UniCredit and V-TServices:

Four Years of Splunk Integration Facing Heterogeneous Use Cases

Stefano Guidobaldi, Advanced Engineering – UniCredit Group ICT & Security Officer

Mirko Carrara, Service Reliability & Splunk Team – V-TServices

VALUE TRANSFORMATION SERVICES
an IBM subsidiary

#splunkconf – Las Vegas, 23rd September 2015

UniCredit

Agenda

- About us
- Our journey with Splunk
- Splunk deployment topology
- Use cases: overview
  - Business Analytics
  - Application Delivery
  - IT Operational Analytics
  - Accounting
  - APInthusiasts
- Recap and Takeaways
- Q&A

About us

Stefano Guidobaldi

- Current position: IT System Architect at UniCredit
- Formerly advisor for UniCredit, working on Splunk projects/ developments
- Area of expertise: system administration, tuning and automation, analytics
- Contact: stefano.guidobaldi@unicredit.eu

Mirko Carrara

- Current position: IT Ops Architect & Splunk Lead at V-TServices
- Formerly working at UniCredit Business Integrated Solutions on IT Ops and Splunk
- Area of expertise: troubleshooting, root cause analysis, monitoring, analytics.
- Contact: mirkocarrara@it.ibm.com

UniCredit: at a Glance

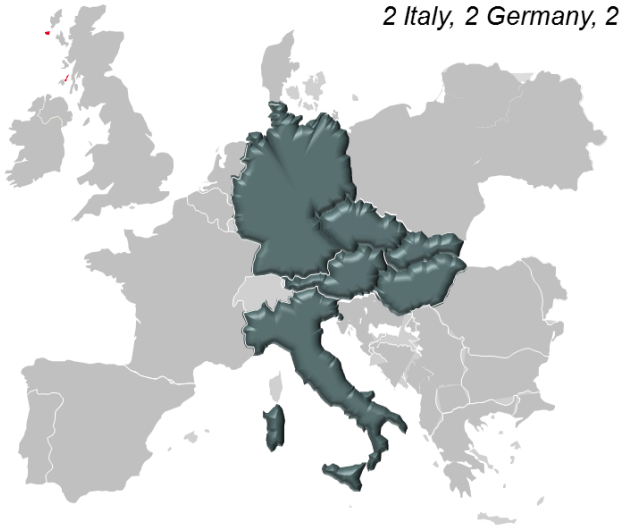
- Employees: more than **127,000***
- Branches: **7,100***
- Banking operations in **17** countries
- International network spanning: **~ 50** countries
- Global player in asset management: **€ 221** bn in managed assets*
- Market leader in Central and Eastern Europe leveraging on the region's structural strengths

* Source: UniCredit Company Profile, data as at June 30, 2015

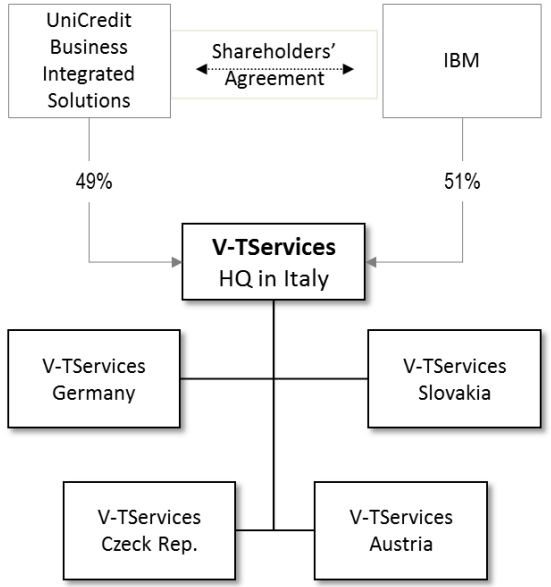
Value Transformation Services: at a Glance

6 Countries:
Italy, Germany, Austria, Czeck Republic, Slovakia, Hungary

6 Data Centers:
2 Italy, 2 Germany, 2 Austria



Legal HQ in Verona (Italy)
~ 100.000 total MIPS
40+ Petabytes Storage
~ 1000 Employees (352 in Italy)
>12.000 Servers:
> 20.000 network devices

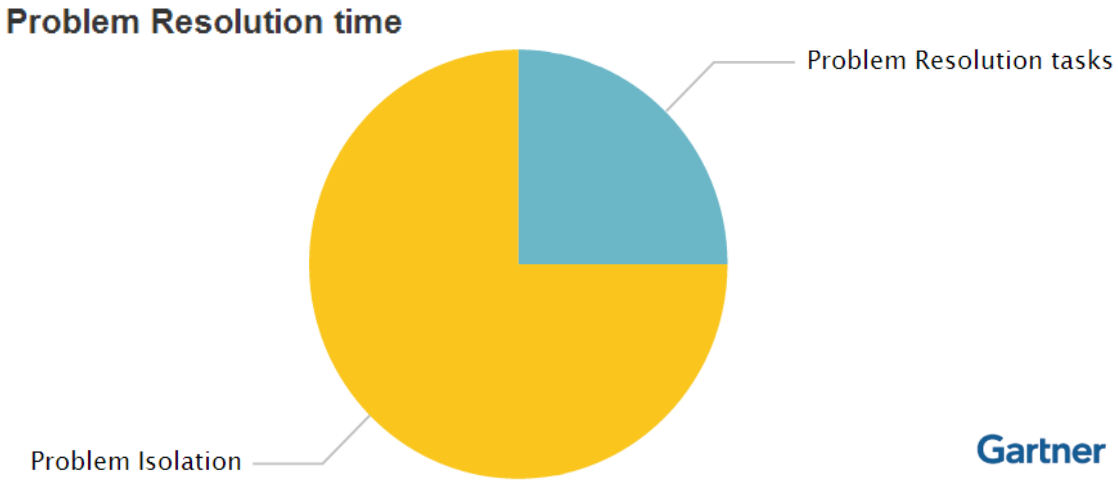


Services for Hungary are delivered to UniCredit Business Integrated Solutions directly by IBM. Core Banking Systems services for CEE countries delivered from Austria Data Centre.

Our journey with Splunk

Why Splunk: troubleshooting complex problems

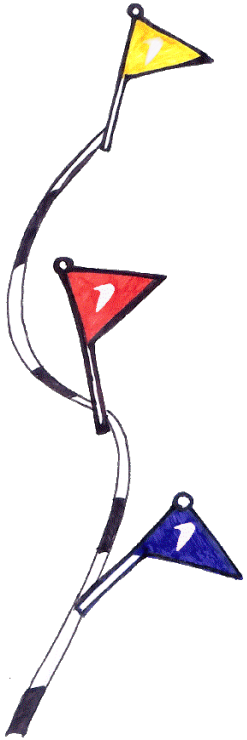
- Highly distributed and multi-layered SOA architectures
- Huge number of log files
- Logs contain 70% of diagnostic data useful for problem isolation



Our journey with Splunk

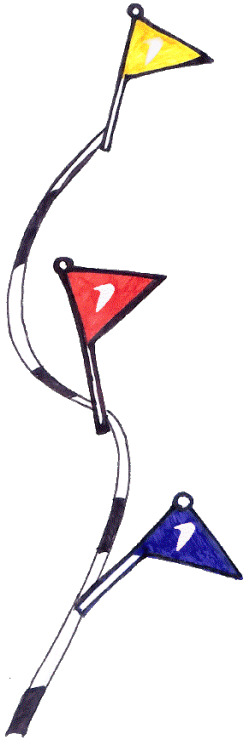
Why Splunk: a flexible solution to a complex problem

Our journey with Splunk



- **2010 Q3**: a Splunk 4 Enterprise trial installed in a test server. Used for POC and to analyze logs for on demand troubleshooting and data analysis.
- **2011 Q1**: 250GB/day license arrived! First production deployment made by 3 indexers collecting application/system logs from some java applications. Used by Service Delivery Team and some pilot users to speed up troubleshooting and for monitoring some services.
- **2013 Q1**: License enlarged. 8 indexers collecting 700GB/day. Added more sources related to java applications logs, web servers, operating systems and some DB2 logging tables. Middleware team and many Developers use Splunk during their daily business.

