

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

Filters

Search

KQL



Last 1 hour

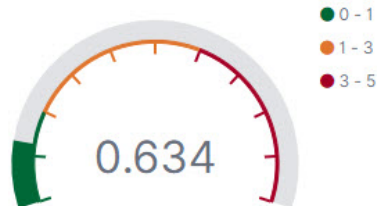
Show dates



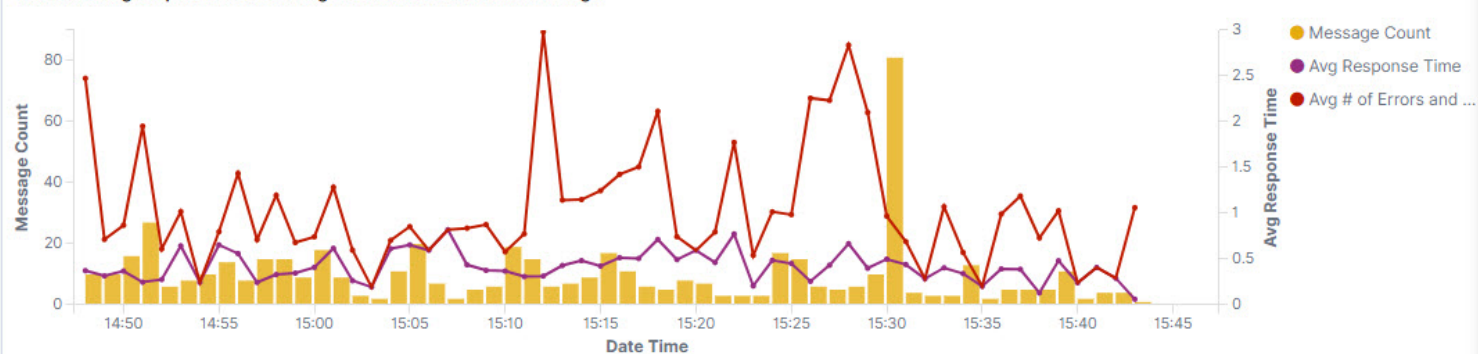
Refresh



+ Add filter

[Home](#) | [Logs](#) | [Operations](#) | [Performance](#) | [Trends](#) | [Validations](#) | [Web Service](#)552
Message Count31
Patients Created62
Patients Updated394
Immunizations Created46
Immunizations Updated143
Patients Returned via QueryAvg # Errors and Warnings
per Message

Volume vs Avg Response Time and Avg Number # of Errors and Warnings



Application Instance

Count

Philly Prod

Delaware Prod

HL7 Log

1-50 of 552



Time	application.instanceName	acknowledgement.customAcknowledgementCode	problemCounts.errorAndWarningCount	mess:
> Aug 5, 2019 @ 15:43:15.727	Delaware Prod	AW	1	QBPQ
> Aug 5, 2019 @ 15:42:50.800	Delaware Prod	AA	0	QBPQ
> Aug 5, 2019 @ 15:42:41.000	Philly Prod	AA	0	QBPQ

