Hewlett Packard
Enterprise

Big Data Conference 2016

#SeizeTheData

Please give me your feedback

Session ID: B9862 **Speaker:** Eli Groesbeck, Dan Woicke

—Use the mobile app to complete a session survey

1. Access “My schedule”
2. Click on the session detail page
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   - If the session is not on your schedule, just find it via the app’s “Session Schedule” menu, click on this session, and scroll down to “Feedback”
   - If you don’t have it, **download the event app today.** Go to your phone’s app store and search for “**HPE Events**”

—To access the session survey online, go to the Agenda Builder in the event session catalog and click on your session

Thank you for providing your feedback, which helps us enhance content for future events.

Improve clinical efficiency, patient experience, and population health with real world analytics

Eli Groesbeck
Director, Population Health

Dan Woicke
Director, Enterprise System Management

Cerner

Cerner’s Operational Analytics

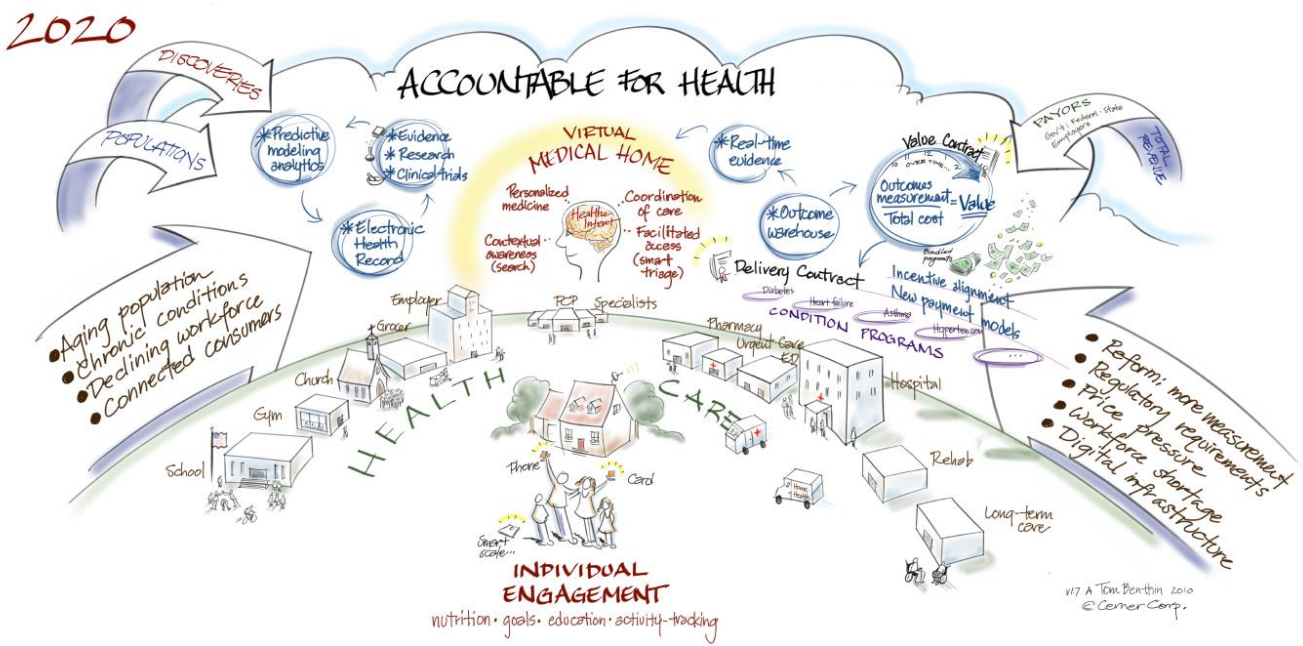
Dan Woicke

Director, Enterprise System Management

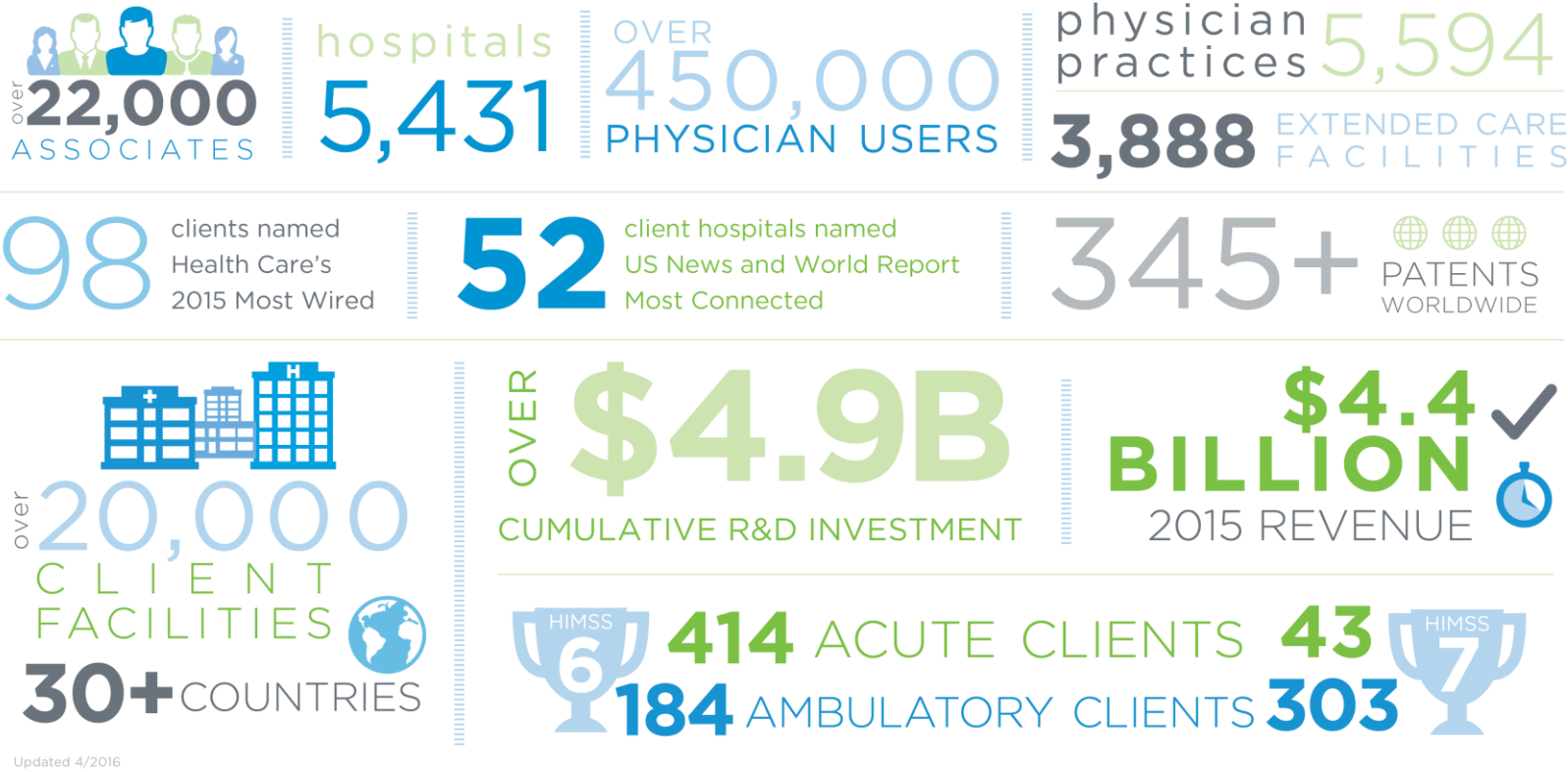
Cerner

Our mission

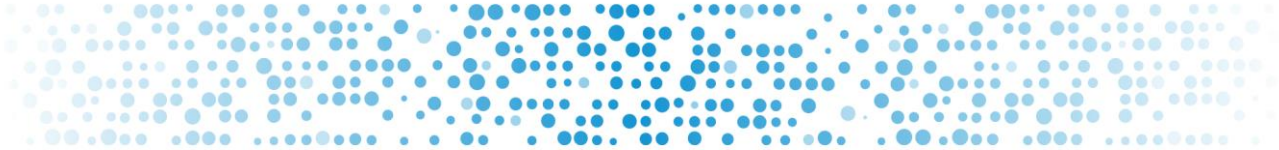
Contribute to the systemic improvement of health care delivery and the health of communities.