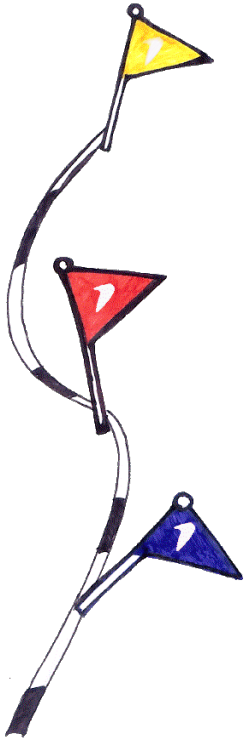
Our journey with Splunk



- **2014 Q4**: 12 indexers collecting 1.7TB/day. Splunk became the main solution to enable developers to view and analyze theirs application logs. Added custom application logs from several different applications. Added more source from systems (loadbalancer, dns, dhcp).
  UniCredit Security Team evaluated Splunk as a solution for Log Management and Security/Audit.

- **2015 Q1:** UniCredit Security Team deployed a new Splunk deployment capable of collecting and analyzing more than 4TB/day (not covered by this session). This new deployment (Splunk Security) runs in parallel with the existing deployment (Splunk ITOA/AM).
  This session will cover the deployment named Splunk ITOA/AM only.

Our journey with Splunk

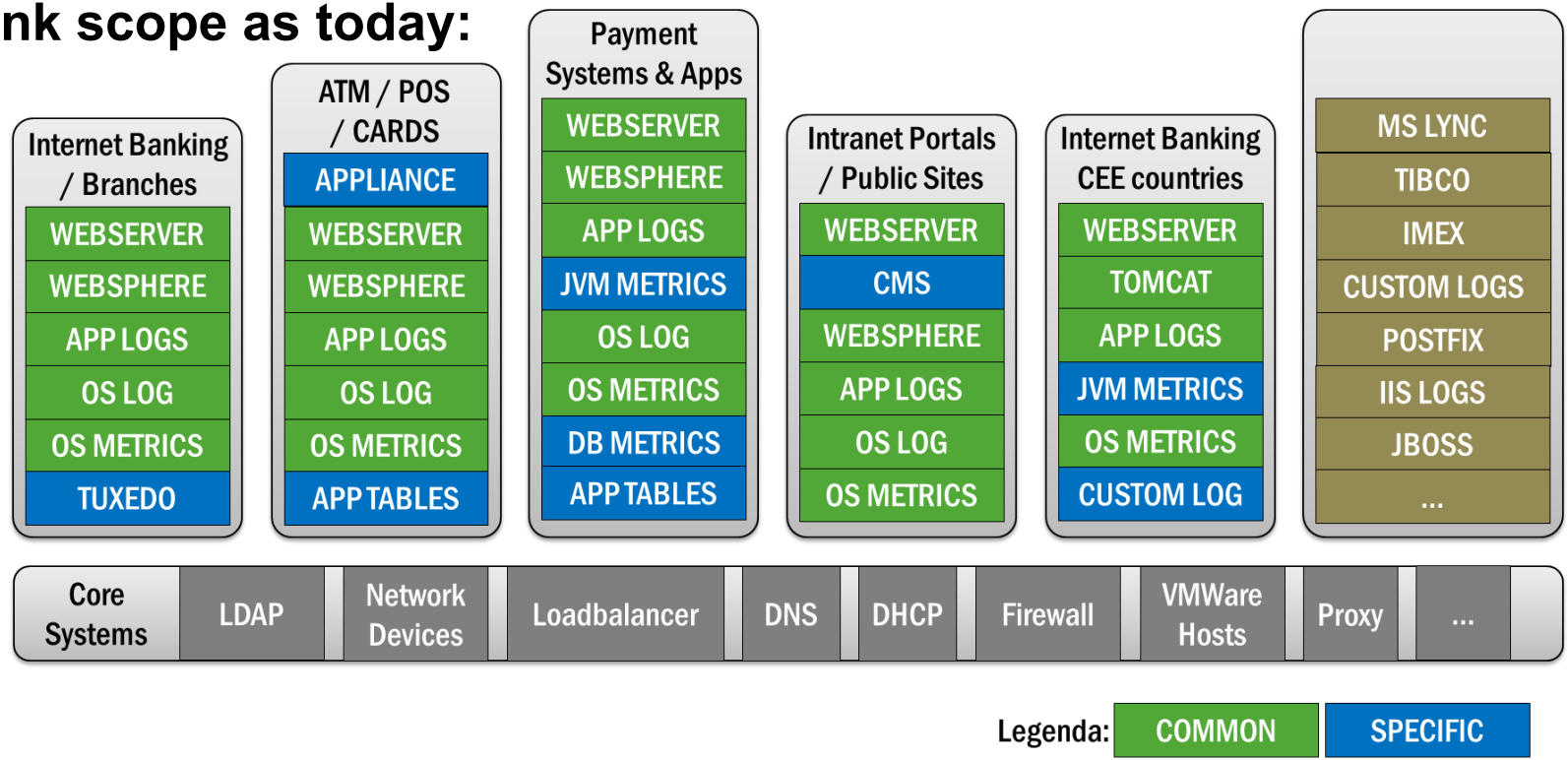


- **Today:** Splunk is one of the main solution for:
  - IT Operational Analytics
  - Application Management.

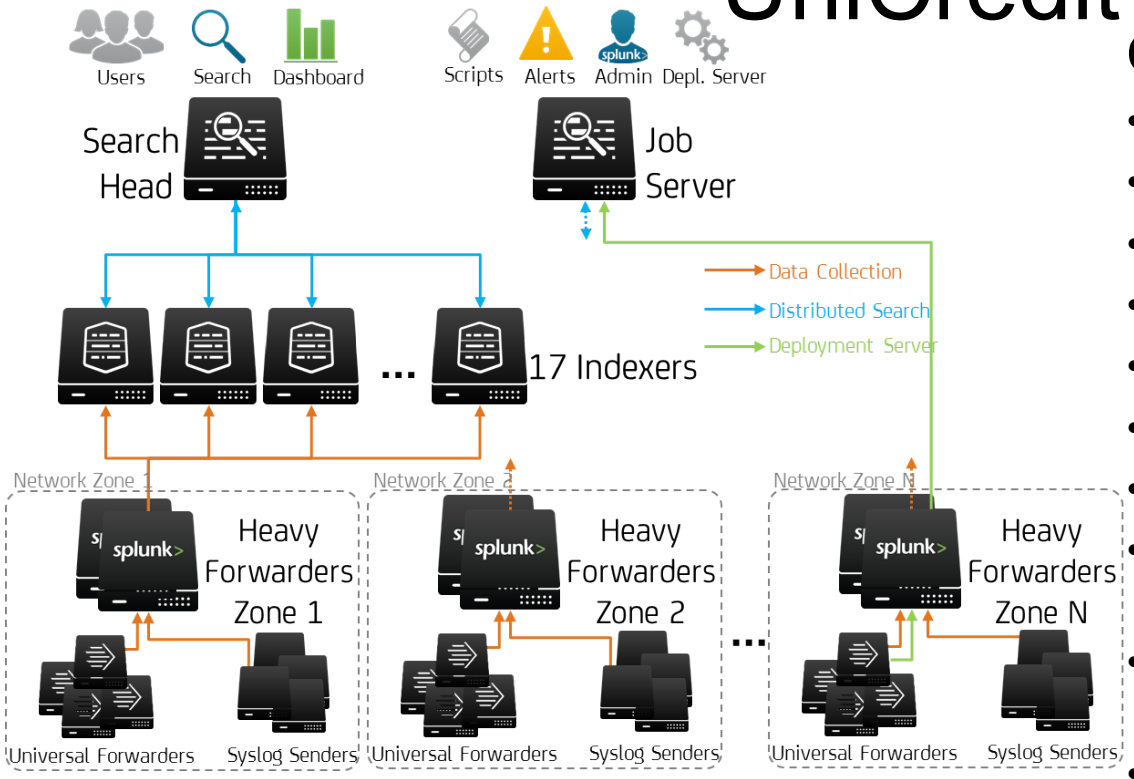
- It is widely used by Developers, System Administrators, Service Delivery Analysts, Network and Network Security Engineers, etc.
- Still important to boost troubleshooting and problem isolation.
- It has a crucial role in the monitoring and reporting area.
- Many new projects include Splunk as an important component for production readiness.