3:47:30 PM

Monday, August 5, 2019

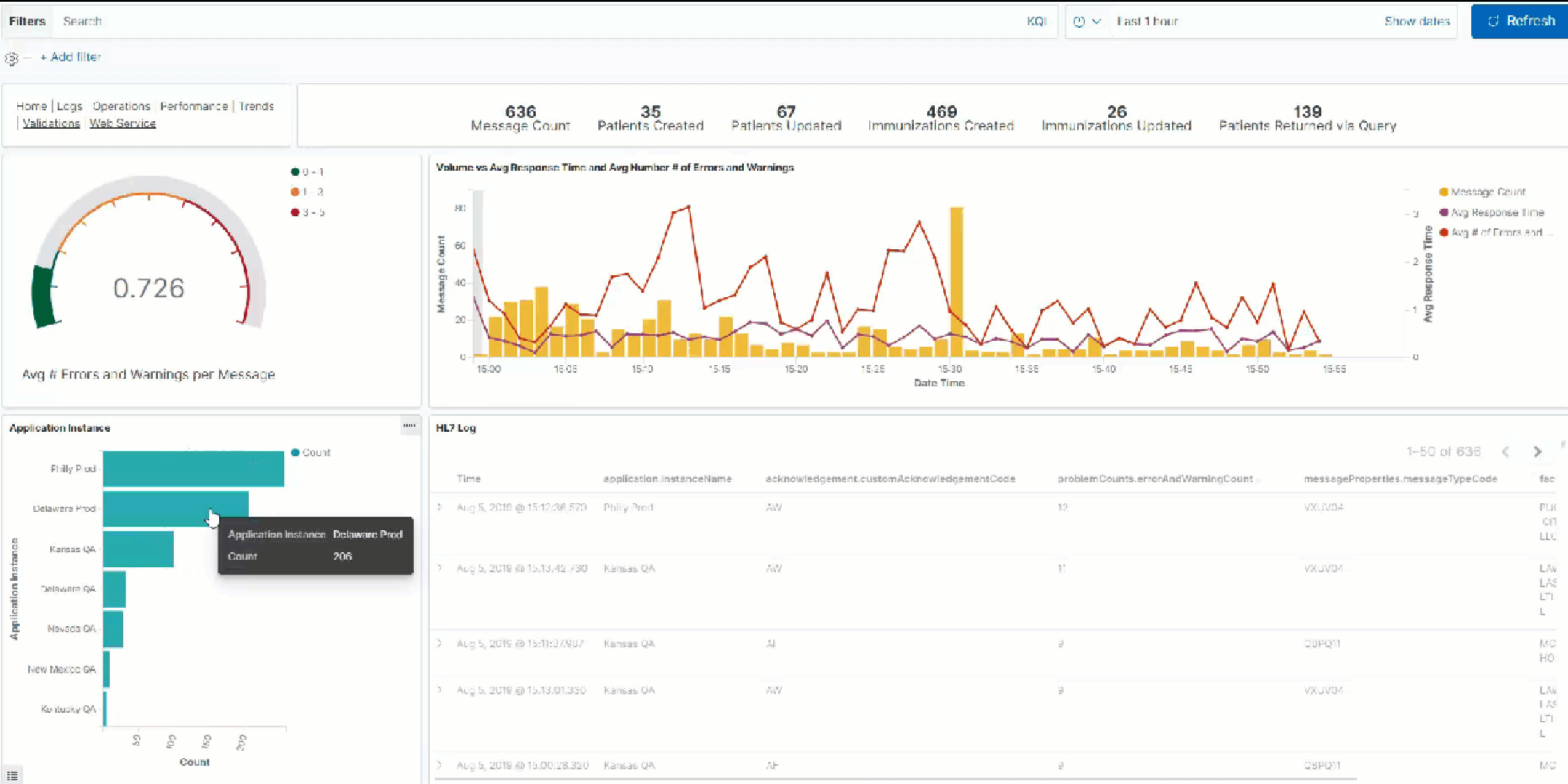
August 2019

Su	Mo	Tu	We	Th	Fr	Sa
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

Today

Set up your calendars to see where
you need to be

Get started



Filters Search

KQL

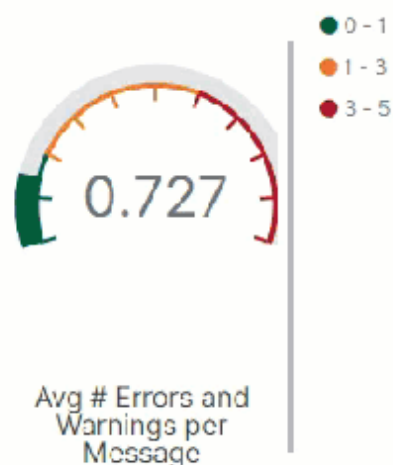


Last 1 hour

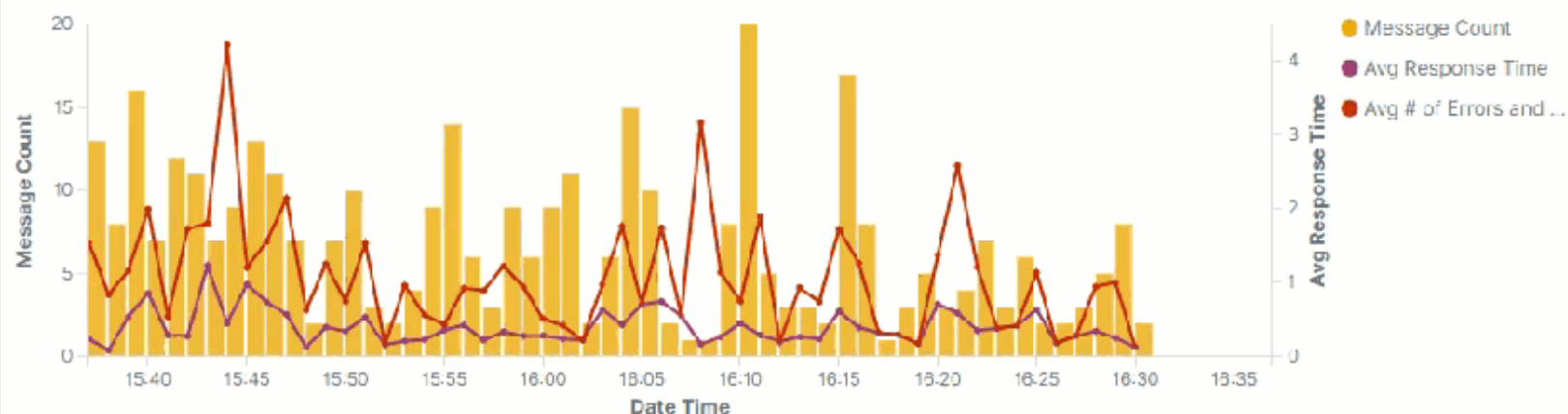
Show dates

Refresh

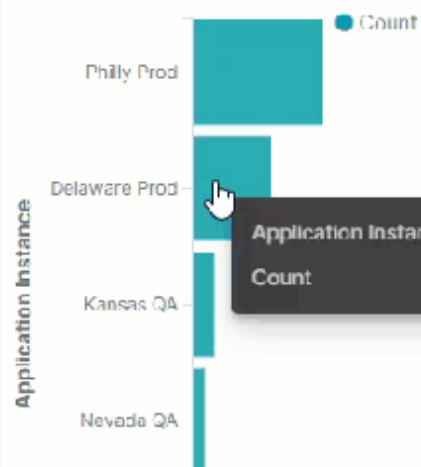
+ Add filter

[Home](#) | [Logs](#) | [Operations](#) |
[Performance](#) | [Trends](#) |
[Validations](#) | [Web Service](#)366
Message Count23
Patients Created43
Patients Updated198
Immunizations Created167
Immunizations Updated

Volume vs Avg Response Time and Avg Number # of Errors and Warnings



Application Instance



HL7 Log

1-50 of 366

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 x + Add filter

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

4,386,531
Message Count

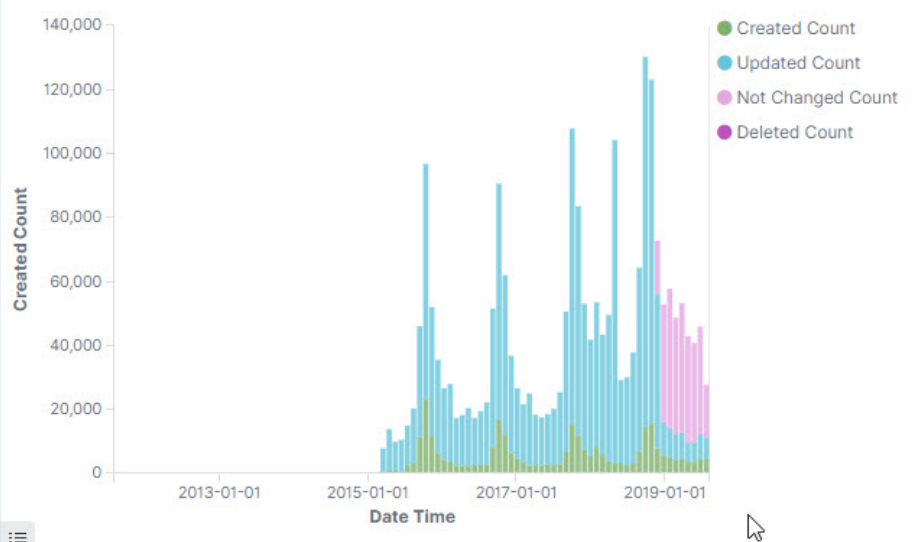
311,357
Patients Created

1,736,510
Patients Updated

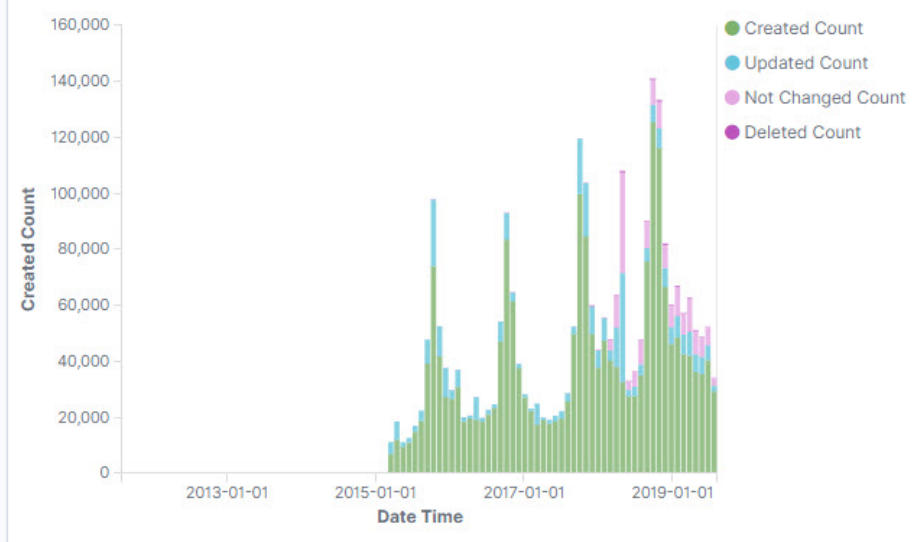
2,105,929
Immunizations Created

344,938
Immunizations Updated

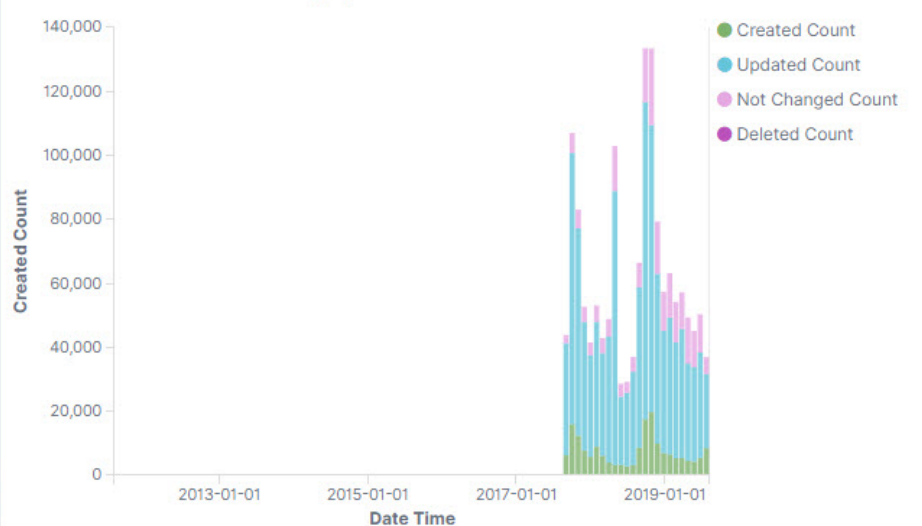
Visualization-Immunizations-HL7Log-Operations-Patients



Visualization-Immunizations-HL7Log-Operations-Immunizations



Visualization-Immunizations-HL7Log-Operations-PatientAddress



Visualization-Immunizations-HL7Log-Operations-AdverseEvents



Filters 2

Search

KQL



Last 8 years

Show dates

Refresh



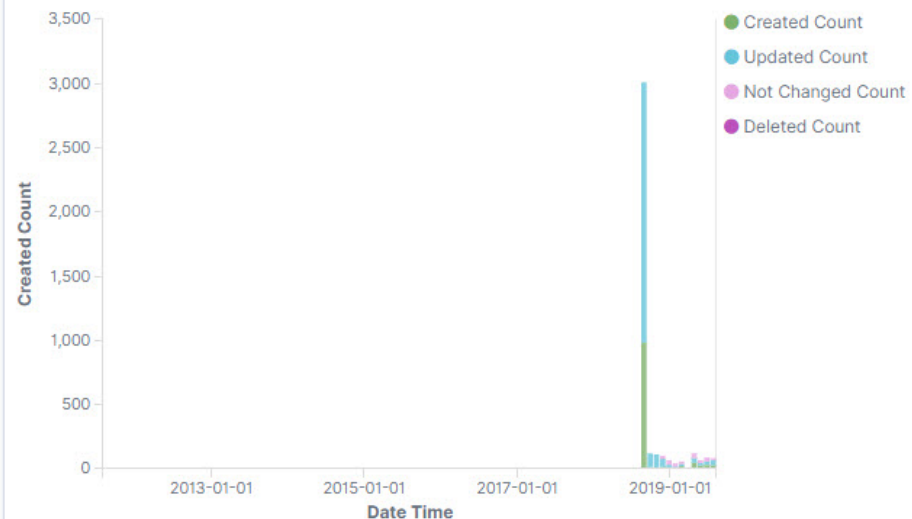
application.instanceName.keyword: Delaware Prod X