Cerner today



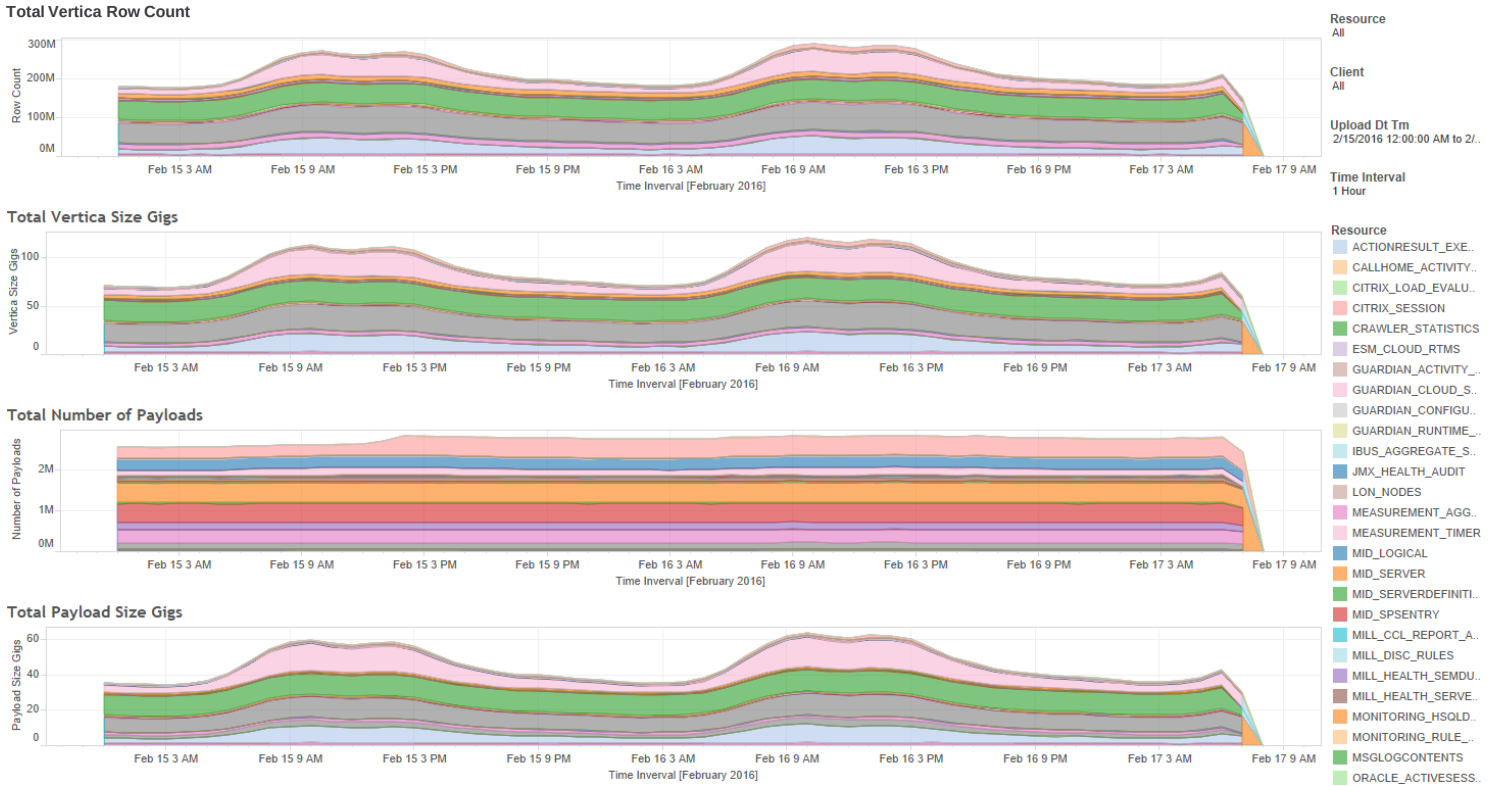
Data, Data and More Data



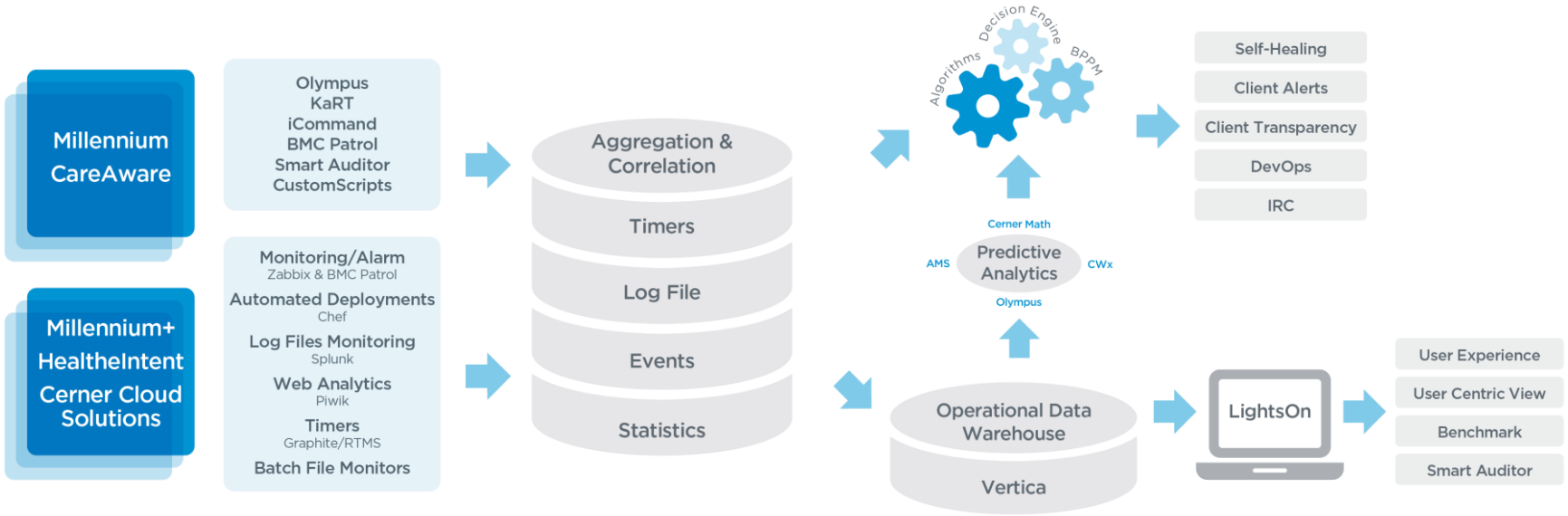
We continue to bring on more and more data sets weekly

- Operating System (CPU/Memory/Disk across Windows/Linus/HP-UX/AIX)
- Millennium (Citrix/App Tier/ Database/Websphere)
- End User Device Network Latency
- SAN RAW and Events
- Network Switches Events
- RTMS – 1.2B rows per day
- Package Installs
- Service Requests

Data Sizing


Total Vertica Row Count
Row Count
300M
200M
100M
0M
Feb 15 3 AM
Feb 15 9 AM
Feb 15 3 PM
Feb 15 9 PM
Feb 16 3 AM
Feb 16 9 AM
Feb 16 3 PM
Feb 16 9 PM
Feb 17 3 AM
Feb 17 9 AM
Time Inverval [February 2016]
Total Vertica Size Gigs
Vertica Size Gigs
100
50
0
Time Inverval [February 2016]
Total Number of Payloads
Number of Payloads
2M
1M
0M
Time Inverval [February 2016]
Total Payload Size Gigs
Payload Size Gigs
60
40
20
0
Time Inverval [February 2016]
Resource
All
Client
All
Upload Dt Tm
2/15/2016 12:00:00 AM to 2/..
Time Interval
1 Hour
Resource
ACTIONRESULT_EXE..
CALLHOME_ACTIVITY..
CITRIX_LOAD_EVALU..
CITRIX_SESSION
CRAWLER_STATISTICS
ESM_CLOUD_RTMS
GUARDIAN_ACTIVITY_..
GUARDIAN_CLOUD_S..
GUARDIAN_CONFIGU..
GUARDIAN_RUNTIME_..
IBUS_AGGREGATE_S..
JMX_HEALTH_AUDIT
LON_NODES
MEASUREMENT_AGG..
MEASUREMENT_TIMER
MID_LOGICAL
MID_SERVER
MID_SERVERDEFINITI..
MID_SPSENTRY
MILL_CCL_REPORT_A..
MILL_DISC_RULES
MILL_HEALTH_SEMDU..
MILL_HEALTH_SERVE..
MONITORING_HSQLD..
MONITORING_RULE_..
MSGLOGCONTENTS
ORACLE_ACTIVESESS..

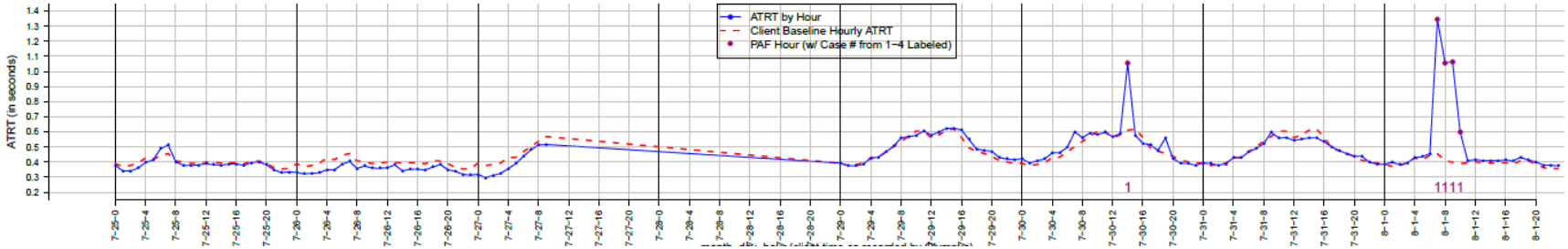
ESM Cloud Based Architecture



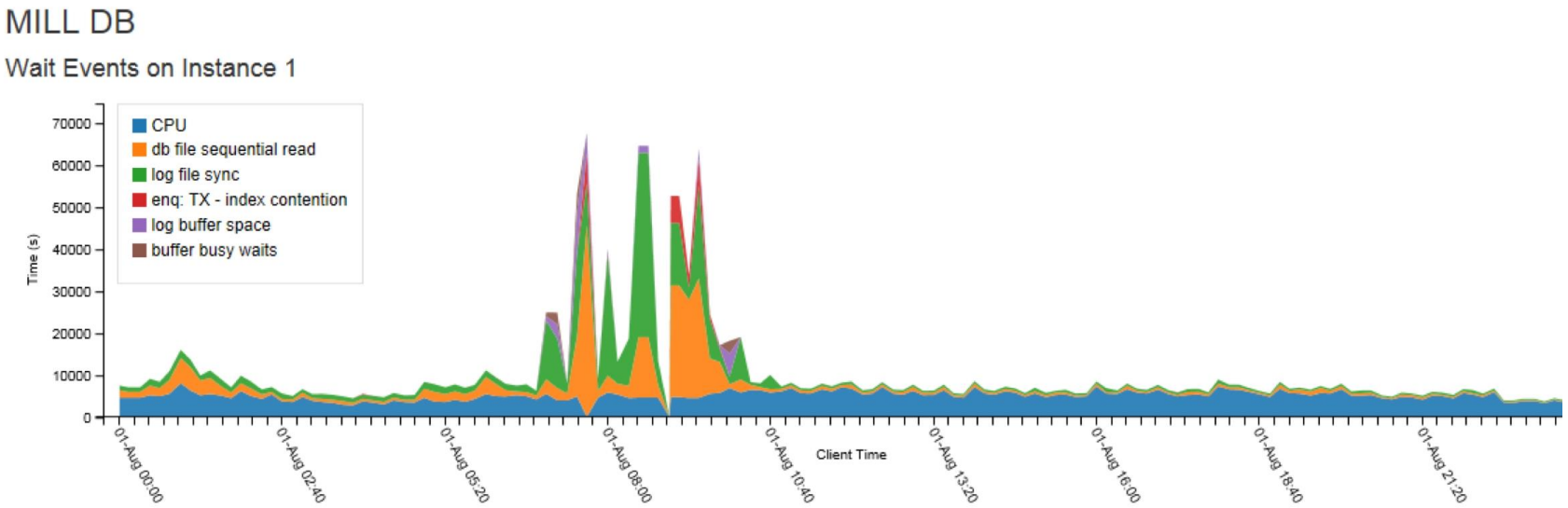
Performance Abnormality Flags

PAFs are markers in time which represent end user performance degradation as compared to the same hour of the week over a 30 day observation period.