Our journey with Splunk

Splunk scope as today:



Splunk ITOA/AM deployment in UniCredit



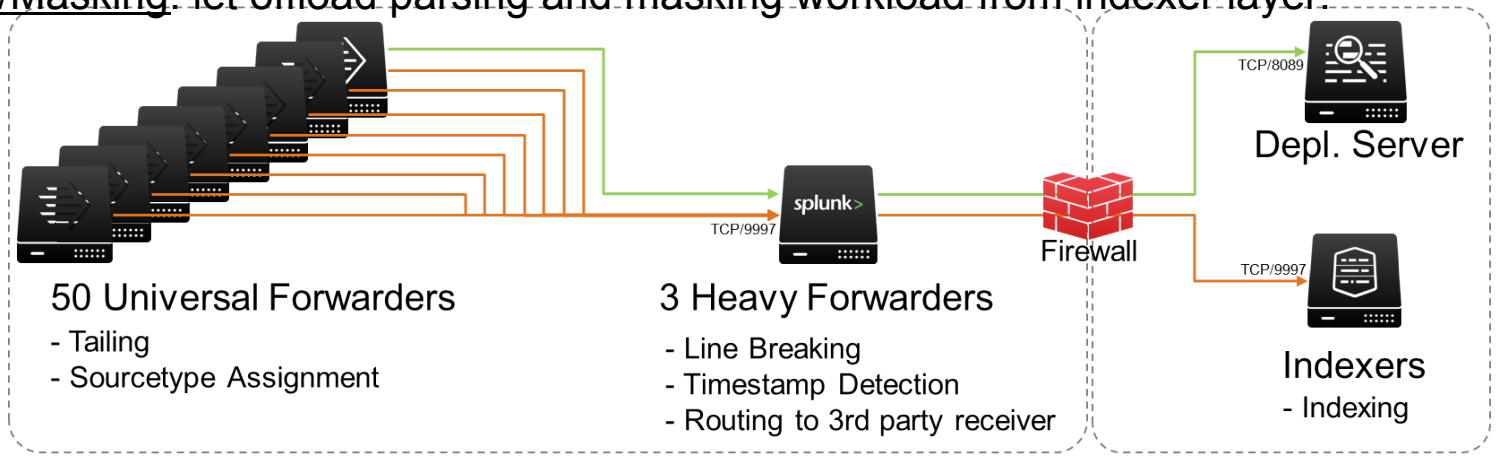
Our deployment in figures:

- ~2.5 TB data collected daily
- >30 days data retention
- >8 billion events collected daily
- >400k events per second (peaks)
- >180 sourcetypes
- >500 universal forwarders
- >15k syslog senders
- ~15k searches executed by users daily
- ~90k searches executed by scheduler daily
- >500 dc(users) logged-in during last month

Splunk ITOA/AM deployment in UniCredit

Why Heavy Forwarders:

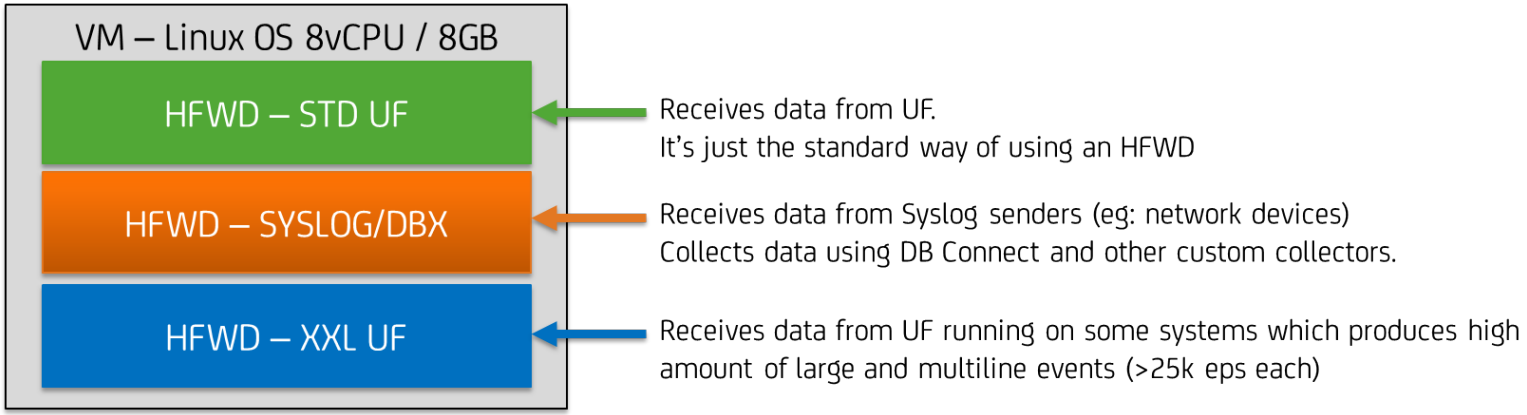
- Aggregation: using intermediate collectors enables to establish a «many to few» relation between senders located on a specific zone and a set of receivers.
- Scale Deployment Server: some Heavy Forwarders works also as intermediate Deployment Server.
- Parsing/Masking: let offload parsing and masking workload from indexer layer.



Splunk ITOA/AM deployment in UniCredit

How we configured Heavy Forwarders:

- More Splunk instances running on the same virtual server.
- Each Splunk instance has a specific role depending on sender type and receives on a different port.



Which are the benefits:

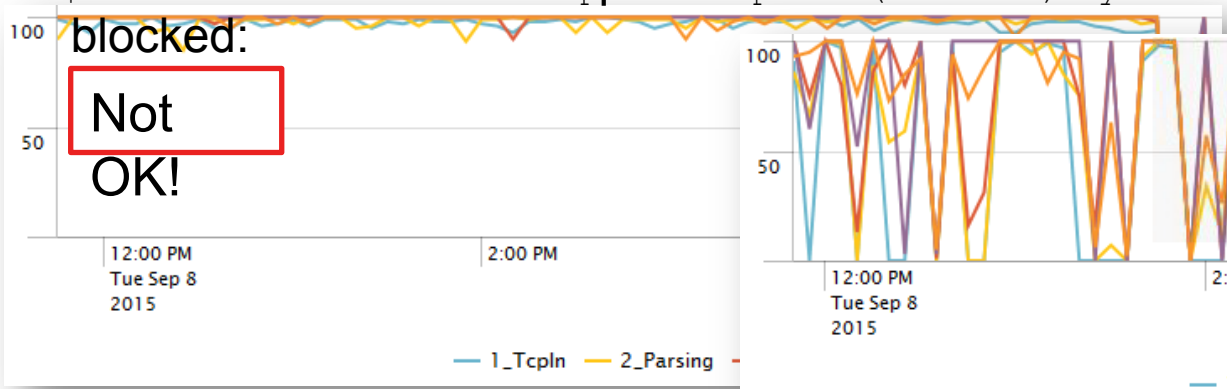
- Optimize resource usage: more Splunk instances running on the same box enables to use full server capacity.
- Split workload: multiline and single-line events are processed on different data pipelines.

Splunk ITOA/AM deployment in UniCredit

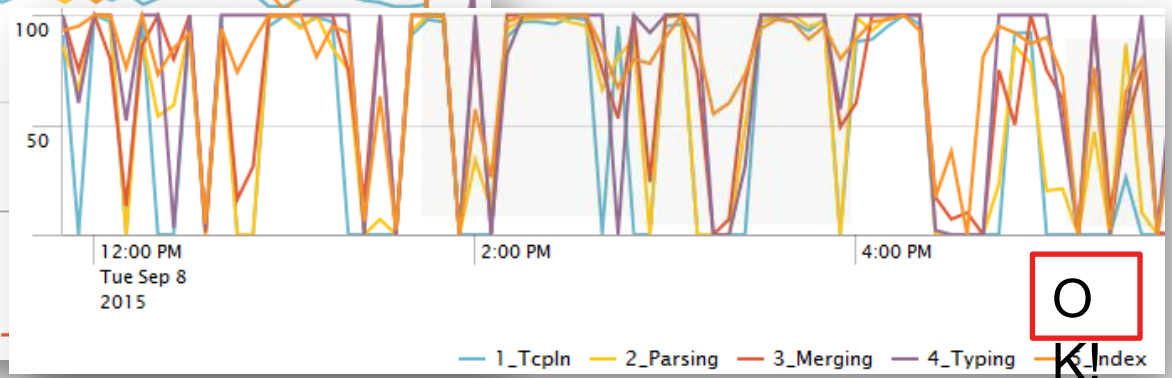
- **Takeaway**: care about Heavy Forwarder data pipeline queue usage. Use following search:

```
index=_internal host="myhfwd" source="*metric*" group=queue AND
(name=aggqueue OR name=indexqueue OR name=parsingqueue OR name=aggqueue OR name=typingqueue
OR name=splunktcpin)|eval name=case(name == "aggqueue", "3_Merging", name == "indexqueue",
"5_Index", name == "parsingqueue", "2_Parsing", name == "typingqueue", "4_Typing", name ==
"splunktcpin", "1_TcpIn")
|eval PercUsed=round((current_size_kb/max_size_kb)*100,0)
|timechart useother=false span=5m perc85(PercUsed) by name
```

- to visualize how often queues are blocked:



Not OK!