properties.isOncPhizHubTraffic: true X

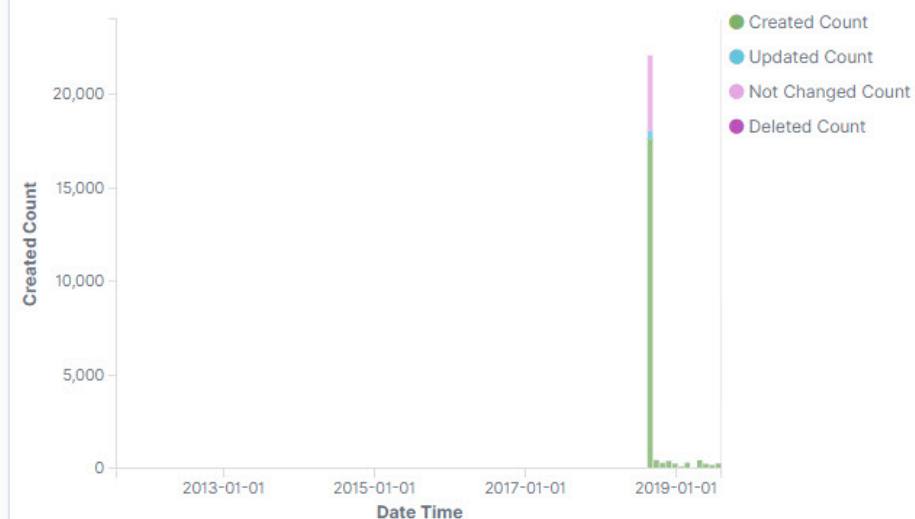
+ Add filter

[Home](#) | [Logs](#) | [Operations](#) |
[Performance](#) | [Trends](#) | [Validations](#)
[Web Service](#)4,525
Message Count1,199
Patients Created2,472
Patients Updated20,835
Immunizations Created498
Immunizations Updated

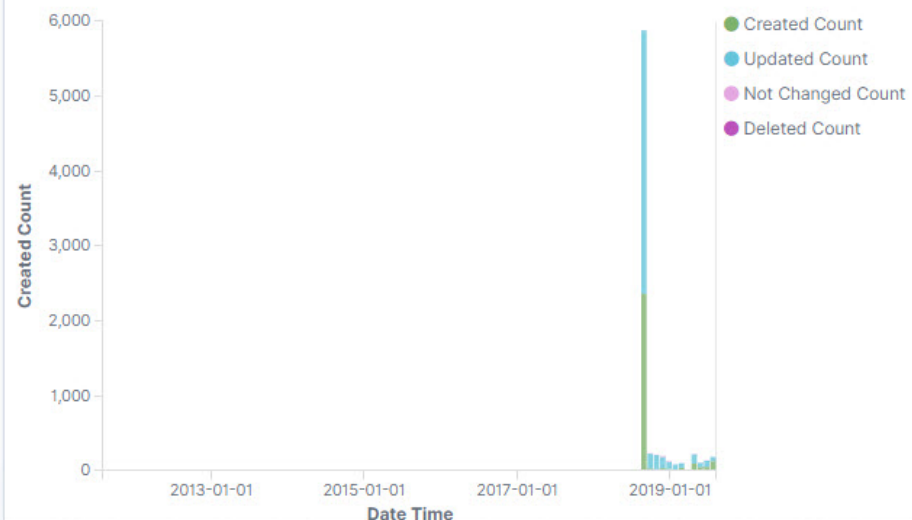
Visualization-Immunizations-HL7Log-Operations-Patients



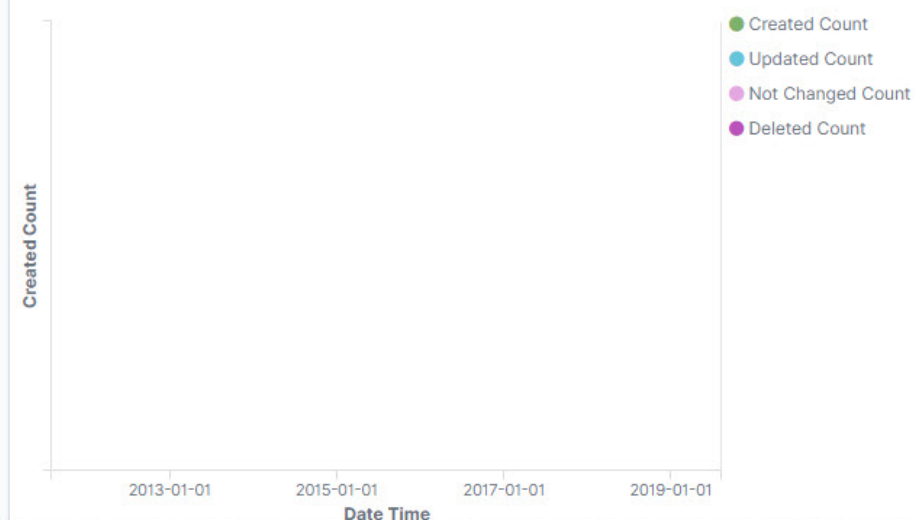
Visualization-Immunizations-HL7Log-Operations-Immunizations



Visualization-Immunizations-HL7Log-Operations-PatientAddress



Visualization-Immunizations-HL7Log-Operations-AdverseEvents



Filters 1

Search

KQL



Last 8 years

Show dates

Refresh

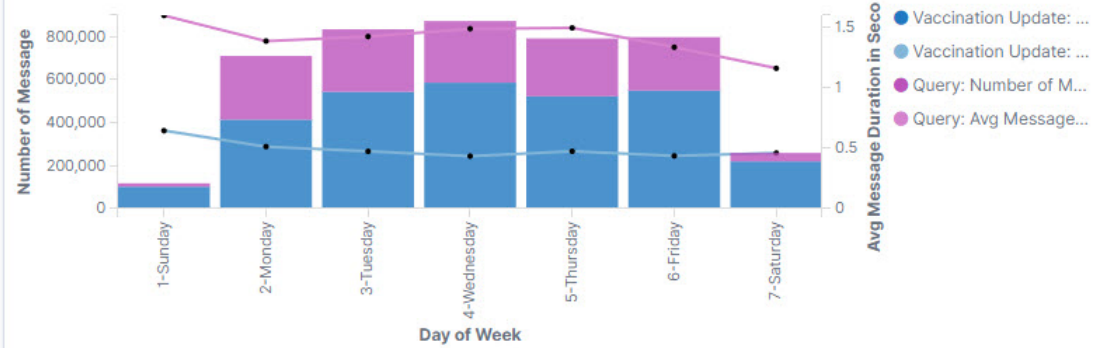
application.instanceName.keyword: Delaware Prod X + Add filter

[Home](#) | [Logs](#) | [Operations](#) |
[Performance](#) | [Trends](#) |
[Validations](#) | [Web Service](#)4,386,534
Message Count311,357
Patients Created1,736,510
Patients Updated2,105,929
Immunizations Created344,938
Immunizations Updated