PAF Analysis

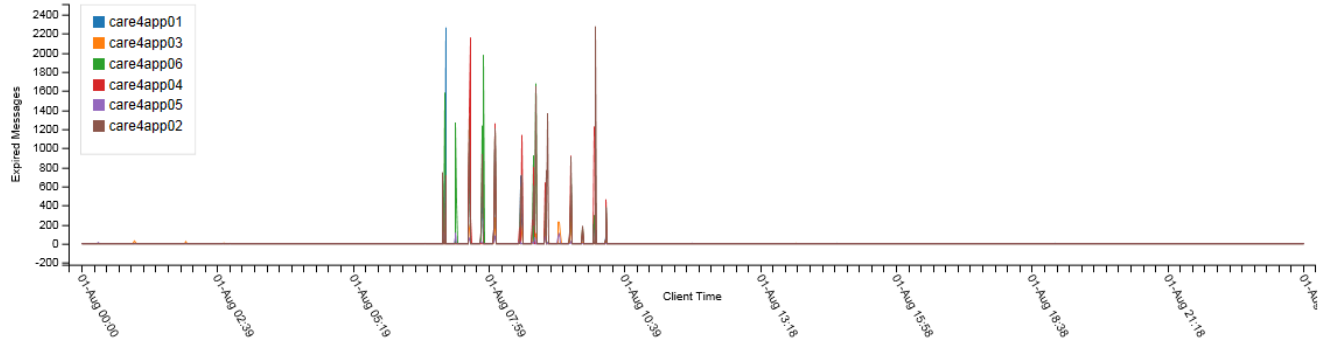


PAF Analysis

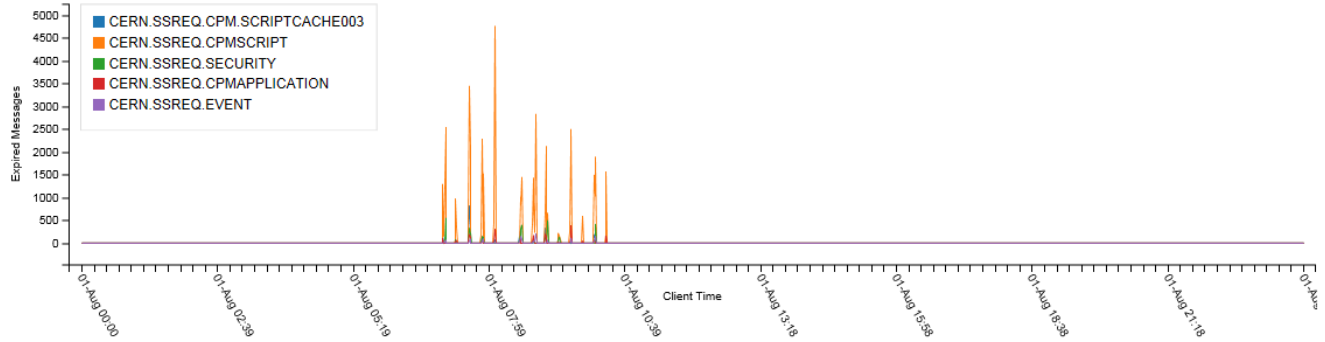


PAF Analysis

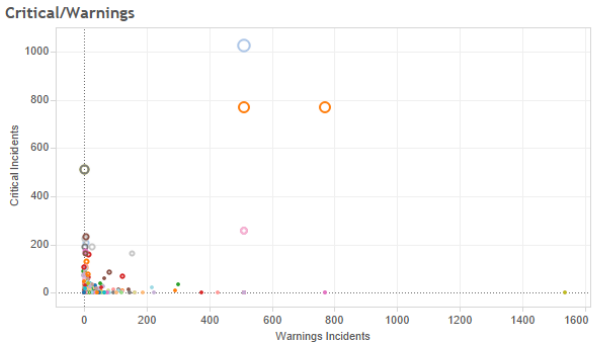
SSREQ Expired Messages by Node

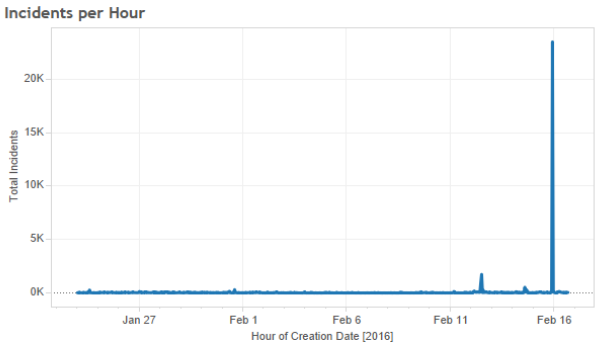


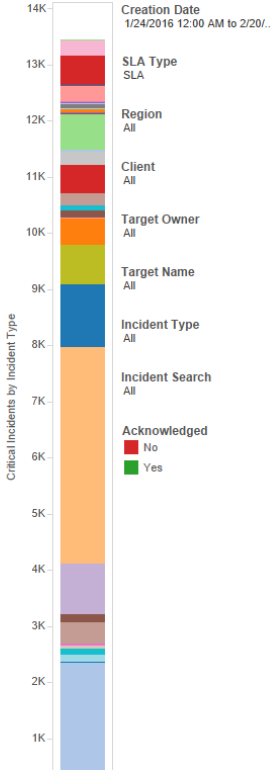
SSREQ Top Expired Messages by Queue



Oracle Enterprise Manager Incidents and Warnings



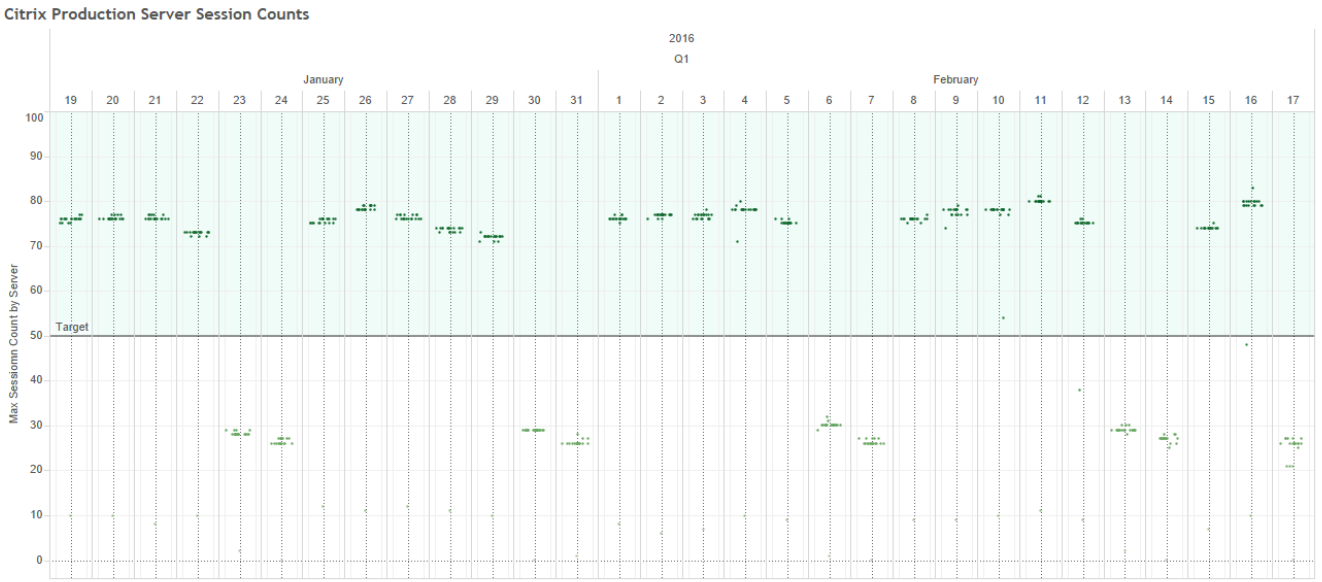




Incident Details - Select an Incident to view it in OEM

Target Owner	Target Name	Creation Date	Incident
Aju,Thomas	+ASM1_hmcprdb1.hmccis.qa	1/26/2016 4:10 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenunable to connect to http server at https://skyboxdbcentral.cernerasp.com:1159/empbs/upload. [peer not authenticated]).
		1/27/2016 5:16 AM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenFailure connecting to https://skyboxdbcentral.cernerasp.com:1159/empbs/upload , err Connection establishment timed out).
		2/10/2016 4:33 AM	Agent is Unreachable (REASON = Unable to connect to the agent at https://hmcprdb1.hmccis.qa:3872/emd/main/ [Connection refused]). Host is unreachable (REASON = Ping timed out.).
		2/15/2016 10:19 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenunable to connect to http server at https://skyboxdbcentral.cernerasp.com:1159/empbs/upload. [peer not authenticated]).
	+ASM1_ov01lnx176.pdc.huca..	1/30/2016 5:19 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenFailure connecting to https://skyboxdbcentral.cernerasp.com:1159/empbs/upload , err Connection establishment timed out).
		1/30/2016 5:23 PM	Agent is Unreachable (REASON = Unable to connect to the agent at https://ov01lnx176.pdc.hucahis.gae4.pa:3872/emd/main/ [Connection establishment timed out]). Host is unreachable (REASON = Ping timed out.).
		2/15/2016 9:23 AM	Agent has stopped monitoring. The following errors are reported : Connection refused.
		2/15/2016 10:12 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenunable to connect to http server at https://skyboxdbcentral.cernerasp.com:1159/empbs/upload. [peer not authenticated]).
		2/15/2016 10:21 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenunable to connect to http server at https://skyboxdbcentral.cernerasp.com:1159/empbs/upload. [peer not authenticated]).
	+ASM1_prphdb01.pdc.ssib.lo..	2/15/2016 10:11 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenunable to connect to http server at https://skyboxdbcentral.cernerasp.com:1159/empbs/upload. [peer not authenticated]).
		2/15/2016 10:21 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenunable to connect to http server at https://skyboxdbcentral.cernerasp.com:1159/empbs/upload. [peer not authenticated]).
	+ASM2_hmcprdb2.hmccis.qa	1/25/2016 10:23 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenFailure connecting to https://skyboxdbcentral.cernerasp.com:1159/empbs/upload , err Connection establishment timed out).
		2/15/2016 10:19 PM	Agent is unable to communicate with the OMS. (REASON = Agent is Unreachable (REASON : Agent to OMS Communication is brokenunable to connect to