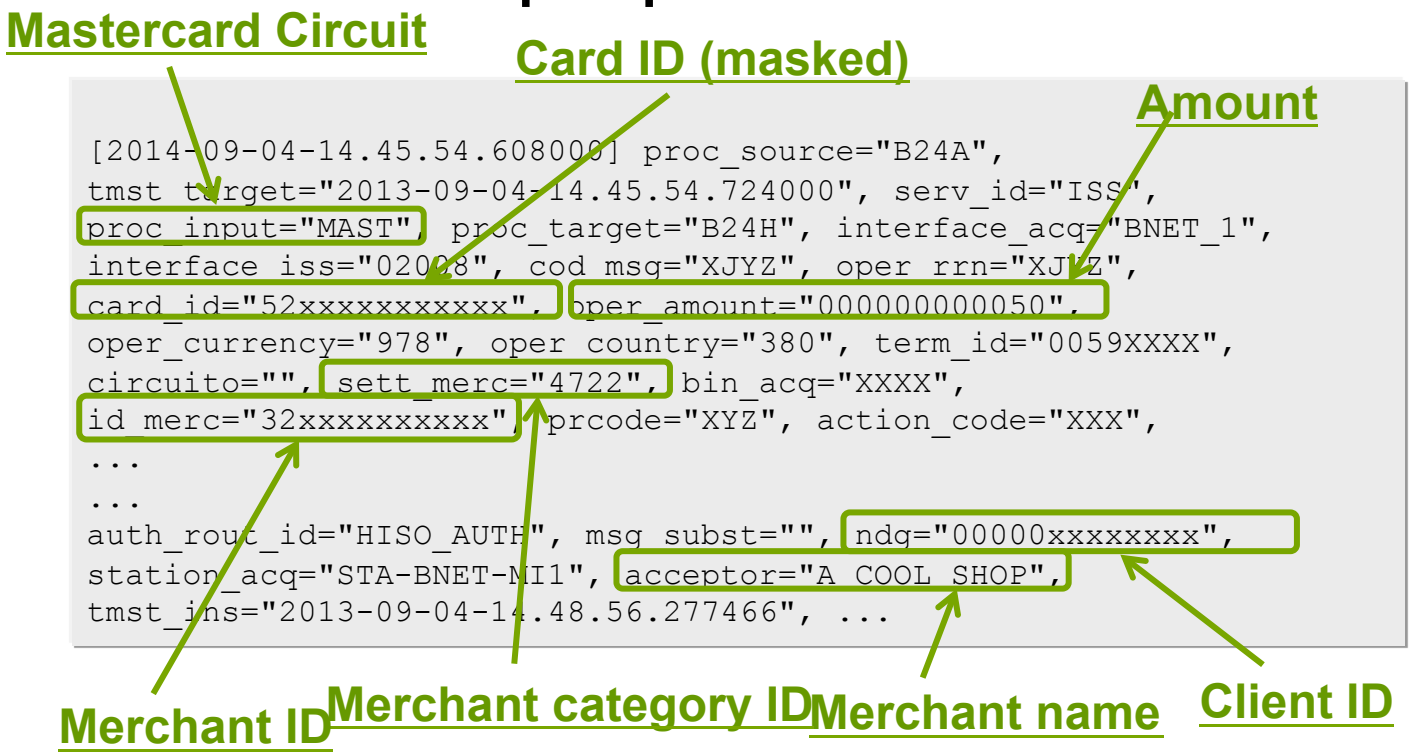
OK!

Use Cases

- **Business Analytics:** We were able to leverage transactions log from our POS and cardholders (previously used for monitoring purposes) to build a new **big data tool** for our merchants
- **Application Delivery (and Advanced Monitoring):** One of our **biggest enterprise applications** is currently monitored using Splunk at many levels. Tons of customizations, dynamic interaction, advanced troubleshooting:-be ready to discover more
- **IT Operational Analytics:** We'll go through many ways to answer classic and modern **IT questions** and provide key concepts to apply same approaches to your environment.
- **Accounting:** We'll show how to replace a standard data entry activity with Excel letting Splunk do the **dirt job** for us
- **APInthusiasts - from data collector to data distribution platform:** Initially we were in the condition of using Splunk to collect and send data to a DB, like a big vacuum cleaner. It ended up with the customer asking us to remove DB and use Splunk as the **data engine** through its REST API

Business Analytics:
How a single data-source served different purposes

How a single data-source served different purposes

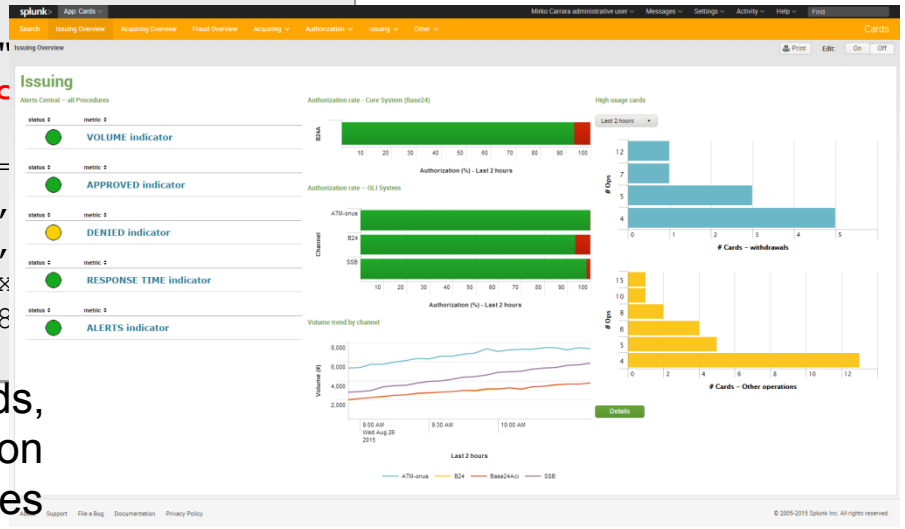


How a single data-source served different purposes

2013 – first implementation: Application Monitoring

- In 2013 we started gathering UniCredit cards' transactions
- Initially they served as operational monitoring data for our Application Delivery team
- Of the whole transaction, only few fields were actually used to monitor system behaviour

```
[2014-09-04-14.45.54.608000] proc_source="B24A",
tmst_target="2013-09-04-14.45.54.724000", serv_id="
proc_input="MAST", proc_target="B24H", interface_ac
interface_iss="02008", cod_msg="1110", ...
id_merc="32xxxxxxx", prcode="003000", action_code=
approval_code="X", oper_mod_input="1", channel="O",
flag_dupl="Y", flag_onus="N", auth_rout_dst="XXXX",
auth_rout_id="HISO_AUTH", msg_subst="", ndg="00000x
station_acq="STA-BNET-MI1", acceptor="COOL SHOP" 38
tmst_ins="2013-09-04-14.48.56.277466", ...
```