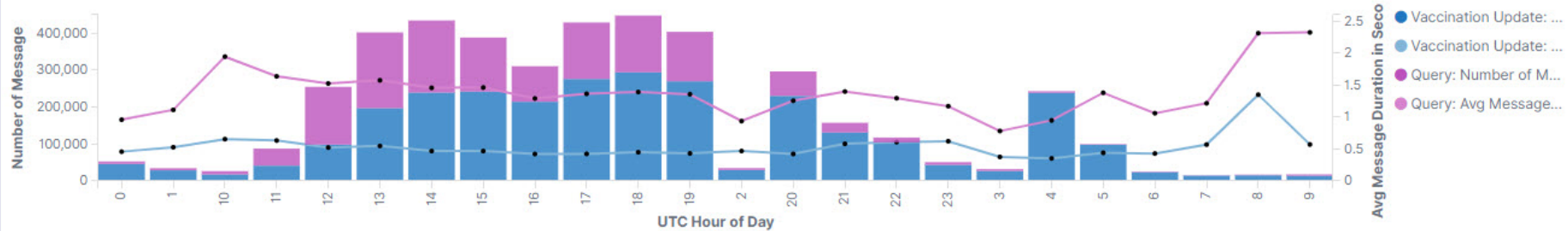
Volume of Response Time Ranges



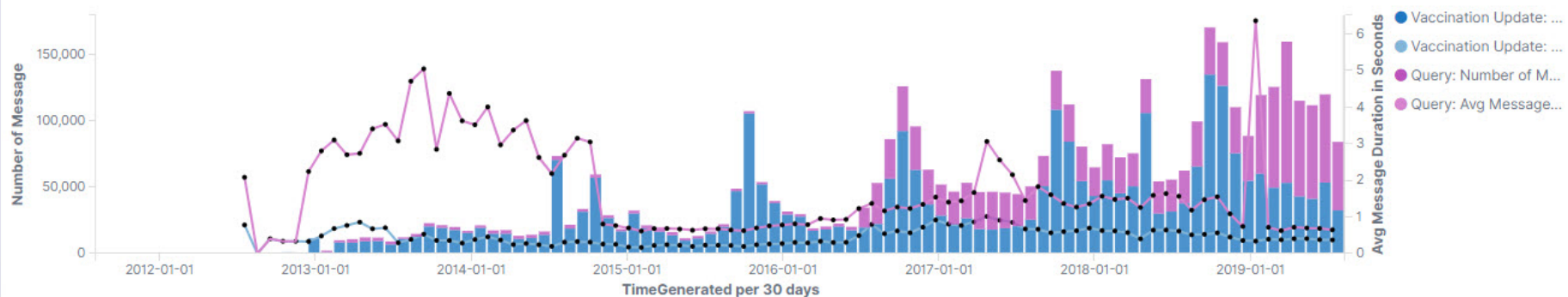
Volume and Response Time by Day of Week



Volume and Response Time by UTC Hour of Day



Visualization-Immunizations-HL7Log-Performance-OverTime



application.instanceName.keyword: Delaware Prod X + Add filter

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

4,386,535
Message Count

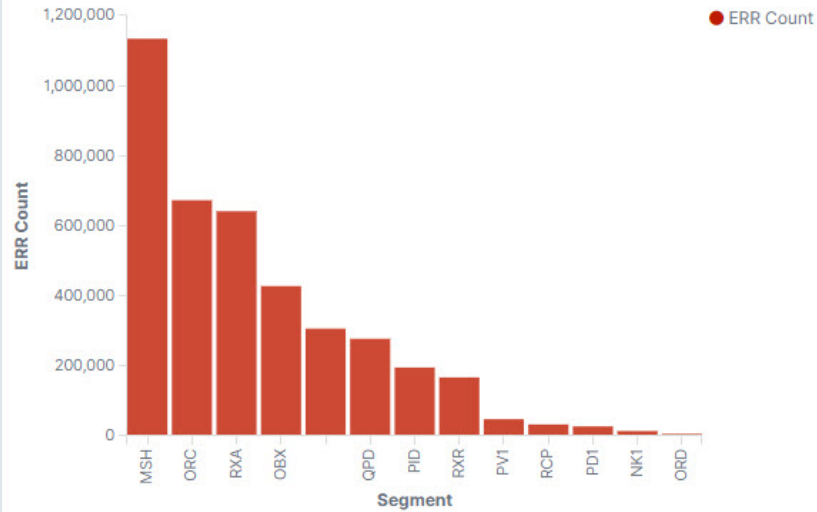
311,357
Patients Created

1,736,510
Patients Updated

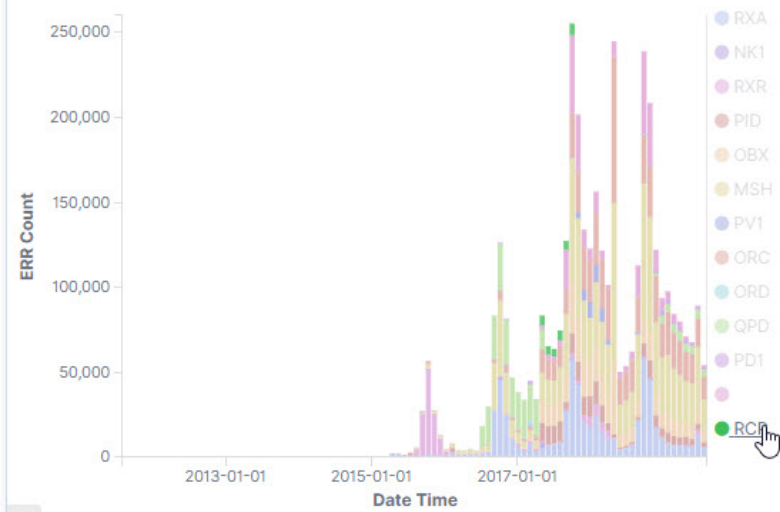
2,105,929
Immunizations Created

344,938
Immunizations Updated

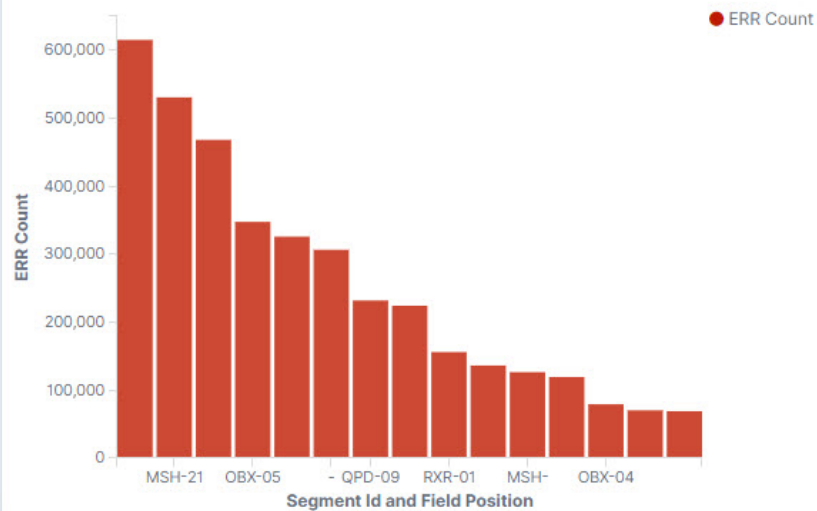
Visualization-Immunizations-HL7Log-Validation-ErrorVolumeBySegment



Visualization-Immunizations-HL7Log-Validation-ErrorVolumeBySegmentOverTime



Visualization-Immunizations-HL7Log-Validation-ErrorVolumeBySegmentAndField



Visualization-Immunizations-HL7Log-Validation-TagCloudByErrorVolumeBySegmentAndField



What we've seen so far...

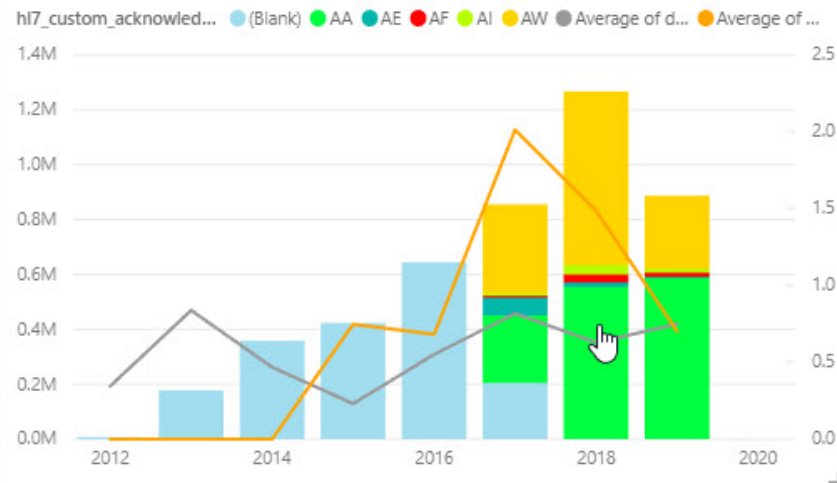
- Pros
- Cons

Ask a question about your data

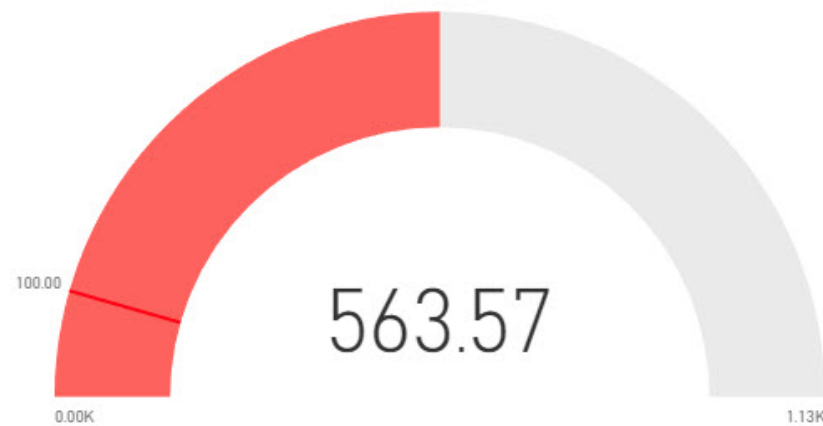
Global Production HL7: Avg Number of ERRs per Message Today
IN ALL THE TRACKED PRODUCTION ENVIRONMENTS WHAT IS THE AVERAGE NUMBER ...