Simultaneous User Per Citrix Server

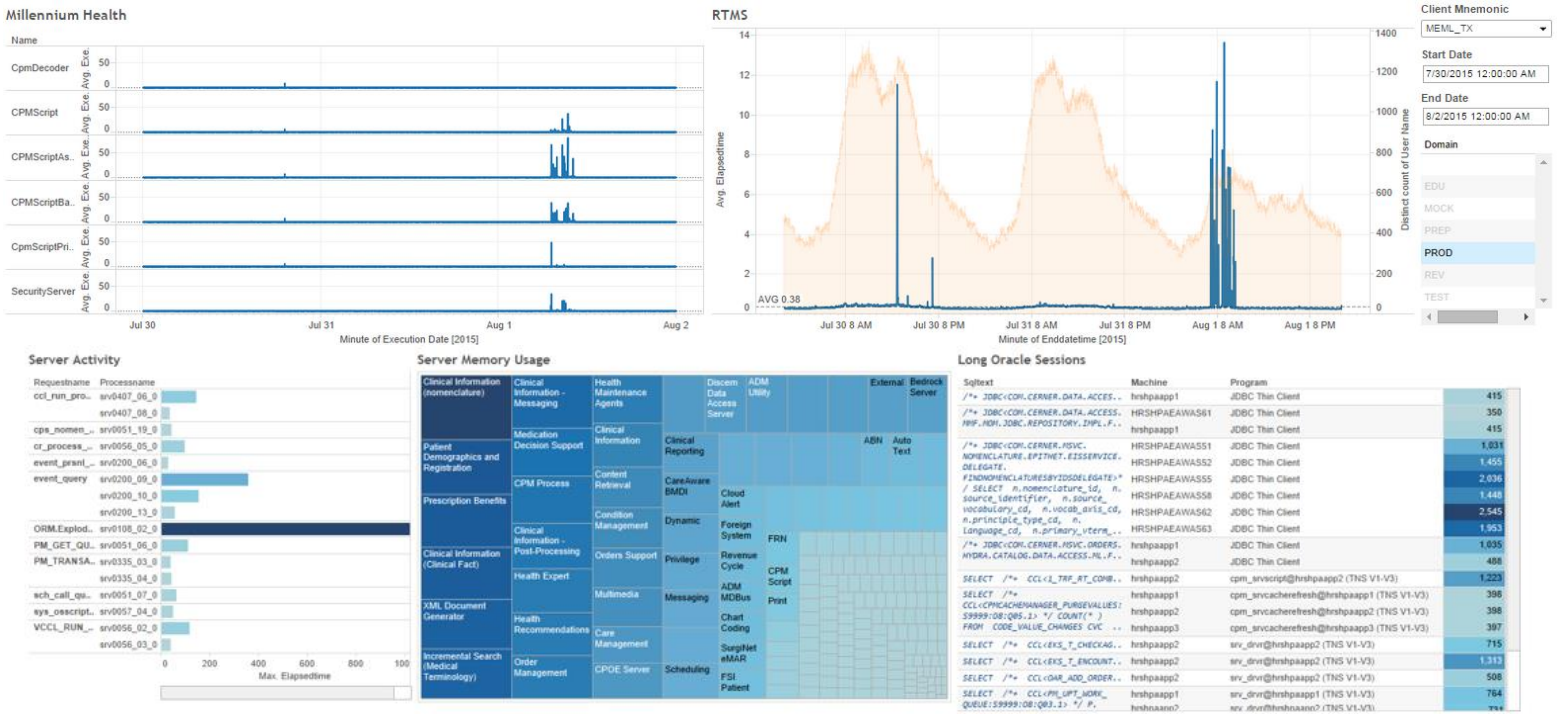


node_name	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6
AHTUAZCTX71	10.00	10.00	8.00	10.00	2.00	0.00	12.00	11.00	12.00	11.00	10.00	0.00	1.00	8.00	6.00	7.00	10.00	9.00	1.0
AHTUAZCTX72	76.00	77.00	77.00	73.00	28.00	26.00	76.00	78.00	77.00	73.00	72.00	29.00	26.00	77.00	77.00	76.00	71.00		
AHTUAZCTX73	76.00	76.00	76.00	73.00	28.00	27.00	76.00	78.00	77.00	74.00	72.00	29.00	26.00	76.00	76.00	76.00	78.00	75.00	30.0
AHTUAZCTX74	77.00	76.00	76.00	72.00	29.00	27.00	75.00	79.00	76.00	73.00	72.00	29.00	26.00	76.00	77.00	77.00	78.00	75.00	30.0
AHTUAZCTX75	75.00	76.00	76.00	72.00	28.00	26.00	76.00	78.00	77.00	74.00	72.00	29.00	26.00	77.00	77.00	77.00	78.00	76.00	29.0
AHTUAZCTX76	75.00	77.00	76.00	73.00	28.00	27.00	75.00	79.00	76.00	74.00	72.00	29.00	26.00	76.00	76.00	76.00	78.00	75.00	30.0

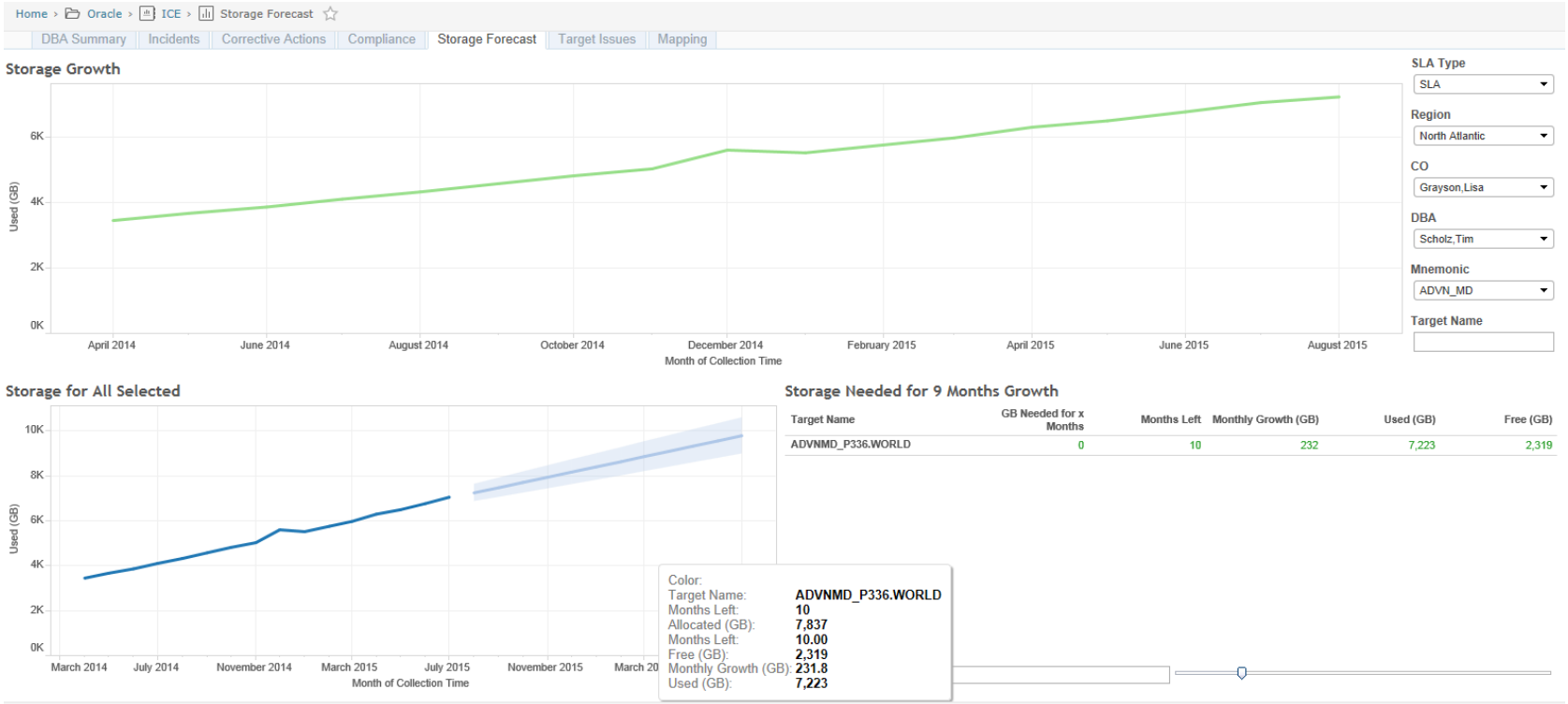
Citrix RTT

+ableau
Site: Default
Search
Woicke,Dan
Home
Client Operations
ICA Roundtrip Time Dashboard
ICA RTT Dashboard
Undo
Redo
Revert
Refresh
Pause
Subscribe
Custom Views
Share
Download
ICA RTT Dashboard
ICA RTT by Type(s)
Day View
Hour View
Minute View
Client_Mnemonic
THCH6_TX
% over 80(ms)
0
100
Avg. Latency (ms)
0
1,000
Total # of Records
1
387
View By...
Device
ICA RTT by Device
Avg. Latency (ms)
% over 80(ms)
View Type
(All)
Start_Dt_Tm
1/25/2016 12:00:00 AM
End_Dt_Tm
1/29/2016 12:00:00 AM
Max_Last_Recorded...
1,000
Device Type
Non-Mobile Devices
User Search
Device Search
Jan 25
Jan 27
Day View
Hour View
Minute View