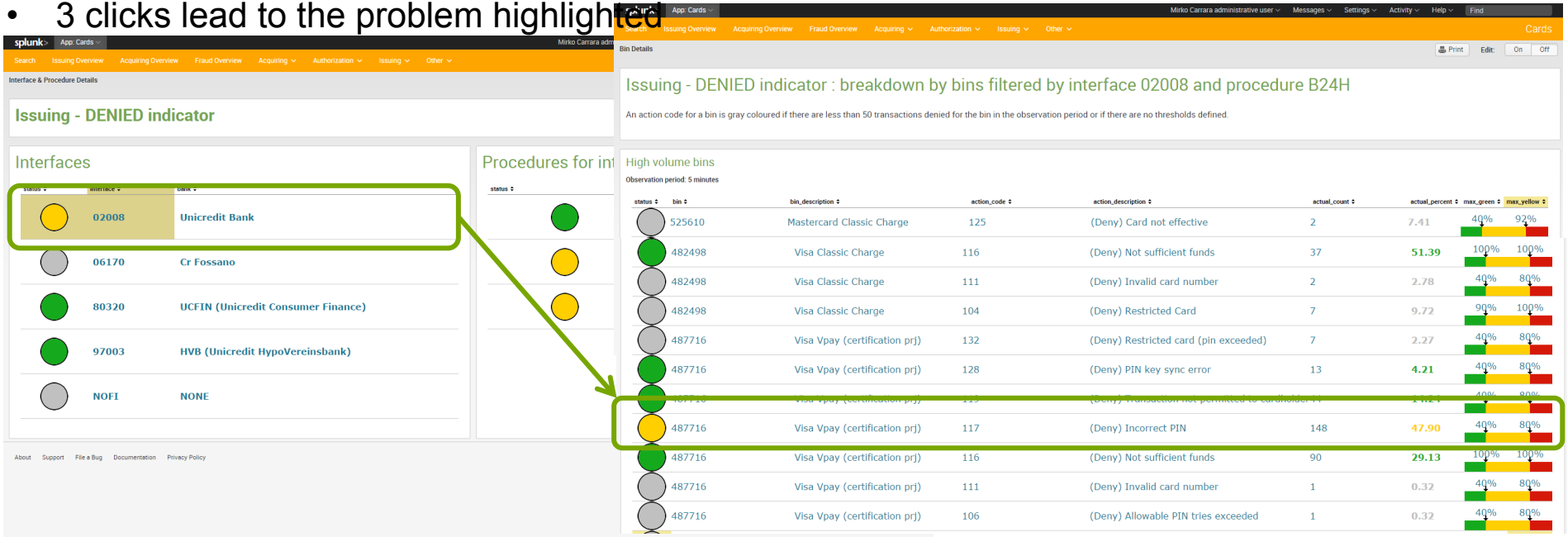


- Few clear graphs in 3-4 interactive dashboards, featuring: green/yellow/red dots for alerts, authorization rates, volumes

How a single data-source served different purposes

2013 – first implementation: Application Monitoring

- Application Team is able to drill down until they reach the root cause of the alert
- 3 clicks lead to the problem highlighted



How a single data-source served different purposes

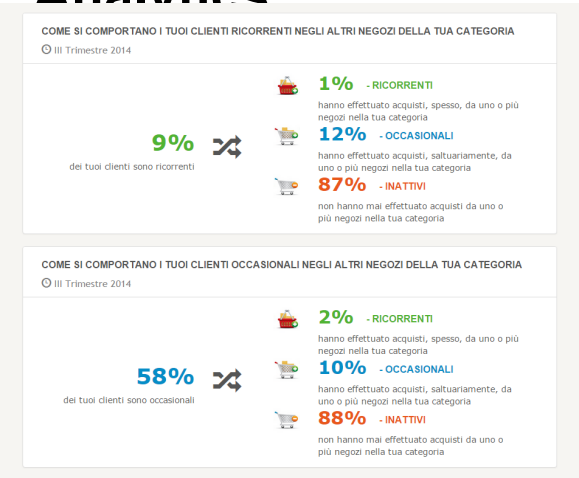
2014 – second implementation: Business Analytics

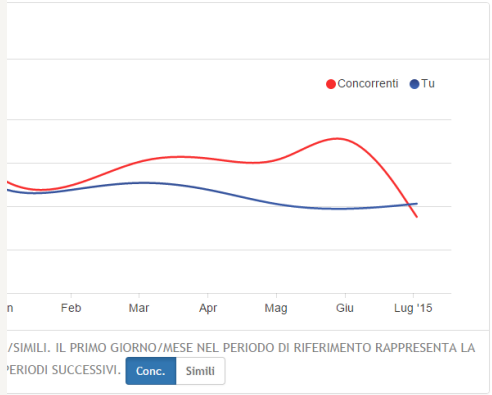
- With the same piece of information, our business teams went up with a new product for our merchants: a dashboard with business data intertwined with customers data
- Monitoring log is full of interesting fields that could be leveraged to setup a business analytics view:
  - Unique ID for customer (hashed, obviously)
  - Amount
  - Currency
  - Country
  - Merchant ID (internal reference)
  - Merchant category ID (e.g. clothing)
  - Acceptor (shop name)

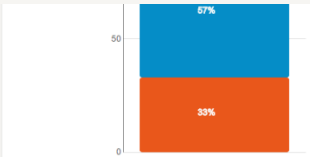
```
[2014-09-04-14.45.54.608000] proc_source="B24A",
tmst_target="2013-09-04-14.45.54.724000", serv_id="ISS",
proc_input="MAST", proc_target="B24H", interface_acq="BNET_1",
interface_iss="02008", cod_msg="XJYZ", oper_rrn="XJYZ",
card_id="52xxxxxxxxxx", oper_amount="000000000050",
oper_currency="978", oper_country="380", term_id="0059XXXX",
circuito="", sett_merc="4722", bin_acq="XXXX",
id_merc="32xxxxxxxxx", prcode="XYZ", action_code="XXX",
...
...
auth_rout_id="HISO_AUTH", msg_subst="", ndg="00000xxxxxxxx",
station_acq="STA-BNET-MI1", acceptor="A COOL SHOP",
tmst_ins="2013-09-04-14.48.56.277466", ...
```

How a single data-source served different purposes

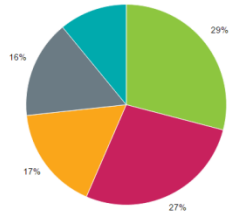
2014 – second implementation: Business Analytics



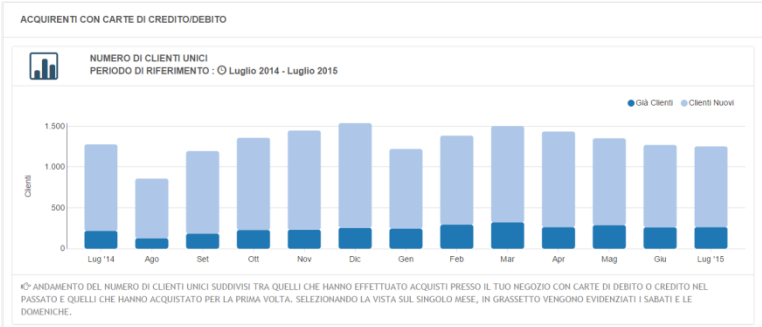




SUDDIVISIONE DEI TUOI CLIENTI: RICORRENTI SE HANNO EFFETTUATO 2 O PIU' ACQUISTI, OCCASIONALI SE HANNO EFFETTUATO 1 ACQUISTO, INATTIVI SE NON NE HANNO EFFETTUATI NEL PERIODO CONSIDERATO.



SE ESISTONO DATI DISPONIBILI, LA TORTA MOSTRA UNA VISIONE DI INSIEME DELLE ABITUDINI DI SPESA DEI PROPRI CLIENTI PRESSO ESERCENTI DI CATEGORIE MERCEOLOGICHE DIVERSE DALLA PROPRIA.



ANDAMENTO DEL NUMERO DI CLIENTI UNICI SUDDIVISI TRA QUELLI CHE HANNO EFFETTUATO ACQUISTI PRESSO IL TUO NEGOZIO CON CARTE DI DEBITO O CREDITO NEL PASSATO E QUELLI CHE HANNO ACQUISTATO PER LA PRIMA VOLTA. SELEZIONANDO LA VISTA SUL SINGOLO MESE, IN GRASSETTO VENGONO EVIDENZIATI I SABATI E LE DOMENICHE.