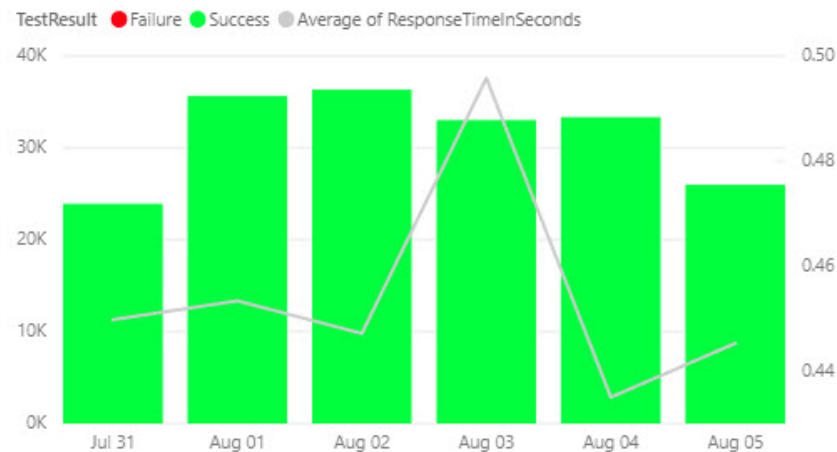
Global All Environments HL7: Custom Ack Codes over Time




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

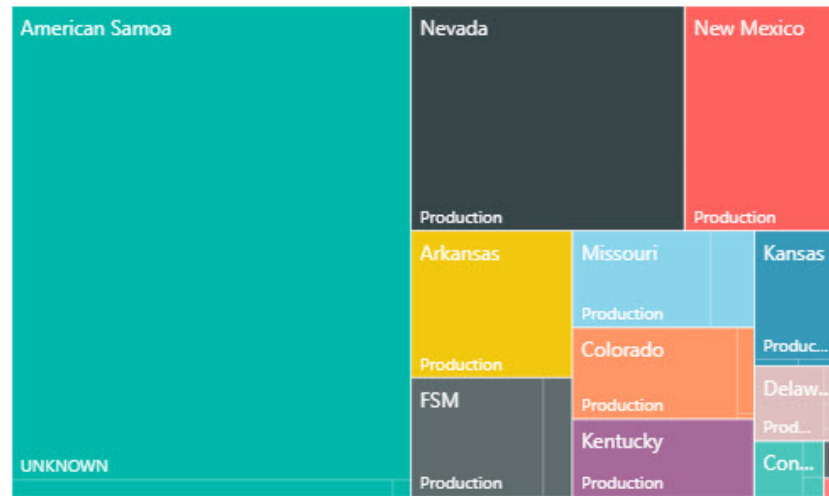


Global All Environments HL7: Availability Tests
TEST ALL METHODS OF ALL WEB SERVICE ENDPOINTS EVERY 5 MINUTES FOR AVAIL...

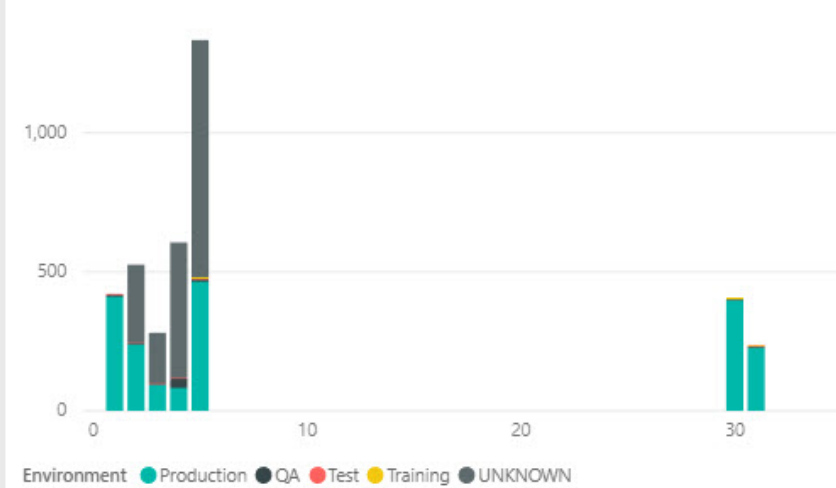


 Ask a question about your data

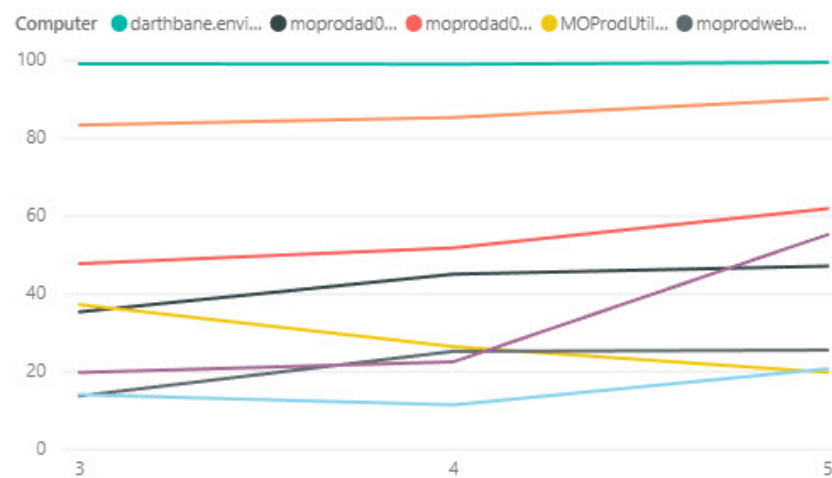
Distribution of Errors by Client and Environment Type



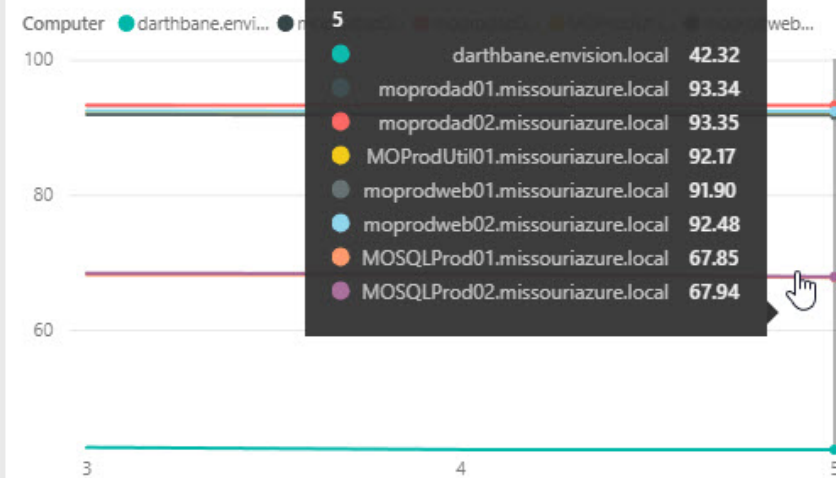
Number of Errors by Environment over Time



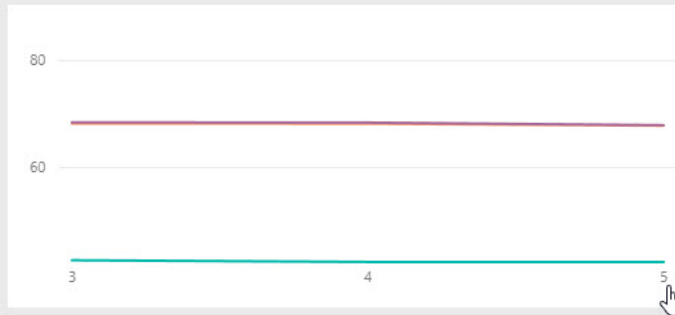
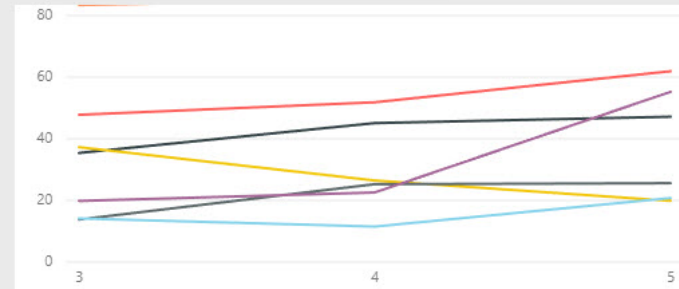
Max CPU % Processor Time