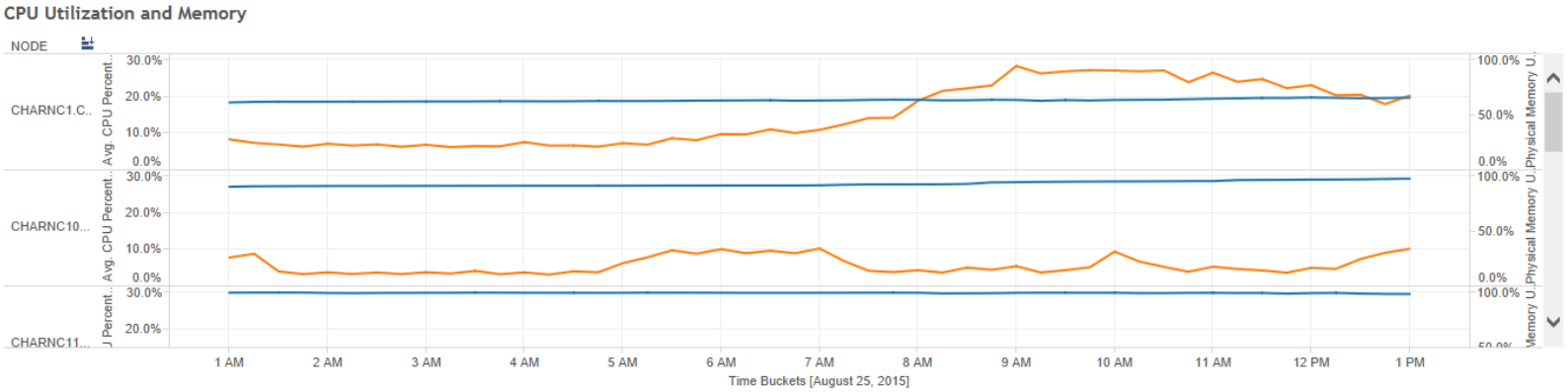
Millennium Dashboard

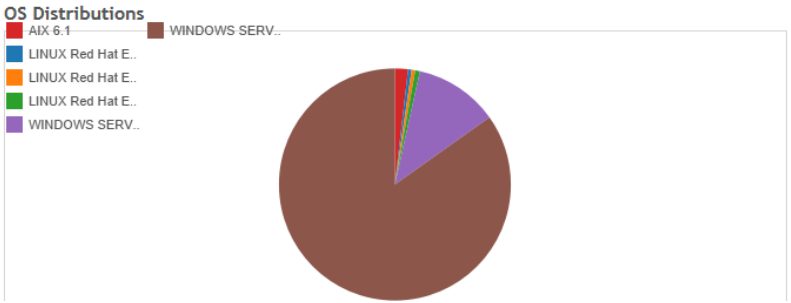


Database Capacity Planning



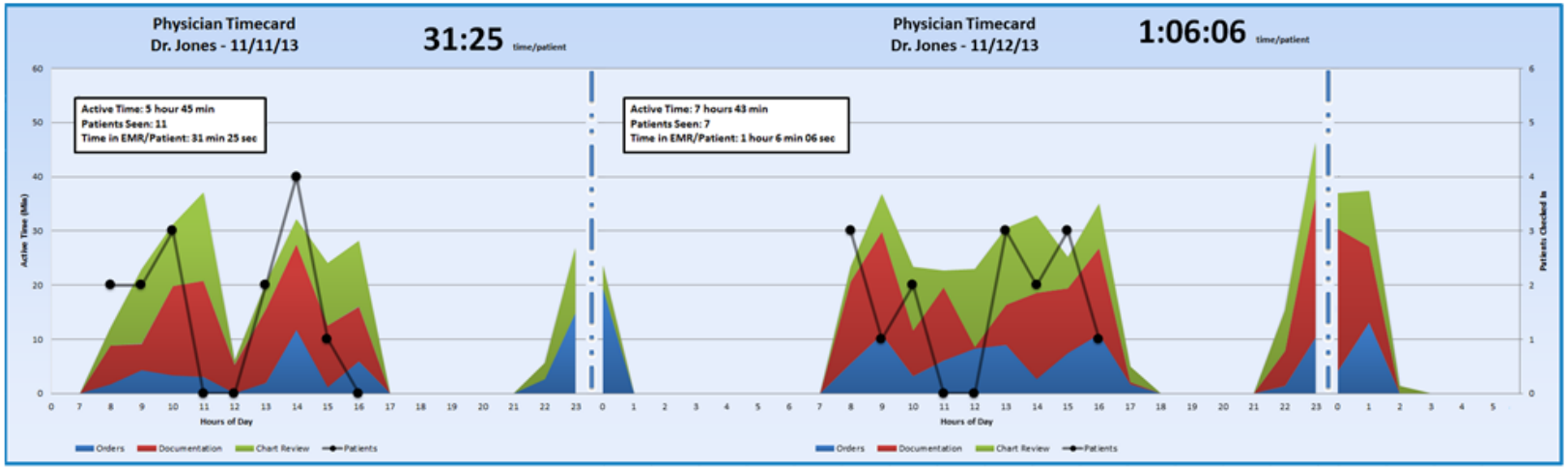
Operating System Statistics



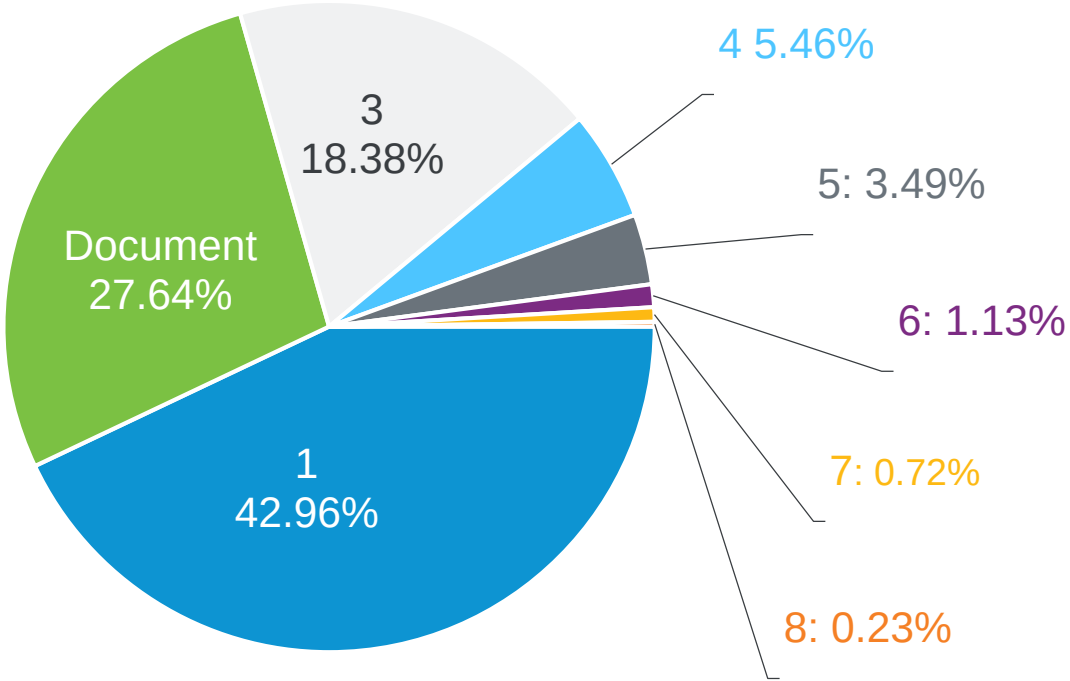


Node	Full Operatin..	Total Physic..	Cpu Count	System Uptime i..
CHARNC1.CERNERASP.COM	AIX 6.1	185.75	176	102.533865741
CHARNC10.CERNERASP.COM	AIX 6.1	62	16	124.373206019
CHARNC3.CERNERASP.COM	AIX 6.1	185.75	176	102.268912037
CHARNC4.CERNERASP.COM	AIX 6.1	185.75	176	102.359791667
CHARNC6.CERNERASP.COM	AIX 6.1	185.7499389..	176	102.369386574
CHARNC7.CERNERASP.COM	AIX 6.1	185.75	176	102.093136574
CHARNC9.CERNERASP.COM	AIX 6.1	62.25	16	127.063726852
CHARNCCRWL01.CERNERASP.COM	LINUX Red H..	5.823963165	2	1232.075643519
CHARNCCTX01.TASP_MOCH3.CERNERASP.C..	WINDOWS S..	3.998622894	2	1.963483796
CHARNCCTX10.TASP_MOCH3.CERNERASP.C..	WINDOWS S..	15.989147186	24	7.792581019
CHARNCCTX22.TASP_MOCH3.CERNERASP.C..	WINDOWS S..	3.999065399	2	1.396608796
CHARNCCTX24.TASP_MOCH3.CERNERASP.C..	WINDOWS S..	3.999065399	2	6.345856481

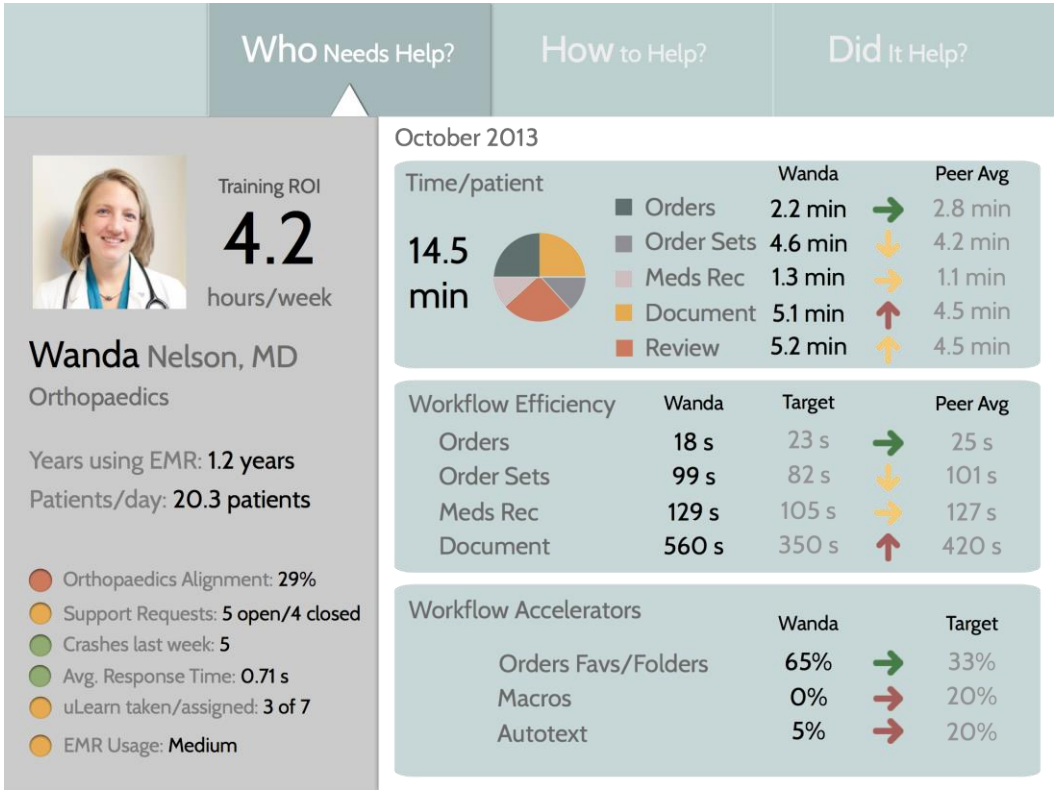
Deep Analysis of One Physician's Day



Where Do Physicians Spend Their Time in the EMR?



