts rule for

Avg Number of Errors and Warnings per Message in

Condition

Above

Threshold

1.25

Maximum notification frequency

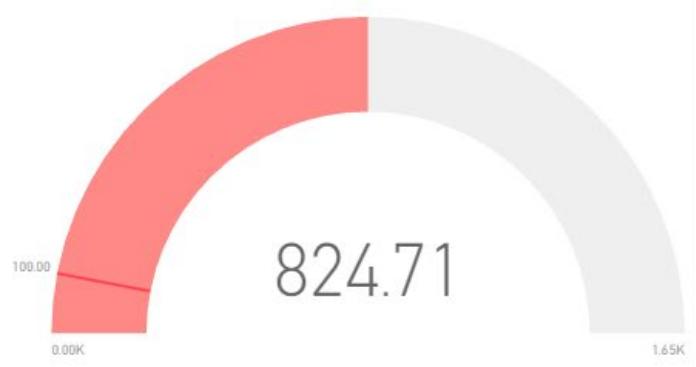
 At most every 24 hours At most once an hour

Alerts are only sent if your data changes.

By default, you'll receive notifications on the service in the notification center.

 Send me email, too

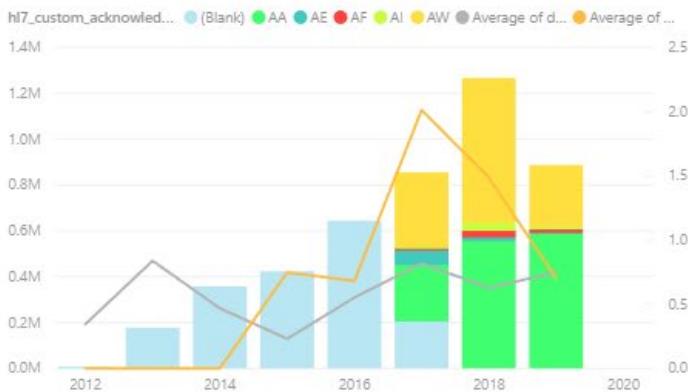
Ask a question about your data

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Distribution of Errors by Client and Environment Type



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Global All Environments HL7: Availability Tests
TEST ALL METHODS OF ALL WEB SERVICE ENDPOINTS EVERY 5 MINUTES FOR AVAIL...

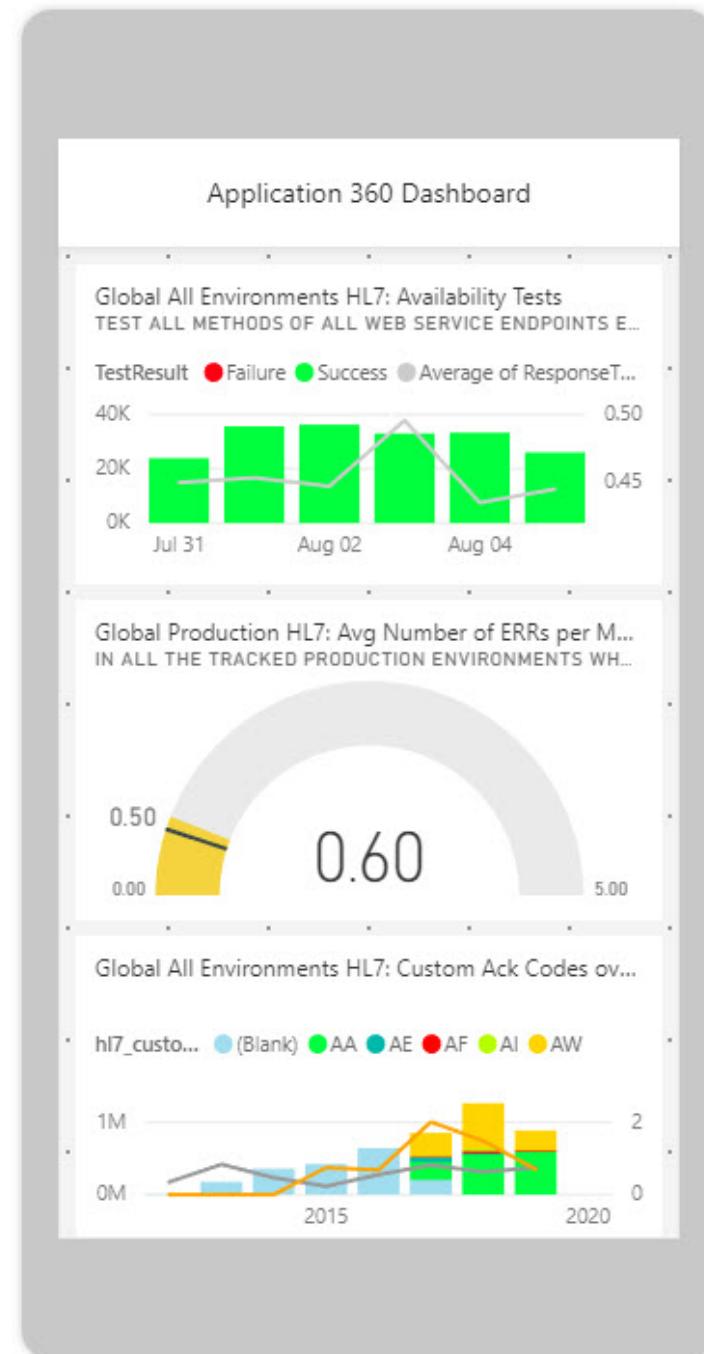
Number of Errors by Environment over Time