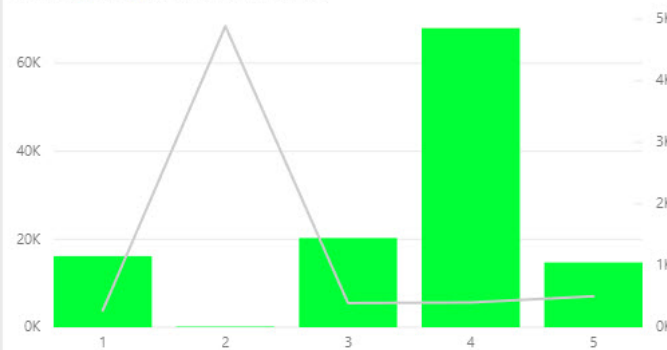
% Free Disk Space



Ask a question about your data

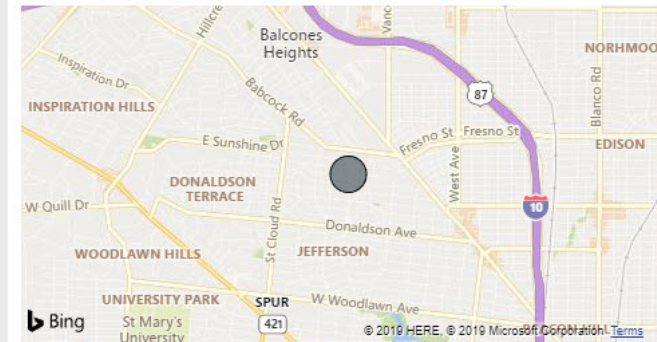


Http Status Codes and Response Time Over Time

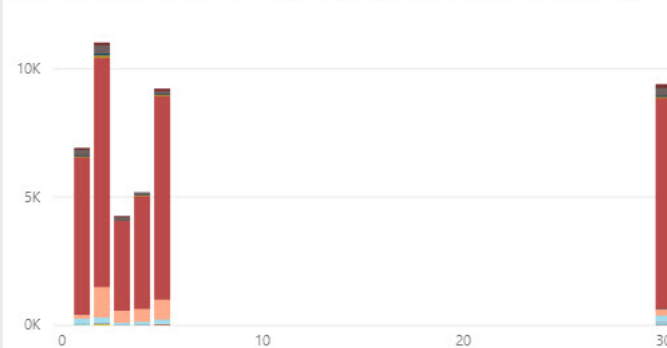
scStatus  200  500  Average of TimeTaken

Remote IP Lat and Long of Web Service Log Calls

*TEXAS CALLS ARE DUE TO DATA CENTER LOCATION

RemoteIPCountry  United States

Count of Event Source by Day

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

Application Errors

Date

timestamp

Last

1

Weeks

7/30/2019 - 8/5/2019

Environment

Search

Production

UNKNOWN

QA

Test

Training

Jurisdiction

Search

American S...

Nevada

New Mexico

Arkansas

FSM

Error Type over Time

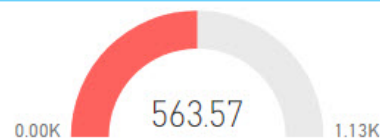
Search

Server

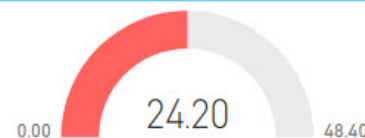
Client

API

Avg Number Of Errors Per Day



Avg Number Of Errors Per Hour



Number of Errors

3945

Count of timestamp

WebIz Version

Search

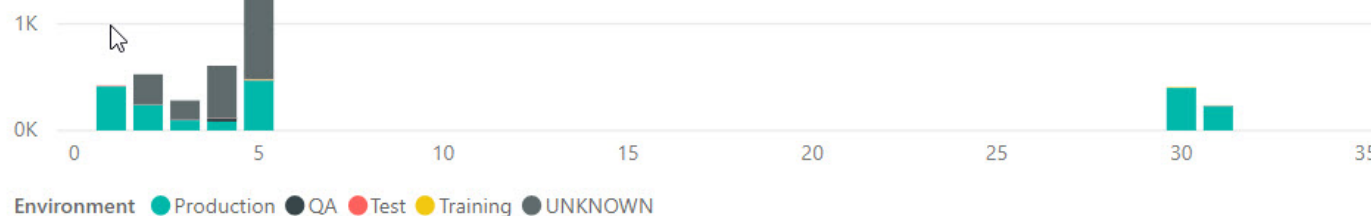
19.2.20190426

17.9.20181207

19.2.20190531

18.1.20180727

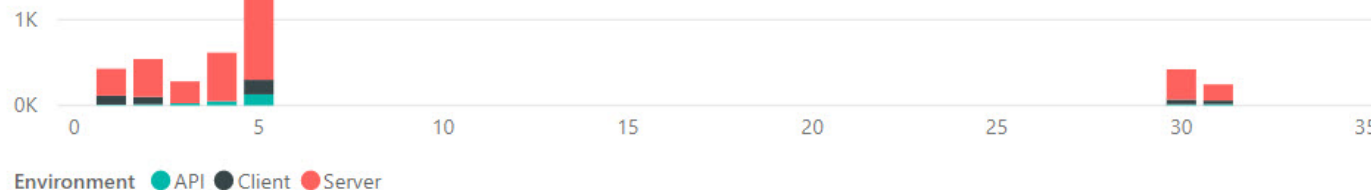
Number of Errors by Environment over Time



Number of Errors by Jurisdiction over Time



Number of Errors by Error Type over Time



Browser

Search

IE6

Chrome75

InternetExplor...

IE 11.0

Mozilla

Machine Name

Search

tamaizweb.D...

nsipwebprod...

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

AA

AW

AE

AI

AF

Message Type Category

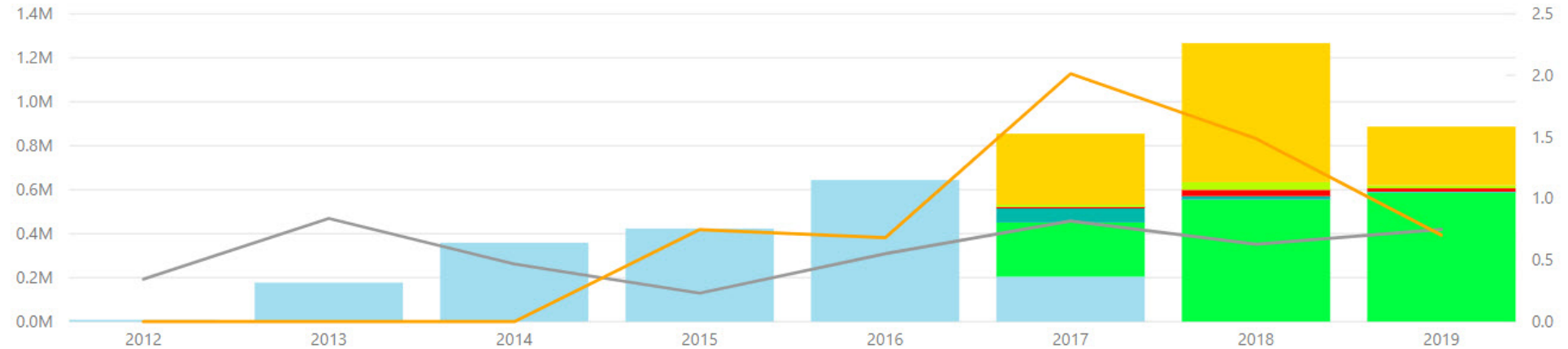
Search

Vaccination U...