- Totally brand new **3rd-party application**
- **Web-based interface** for merchants
- **Tablet-friendly**, interactive, innovative

How a single data-source served different purposes

Key takeaways

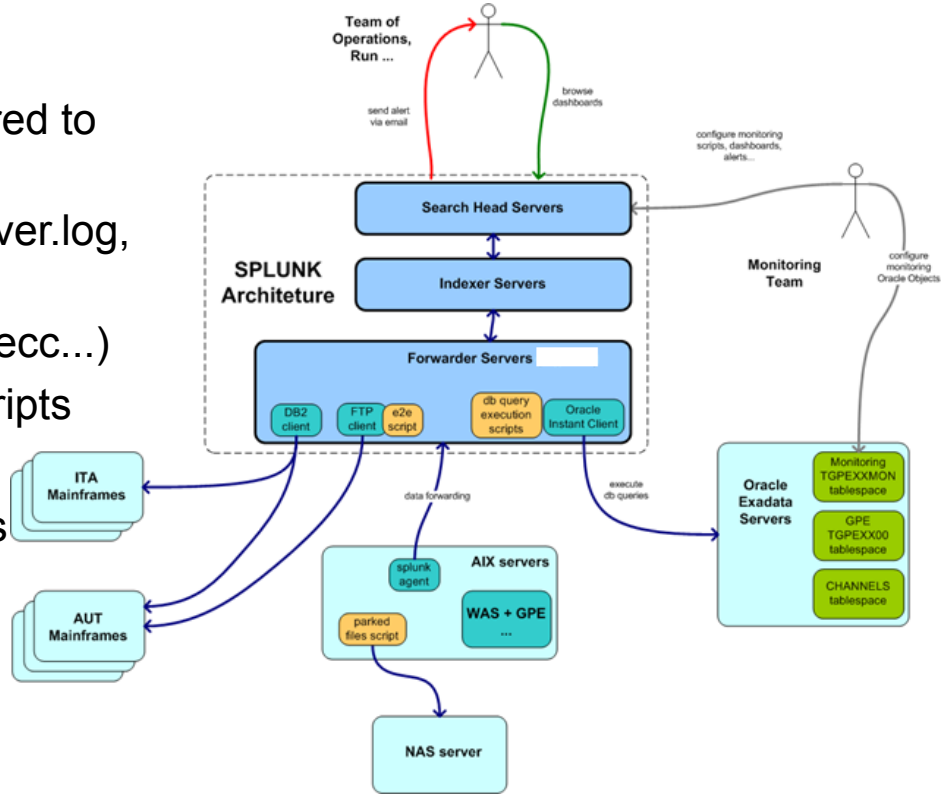
- Many use cases share the **same set** of data
- When preparing a new log include **anything** that can be valuable in the future
- Use summary indexes to **aggregate** data

Application Delivery:
See the forest *AND* the trees

See the forest *AND* the trees

Target architecture

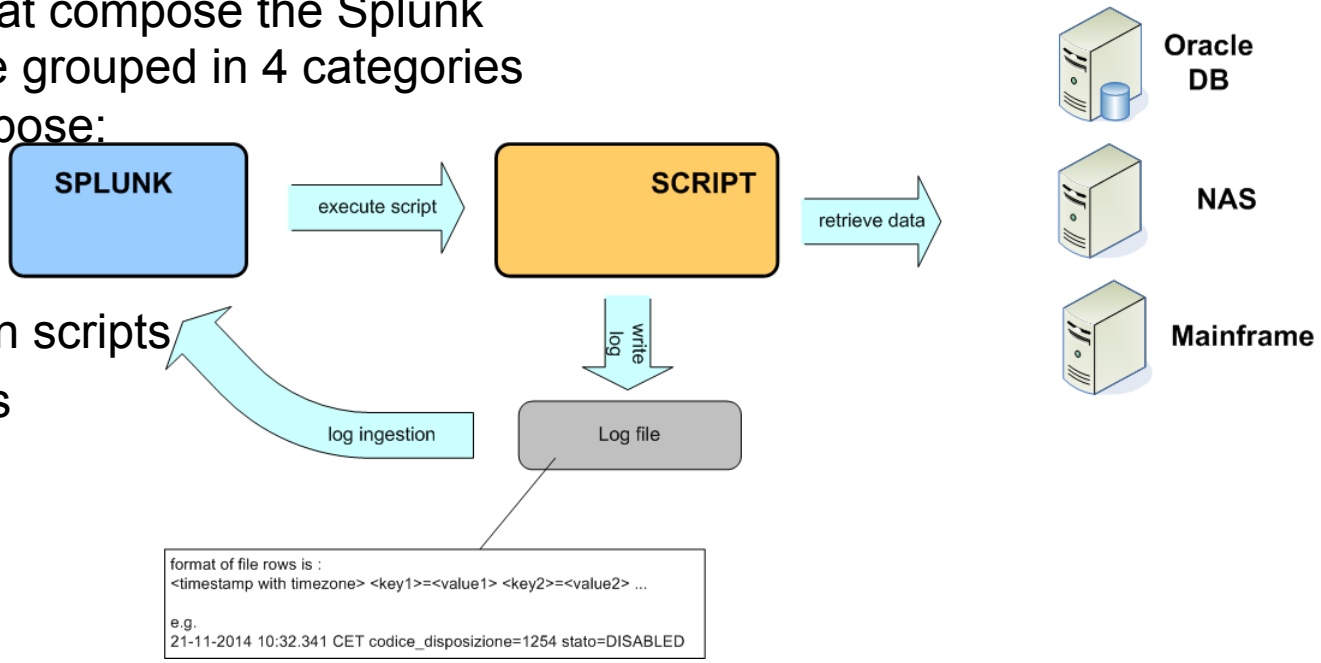
- For SDD system monitoring, Splunk is configured to retrieve these types of log:
  - application server log (e.g. Websphere server.log, server.err, ecc..)
  - application data log (e.g. GPE log4j, JGH, ecc...)
  - custom monitoring data log provided by scripts
- Components involved:
  - NAS server used by GPE and e2e systems
  - Oracle Database
  - WebSphere Application Servers
  - ITA Mainframe
  - AUT Mainframe (stricter policies)



See the forest *AND* the trees

Splunk Monitoring Engine (SME)

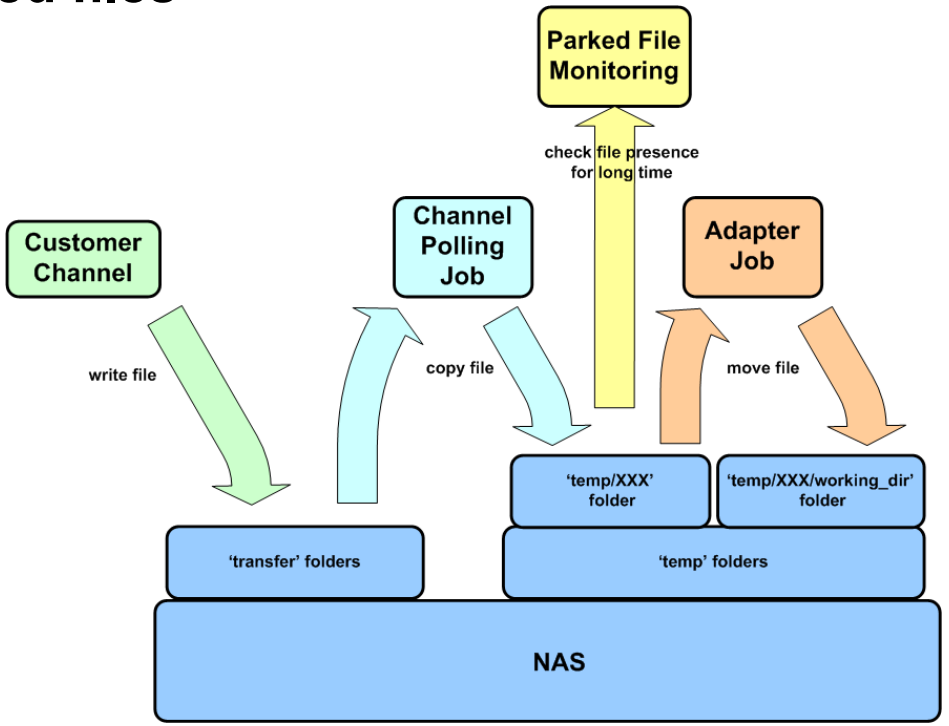
- The custom scripts that compose the Splunk Monitoring Engine are grouped in 4 categories according to their purpose:
  - system scripts
  - e2e scripts
  - db query execution scripts
  - parked files scripts