Use Microsoft Flow to trigger additional actions

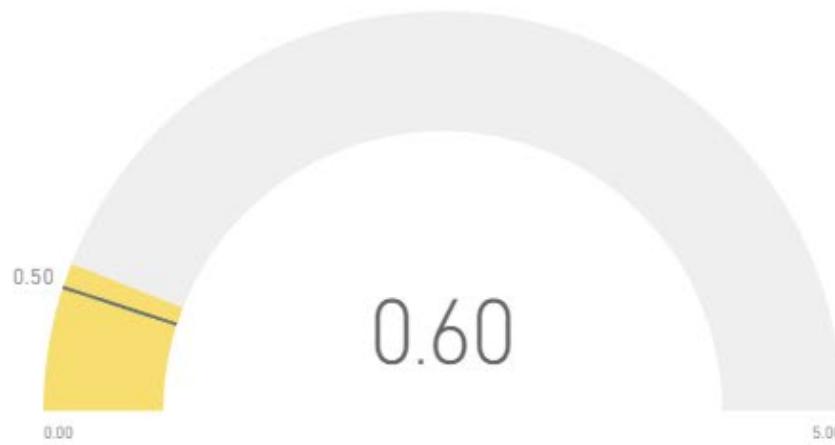
Save and close

Cancel

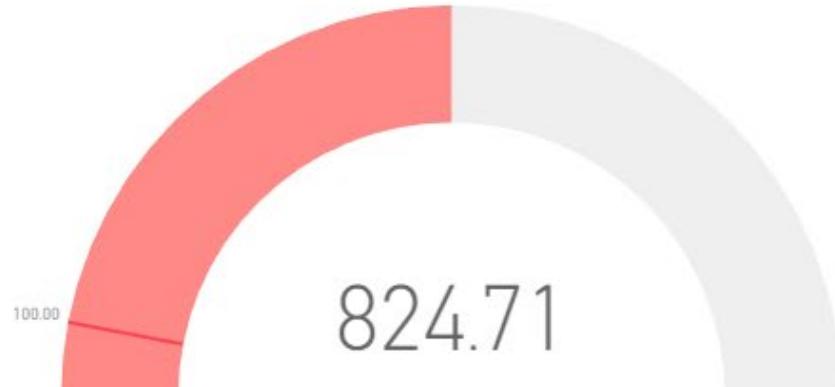


Ask a question about your data

Global Production HL7: Avg Number of ERRs per Message Today
IN ALL THE TRACKED PRODUCTION ENVIRONMENTS WHAT IS THE AVERAGE NUMBER ...



Global All Environments WebIZ: Number of Application Errors Today
WHAT IS THE TOTAL NUMBER OF WEBIZ ERRORS TODAY IN ALL ENVIRONMENTS OF A...



Global All Environments HL7: Custom Ack Codes over Time



Global All Environments HL7: Availability Tests
TEST ALL METHODS OF ALL WEB SERVICE ENDPOINTS EVERY 5 MINUTES F...



Subscribe to emails

APPLICATION 360 DASHBOARD

+ Add another subscription

Application 360 Dashboard

Run Now On

Subscribe

Kevin Snow Enter email address

Subject

Application 360 Degree Dashboard Weekly

Include an optional message...

Frequency

Weekly

Sun Mon Tue Wed Thu Fri Sat

Scheduled Time

6 30 AM (UTC-07:00) Mountain Time (US ar...

Start date End date

8/5/2019 8/5/2020

Also give access to this dashboard

Emails will be sent weekly at 06:30 AM Mountain Standard Time starting 8/5/2019.

[Exit Q&A](#)

Questions to get you started

count applications

count webiz user names

count application versions

show hl 7 0357 error status codes

compare file offset versus severity

what is the average application audit create user

show sc bytes and confidences

total sc byte by outer method

top hl 7 endpoints by application audit update user

total remote IP latitude by log analytics performance _ResourceId

show me count of id average per success for the last year

show me count of id average per success for the last week

show me count of id average per success for the last month

top methods by avg number of errors per hour

top problem ids by avg number of errors per day

top problem ids by avg number of errors per hour

 what is the average response time in seconds

0.39

Average of ResponseTimeInSeconds