Query

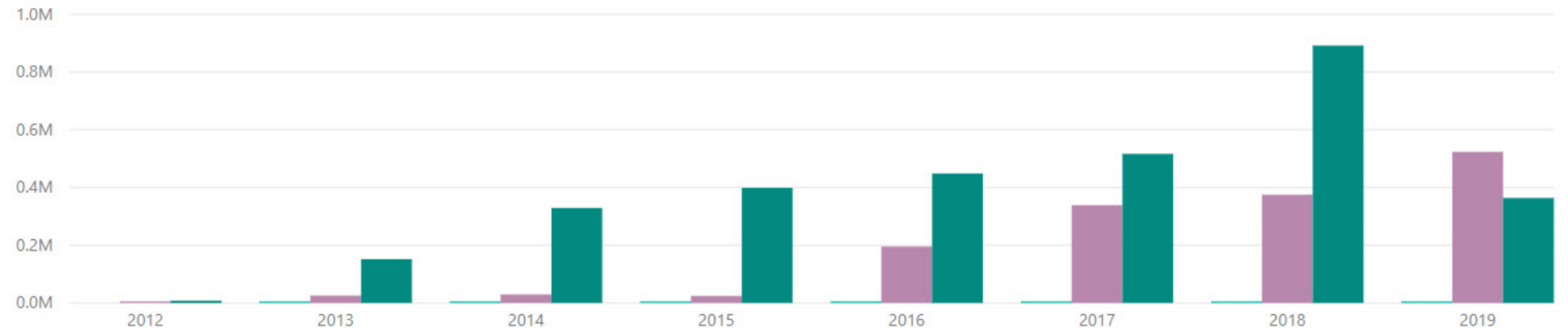
Custom Ack Codes Over Time

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 Over Time

hl7_message_type_category_code (Blank) Query Vaccination Update



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



Message Type Category

Search

Vaccination U...

Query



Provider Volume and Message Quality



NEMOURS PEDIATRICS

WALGREENS HAPPY HARRY'S

WIC.WOW

FIRST STATE PE...

CHRISTIA...

MID SU...

provider_desc BEEBE MEDICAL GROUP
Count of global_hl7_log_id 250112

...ICAL GROUP

BAYHEALTH

RITE AID PHARMACY

CHRISTIANA HOSPITAL

CENTER FOR PE...

ABC PE...

UNITE...

WAL-...

PEDI...

DEL...

NEMOURS AI D...

DEDICA...

AI...

A...

WESTSIDE FAMI...

HIGH SC...

PR...

BEACON PEDIA...

COMPLE...

BEEB...

CVS PHARMAC...

RAINBO...

(Blank)

NAN...

FAM...

WIN...

Key Influencers for ERR Segments

Error Count

778.11K

Jurisdiction

Nevada

Environment

QA

Message Date

7/20/2012

7/29/2019

Application Instance

Search

Nevada QA

Message Type Category

Search

Query

Vaccination U...

Key Influences for ERR segments

Key influencers Top segments

What influences count_err_errors_and_warnings_combined to Increase ?

When...

...the average of
count_err_errors_and_warnings_c
increases by

clinic_desc is AIRA TESTING
CLINIC

7.34

provider_desc is NEVADA
STATE IMMUNIZATION
PROGRAM

7.26

Time is 2:31:00 AM - 3:10:00
AM

4.68

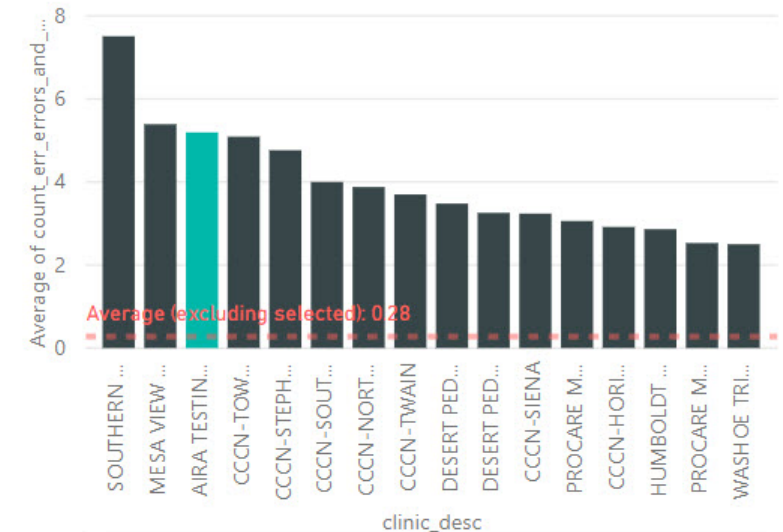
Day Name is Sunday

3.43

Month Name is May

2.21

← count_err_errors_and_warnings_combined is more likely to increase when clinic_desc is AIRA TESTING CLINIC than otherwise (on average).



☐ Only show values that are influencers

Key Influencers for Performance

Message Count

1.24M

Jurisdiction

Nevada

Environment

QA

Message Date

11/26/2017

7/29/2019

Application Instance

Search

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

Increase

?

When...

...the average of
duration_seconds_hl7
increases by

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

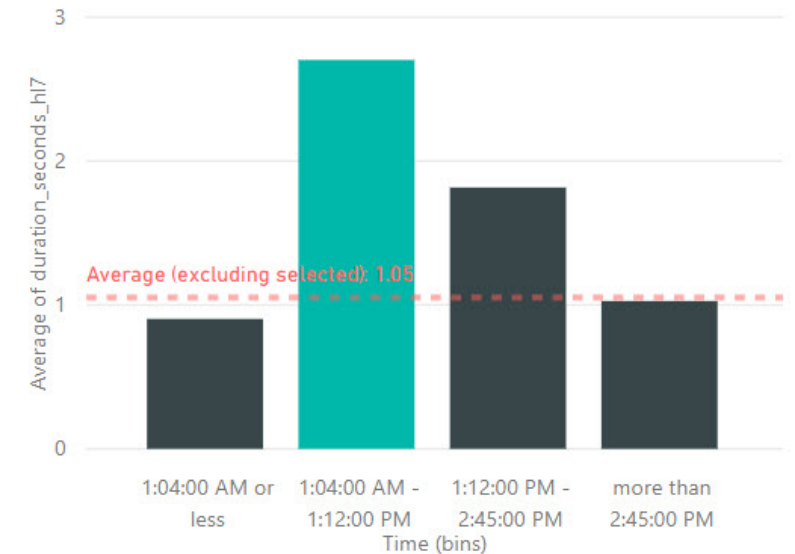
provider_desc is ST ROSE DOMINICAN HOSPITAL - DE LIMA

1.02

clinic_desc is ST ROSE DOMINICAN HOSP - DE LIMA

1.02

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



☐ 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

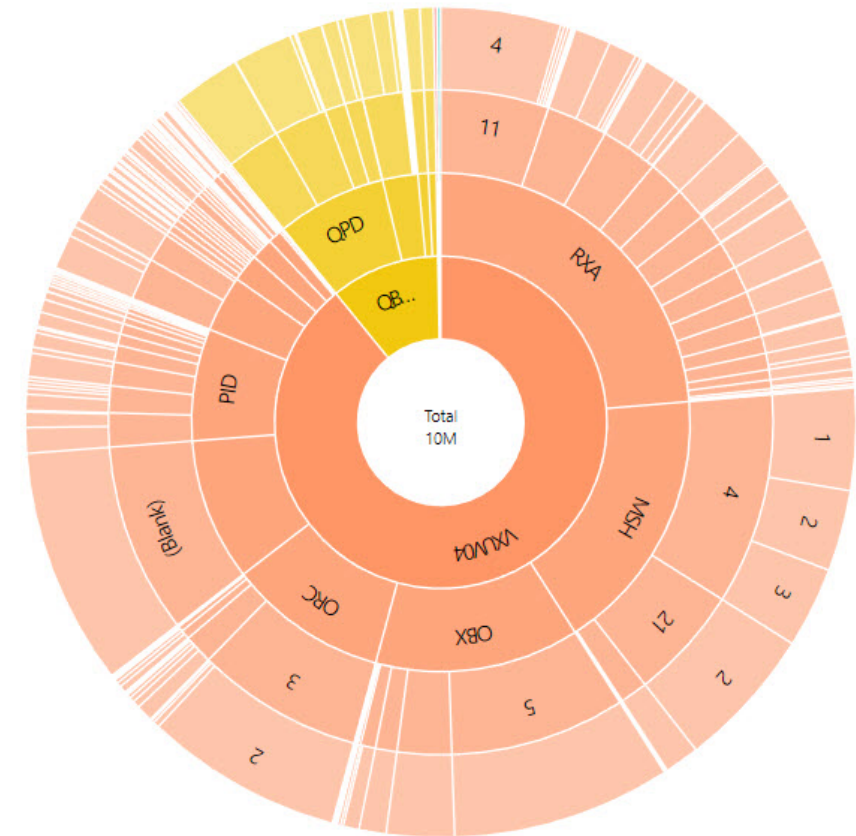


user_message	Count of global_hi7_log_error_segment_value_id
ORC-3 (FillerOrderNumber): Has a conditionally required element [NamespaceID]. Expectation: value EI.2 is required when EI.1 is present.	779497
MSH-21 (MessageProfileIdentifier[1]): Has a conditionally required element [NamespaceID]. Expectation: value EI.2 is required when EI.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

hi7_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

AA

AW

AF

AI

AE

AR

Message Type Category

Search

Vaccination U...