See the forest *AND* the trees

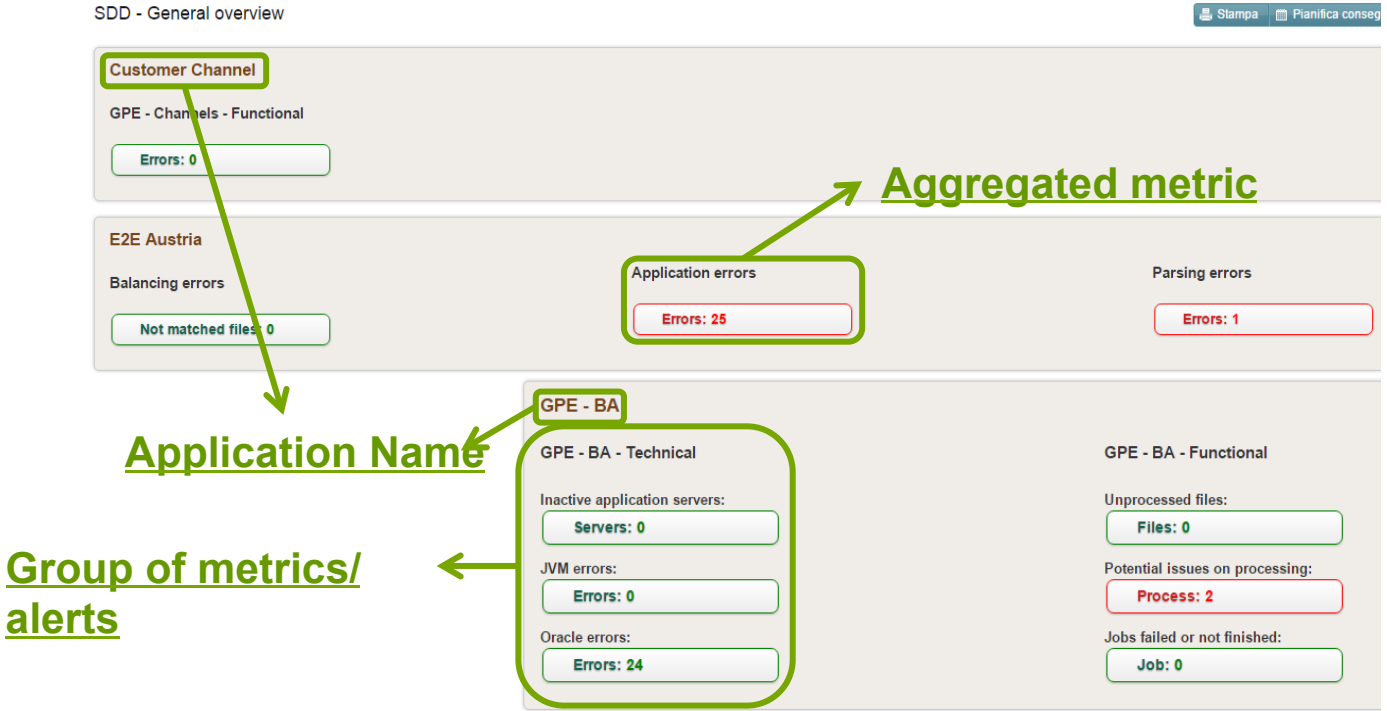
Example of custom monitoring: parked files

- “Parked Files” monitoring:
  - The aim of these scripts is to find halted files on GPE NAS called also "parked files".
  - They are installed on the AIX servers containing WAS and GPE application
  - The scripts check in the channel root directories if there are halted files for more than 60 minutes, in order to identify files that have not been processed by GPE Adapter Job.



See the forest *AND* the trees

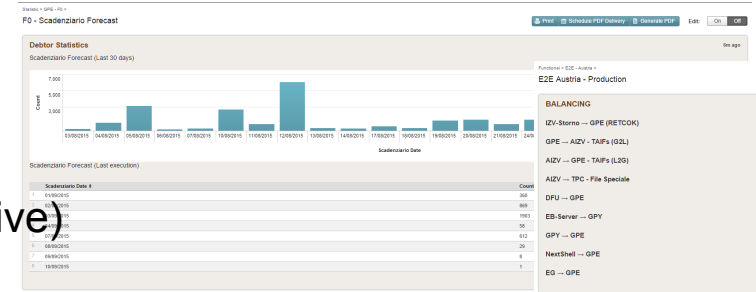
One single pane of view to rule them all!

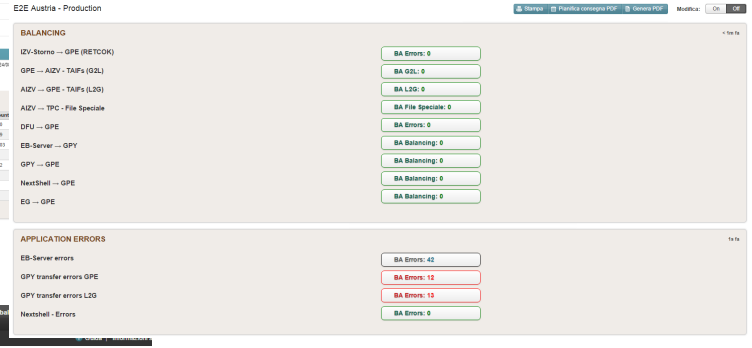


See the forest *AND* the trees

Four points of view

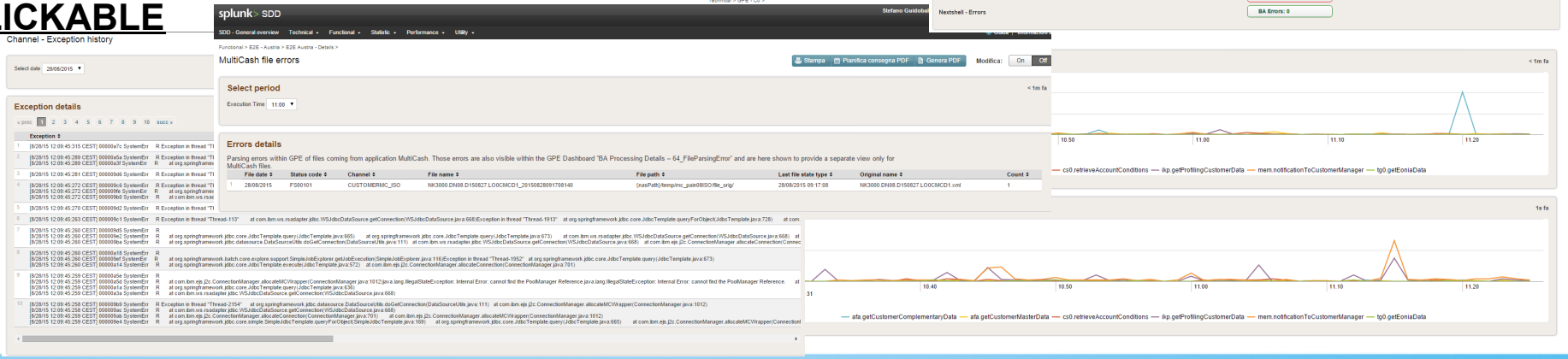
- Technical
- Functional
- Statistical (and, thus, predictive)
- Performance