Need a title or context around this



Analytics and EDW

Eli Groesbeck

Director, Population Health

Cerner

Identifying opportunities and measuring outcomes

Efficiently utilizing data already available…

…and connecting to aggregated, normalized data from disparate sources for further analysis.

Industry Differentiators

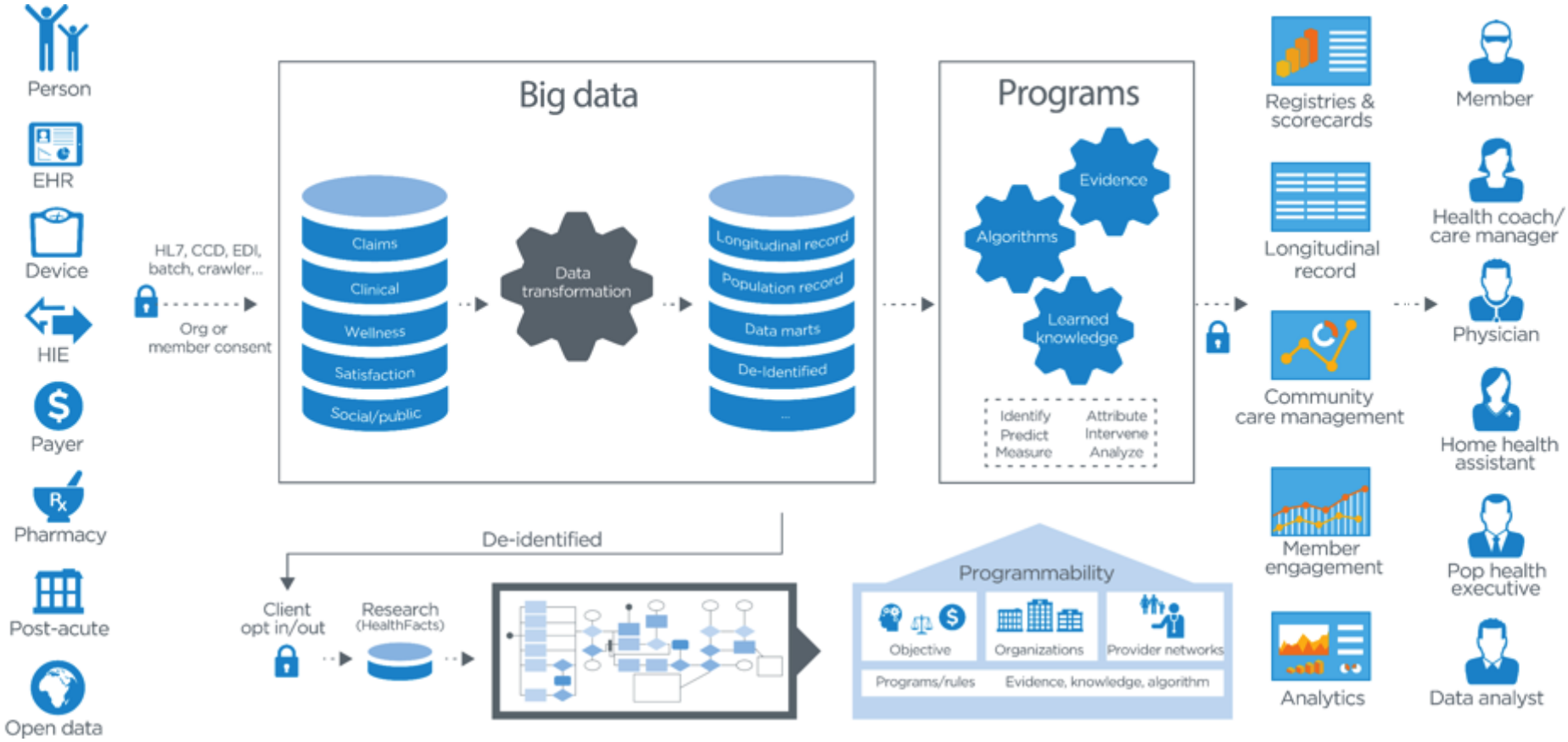
Centralized person-centric data aggregation and normalization
across multiple, disparate sources within a single platform

Streamlined process improvement
based on interactive visuals, out-of-the-box content and evidenced-based workflow

Integration within the appropriate workflow
to deliver the right information, to the right person, at the right time

Industry leading technologies
to customize and develop analytic capabilities

HealtheIntent Platform



177+ HealtheIntent unique LIVE connected data sources

Data types

- American Time Use Survey
- Appointment
- Charge
- Claim
- Claim bill
- Debt collection
- Demographic
- Diagnosis-related group
- Encounter
- Financial balance
- General ledger interface
- Health plan balance
- Person provider relationship
- Slot
- Statement bill
- Transaction

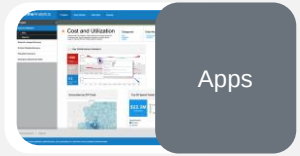
- HCAHPS (patient survey)
- Health care associated infection
- HUD census/zip
- NPPES
- Outpatient imaging efficiency
- Readmission, complication & death
- Relative value unit
- Social vulnerability index
- Timely & effective care
- Value-based purchasing

- Episode of care
- Immunization

(questionnaire)

*Information is current as of August 2015.

Workflow


Apps

Tableau

Business Objects

EHR

Intelligence

Views and Reports

- **Cost & Utilization**: Member Discovery; Frequent Flyer Discovery; …
- **Registries**: Provider Attrib.; Org. Quality Dash.; Measure Met % Trending; …
- **Home Care**: Patient Analysis Discovery; Financial Analysis Discovery; …
- …