Query

Lab Update

Query Respon...

Batch

Vaccination R...

Message Type relationships to performance and ERRs

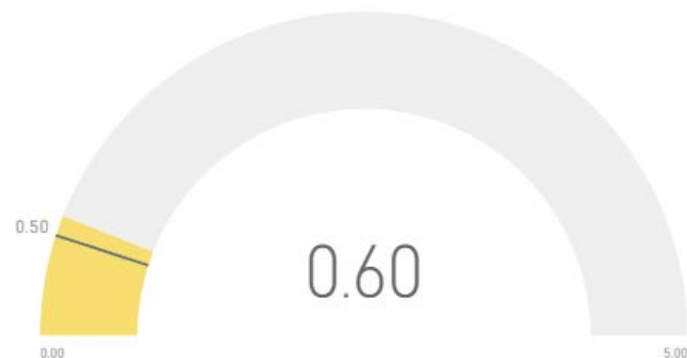
count_err_errors_and_warnings_combined duration_seconds_hl7



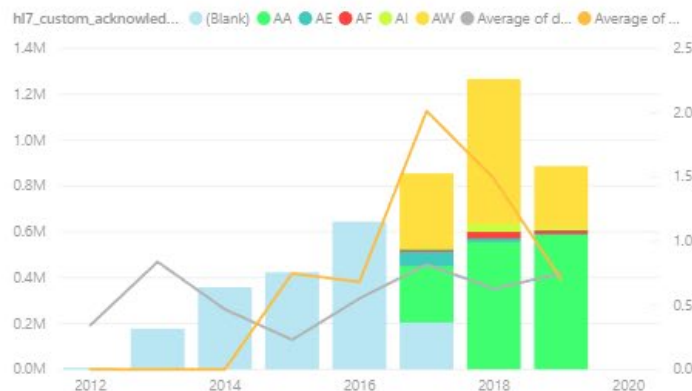
More features...

Ask a question about your data

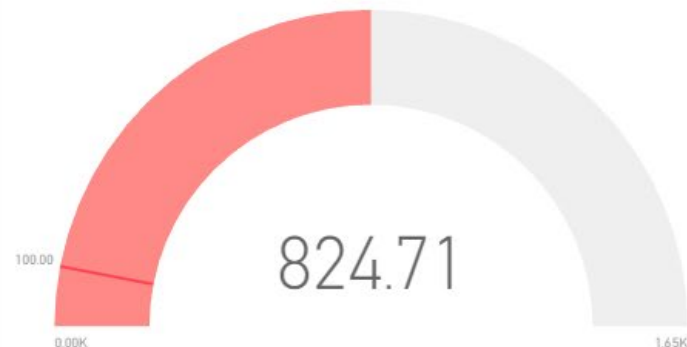
Global Production HL7: Avg Number of ERRs per Message Today
IN ALL THE TRACKED PRODUCTION ENVIRONMENTS WHAT IS THE AVERAGE NUMBER ...



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...



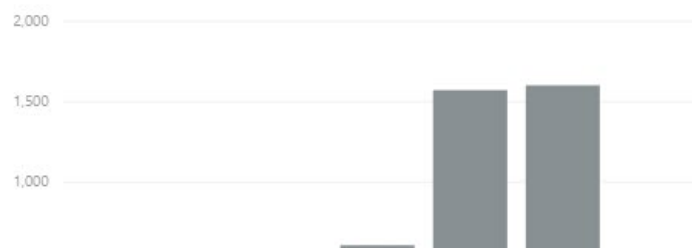
Global All Environments HL7: Availability Tests
TEST ALL METHODS OF ALL WEB SERVICE ENDPOINTS EVERY 5 MINUTES FOR AVAIL...



Distribution of Errors by Client and Environment Type



Number of Errors by Environment over Time



Manage alerts

[+ Add alert rule](#)

Alert for Global Production HL...

Active

☒ On

Alert title

Alert for Global Production HL7: Avg Number of ERRs

Set alerts rule for

Avg Number of Errors and Warnings per Message in

Condition

Threshold

Above

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

[Use Microsoft Flow to trigger additional actions](#)

Save and close

Cancel

Application 360 Dashboard

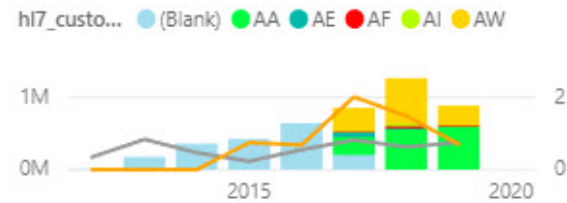
Global All Environments HL7: Availability Tests
TEST ALL METHODS OF ALL WEB SERVICE ENDPOINTS E...



Global Production HL7: Avg Number of ERRs per M...
IN ALL THE TRACKED PRODUCTION ENVIRONMENTS WH...

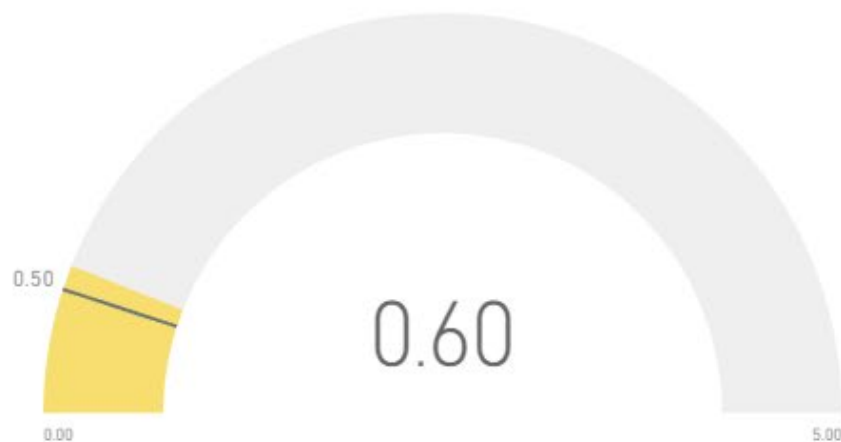


Global All Environments HL7: Custom Ack Codes ov...

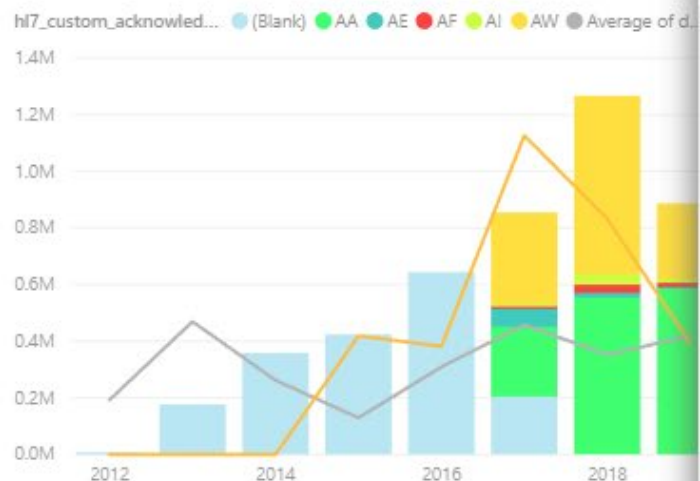


Ask a question about your data

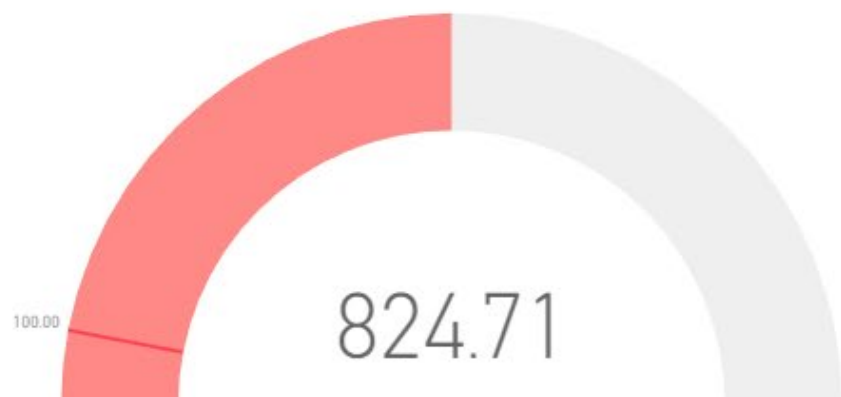
Global Production HL7: Avg Number of ERRs per Message Today
IN ALL THE TRACKED PRODUCTION ENVIRONMENTS WHAT IS THE AVERAGE NUMBER ...



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 F



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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

8/5/2019

End date

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.

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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