Model

- Population Health
- Operational
- Financial
- Clinical
- …

Data

- Normalized Record
- Raw
- Custom
- Reference

Leverage Existing Capabilities

Client Development

HealtheIntent – Proven Scale

55M persons
Unique Persons

15M persons
HealtheRegistries

46M persons
HealtheAnalytics

10M Linked
Master Person Index

3M GB
Active Data

700 Nodes
Hadoop Cluster

110,000
Daily Processing Jobs

177
Sources Live

156
Sources In-process

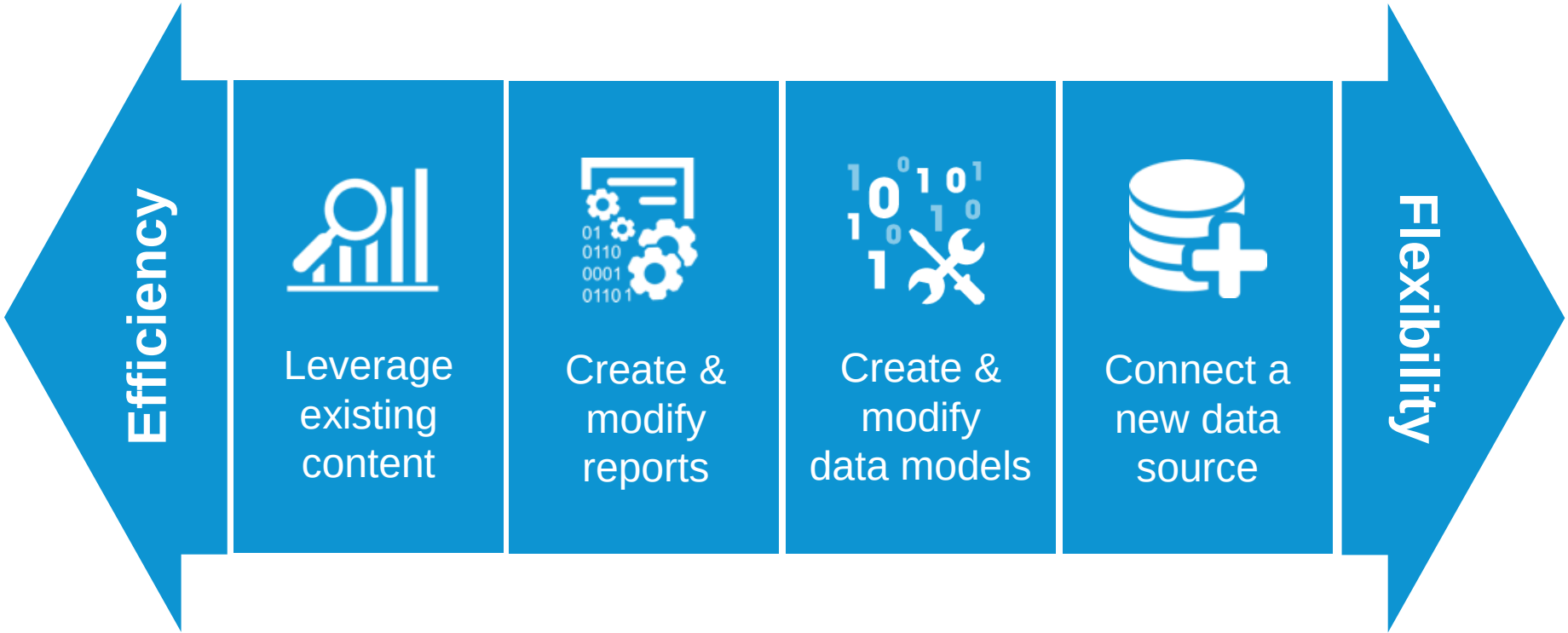
28+
Registries

350+
Measures

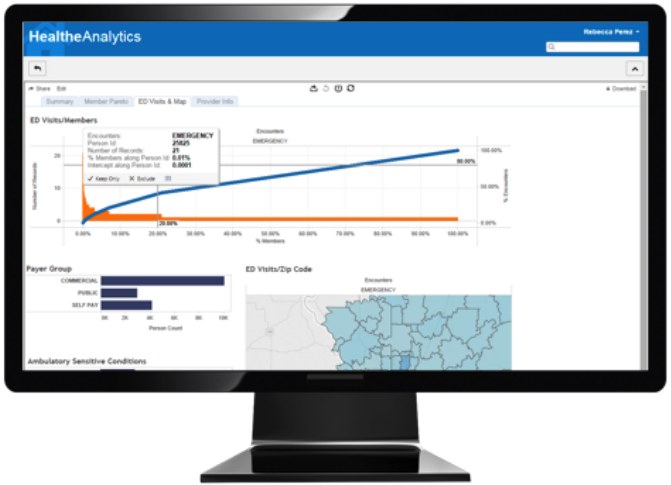
224,456
Proprietary Codes Mapped

29,473
Concepts Curated

Enterprise data warehouse tools



Data interaction and discovery visuals



Utilizes industry-leading visualization and business intelligence tools:

SAP® BusinessObjects:
Delivers key performance indicators with pre-defined interactions (drill paths, charts and graphs, etc.)

Tableau: Provides quick prototyping and interactive data exploration

Intelligence

Sepsis is Preventable

Rory Staunton
died of Sepsis in April 2012

March 28
Rory Staunton, an 11-year-old cut his arm during basketball practice in school

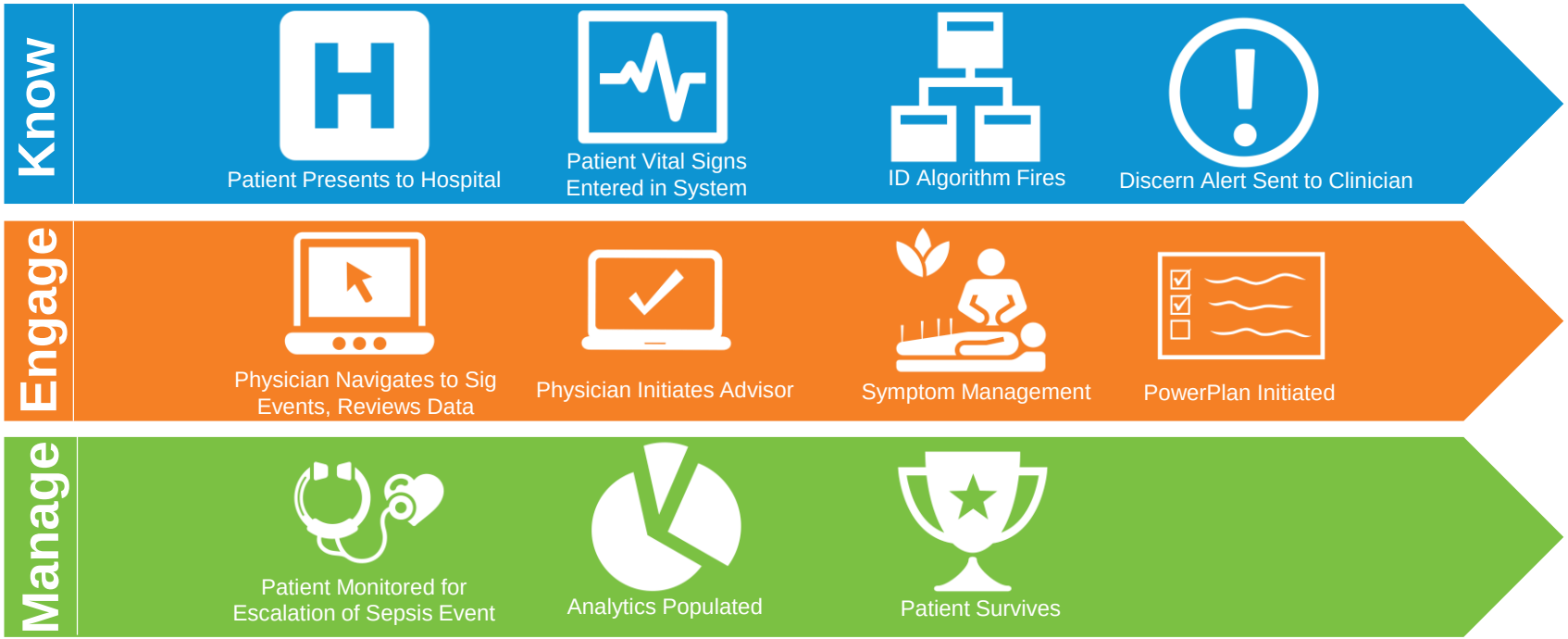
March 29, morning
Rory woke up vomiting and complaining of pain in his leg. By morning he had a fever of 104.

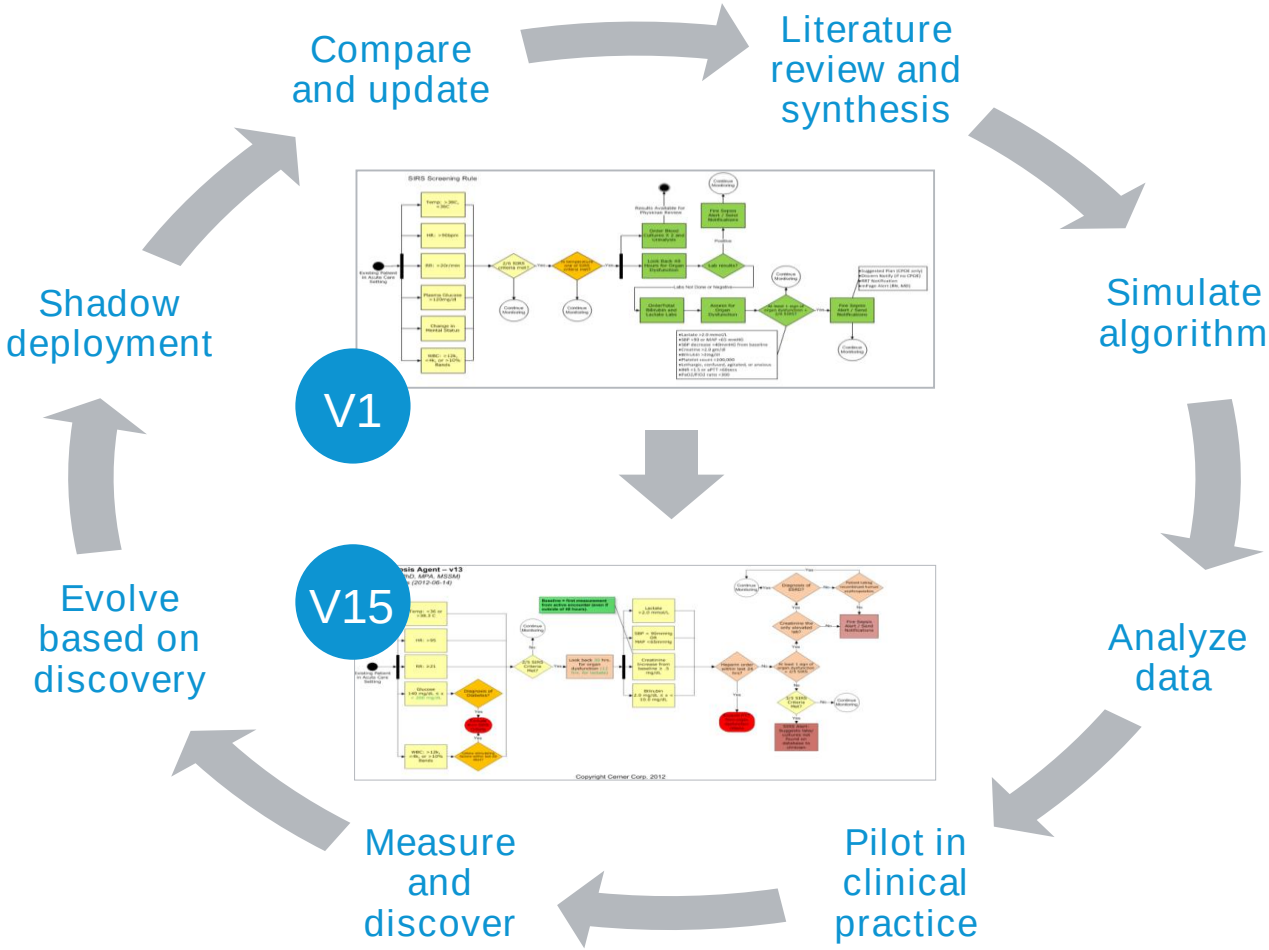
March 29, evening
Rory went to the emergency room and was discharged two hours later, after being diagnosed with “acute febrile gastritis” (the flu).

April 1
Rory Staunton died in intensive care, of severe septic shock brought on by the infection.

We can save lives, so other families won’t have to experience loss.

Sepsis Workflow




Literature review and synthesis
Simulate algorithm
Analyze data
Pilot in clinical practice
Measure and discover
Evolve based on discovery
Shadow deployment
Compare and update
V1
V15

Sepsis Client Achievements

TRINITY HEALTH
Novi, Michigan

- 1,980 lives saved since 2010
- Over $27.3 Million in cost savings
- Sepsis mortality rate decrease by 4.2%
- Sepsis LOS reduced from 9.8 days to 8.3 days

MEMORIAL HERMANN
Breakthroughs every day

- 156 lives saved in FY2014
- Sepsis, any diagnosis, mortality rate decrease by 1.42%
- Nearly 1 patient saved every 2 days

MIDDLESEX HOSPITAL

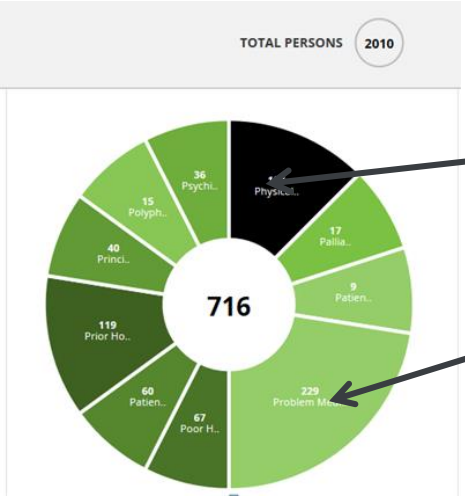
- Sepsis mortality rate dropped 20%
- Sepsis LOS reduced from 6.3 days to 4.8 days

Methodist Healthcare

- Sepsis mortality rate dropped 17%

Latest innovations

Readmission Prevention



- **20% more accurate** than industry (Yale, LACE, etc.)
- **3.5 FTE productivity savings** across system
- **Automated continuous calculation** of risk score in EHR
- **20% reduction in readmission rates** (for high risk patients)

Transition of Care of Model

Discharge Locations	Actual (Historic)	Model recommends higher level	Model recommends lower level	Model
Home	67.1%	11%	19%	66.4%
Home Health	13.2%			15.5%
SNF	14.7%			14.2%
Rehab	2.4%			1.6%
LTAC	2.6%			2.3%

- Model suggest **30% of the population could be sent to a more optimal venue** and achieve better outcomes
- Above venue shift accounts for **~$200 million in savings** from total cost of care
- "Exploratory analysis estimated that by better management of post-acute episodes and sending more beneficiaries to home health, Medicare could **save $34 billion to $100 billion over 10 years.**"

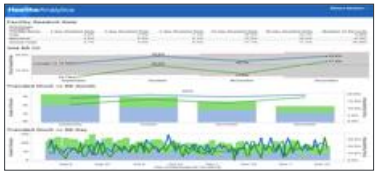
1] (Steven Landers, JAMA 2013;310(14):1443-1444)

Questions?

Appendix

Cost and Utilization

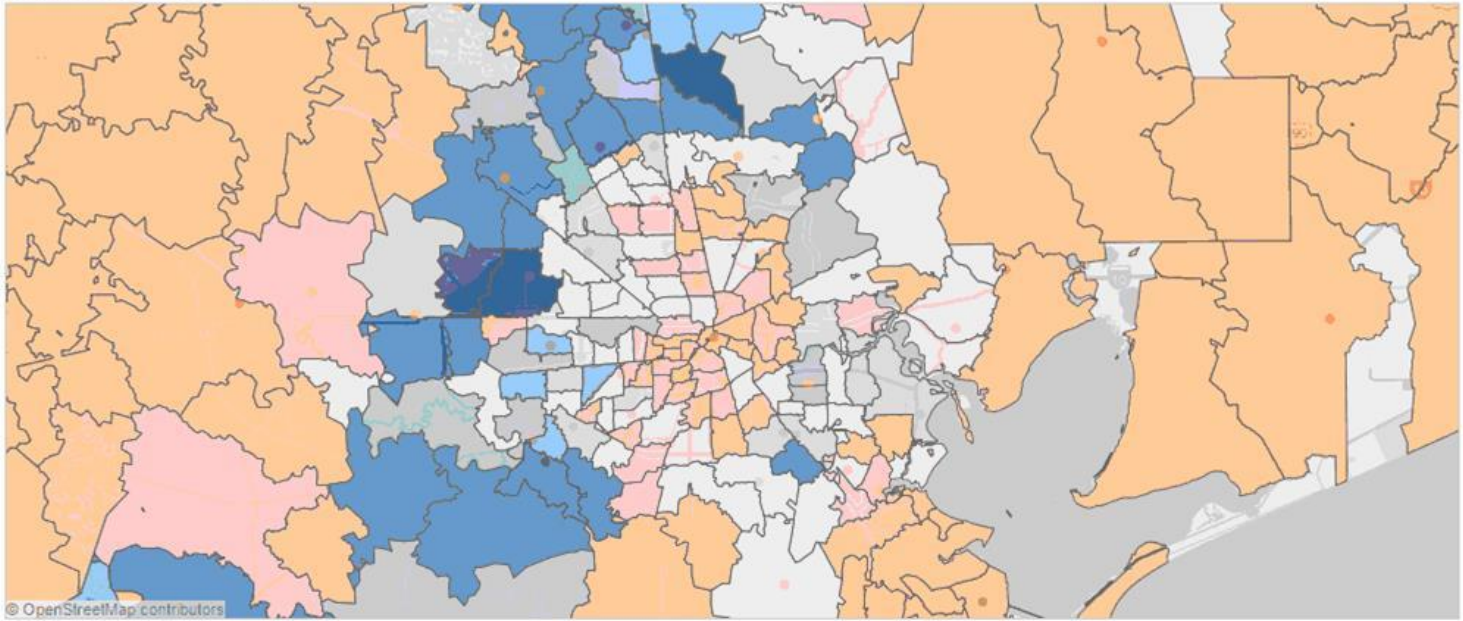
- **Claims Analytics**
  - PMPM / cost analysis
  - Risk stratification (MARA)
  - Utilization analysis
  - In Network/out of Network analysis
  - Member demographics analysis
  - Generic drug dispense analysis
  - Readmissions claims analytics
- **Quality Performance Analytics**
- **Value-based Payer Reporting**
- **Dimensions / Data Drill-in**
  - All Population, Payer/Plan, Region, Practice, Provider, CI-APCP, CI-APP & Member



Example Metrics

- ✓ Attributed population
- ✓ Member Months
- ✓ Risk-adjusted PMPM – Total
- ✓ Risk-adjusted PMPM – Medical
- ✓ Risk-adjusted PMPM – Rx
- ✓ Risk-adjusted PMPM – Inpatient
- ✓ Risk-adjusted PMPM – Outpatient
- ✓ Risk scores – concurrent & prospective
- ✓ PMPM (Real)
- ✓ Generic Drug Utilization
- ✓ High-cost Imaging/1000
- ✓ Admits/1000
- ✓ ED/1000
- ✓ Inpatient Days/1000
- ✓ ED Unique Members/1000
- ✓ # of Unique Members with Admit
- ✓ # of Unique Members with ED Visit
- ✓ OP Visit/1000
- ✓ 30-day readmits (no exclusions)
- ✓ ED/IP/OP Counts
- ✓ CT Scans/MRI Counts
- ✓ Registries 230 standard measures

Unattributed Persons Map



Summary

Attributed Patients	170,211
Unattributed Patients	49,992
Total Patients	220,203

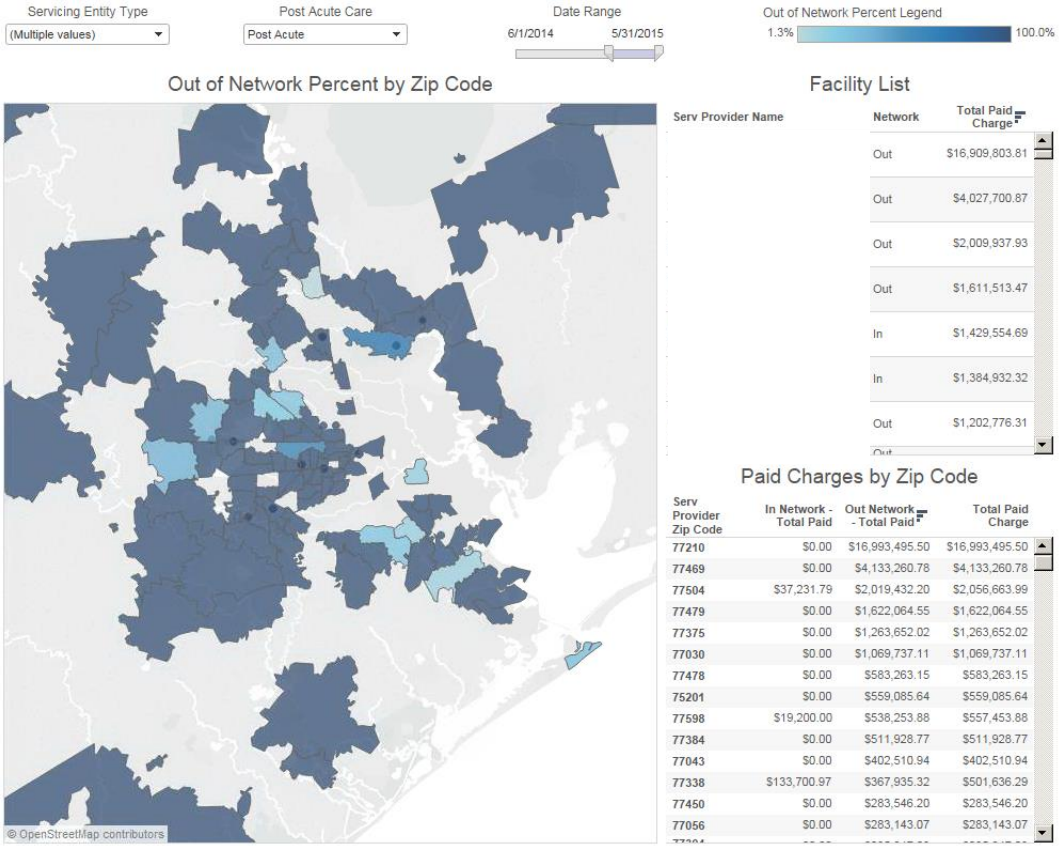
Unattributed Patients

0 420

Plan Summary

Plan Name	Total Patients	Attributed Patients	Unattributed Patients
	6,503	6,484	19
	70,327	69,763	564
	3,185	1,324	1,861
	21,652	13,028	8,624
	6,734	4,759	1,975
	7,495	6,871	624
	79,924	43,681	36,243

Network Utilization – Geographic Analysis



Please give me your feedback

Session ID: B9862 **Speaker:** Eli Groesbeck, Dan Woicke

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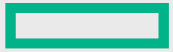
Thank you for providing your feedback, which helps us enhance content for future events.



Hewlett Packard
Enterprise

Thank you