Plus, every button is

CLICKABLE

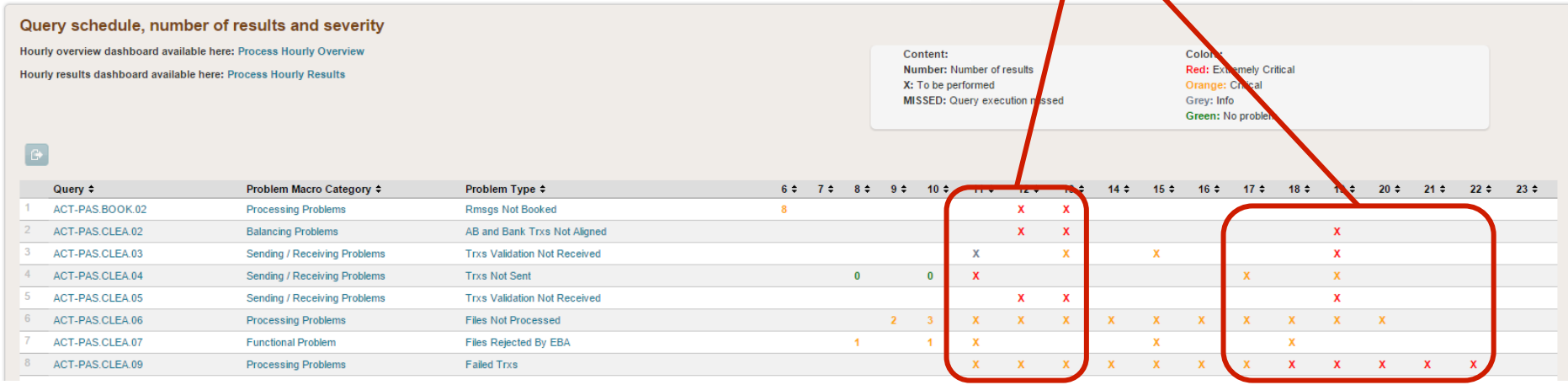


See the forest *AND* the trees

Focus: functional monitoring on queries

- Scheduling overview of daily jobs
- Colour based on criticality
- Find immediately jobs missing
- Grouped in categories

Easily identify critical periods during day



Query schedule, number of results and severity

Hourly overview dashboard available here: Process Hourly Overview

Hourly results dashboard available here: Process Hourly Results

Content:
Number: Number of results
X: To be performed
MISSED: Query execution missed

Color:
Red: Extremely Critical
Orange: Critical
Grey: Info
Green: No problem

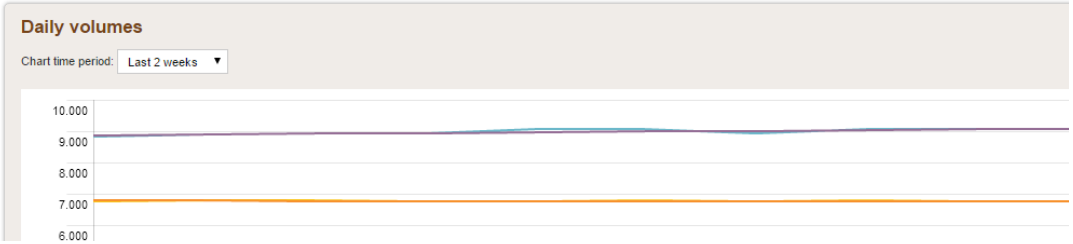
	Query	Problem Macro Category	Problem Type	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	ACT-PAS.BOOK.02	Processing Problems	Rmsgs Not Booked	8						X	X										
2	ACT-PAS.CLEA.02	Balancing Problems	AB and Bank Trxs Not Aligned							X	X						X				
3	ACT-PAS.CLEA.03	Sending / Receiving Problems	Trxs Validation Not Received						X		X		X				X				
4	ACT-PAS.CLEA.04	Sending / Receiving Problems	Trxs Not Sent			0		0	X						X		X				
5	ACT-PAS.CLEA.05	Sending / Receiving Problems	Trxs Validation Not Received							X	X						X				
6	ACT-PAS.CLEA.06	Processing Problems	Files Not Processed				2	3	X	X	X	X	X	X	X	X	X	X			
7	ACT-PAS.CLEA.07	Functional Problem	Files Rejected By EBA			1		1	X				X			X					
8	ACT-PAS.CLEA.09	Processing Problems	Failed Trxs						X	X	X	X	X	X	X	X	X	X	X	X	

See the forest *AND* the trees

Focus: technical monitoring on Oracle

Technical > GPE - C0 >

C0 - Oracle tablespace growth



- Overview graph with trend over weeks
- Table with statistical details

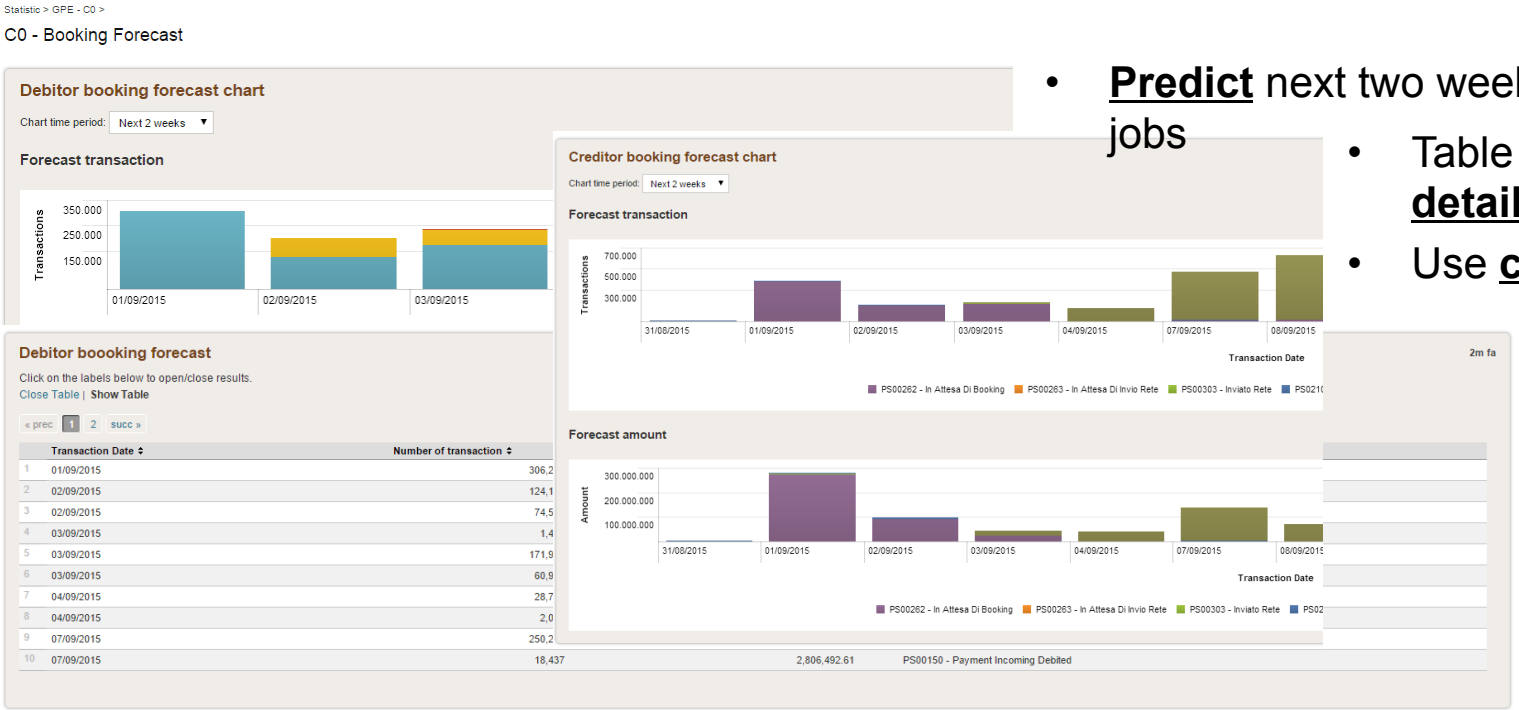
Tablespace growth

« prec 1 2 3 4 5 6 7 8 9 10 succ »

	Date	Tablespace	Avg	Median	Stdev	Min	Max
1	31/08/2015	TGPEC0MD	510	160	990	2	4925
2	31/08/2015	TGPEC000_X	6478	6736	4158	38	15583
3	31/08/2015	TGPEC000	8731	9185	5786	2	28879
4	30/08/2015	TGPEC0MD	508	153	1005	2	4925
5	30/08/2015	TGPEC000_X	6442	6736	4179	38	15583
6	30/08/2015	TGPEC000	8636	9150	5817	2	28879
7	29/08/2015	TGPEC0MD	508	153	1005	2	4925
8	29/08/2015	TGPEC000_X	6519	6736	4117	38	15583
9	29/08/2015	TGPEC000	8770	9185	5765	2	28879
10	28/08/2015	TGPEC0MD	445	146	951	2	4925

See the forest *AND* the trees

Focus: statistics and forecasting



- **Predict** next two weeks of scheduled jobs
  - Table with **statistical details**
  - Use **custom** algorithms

See the forest *AND* the trees

Focus: performance monitoring on mainframe transactions

Performance > GPE - C0 >

C0 - Booking performance

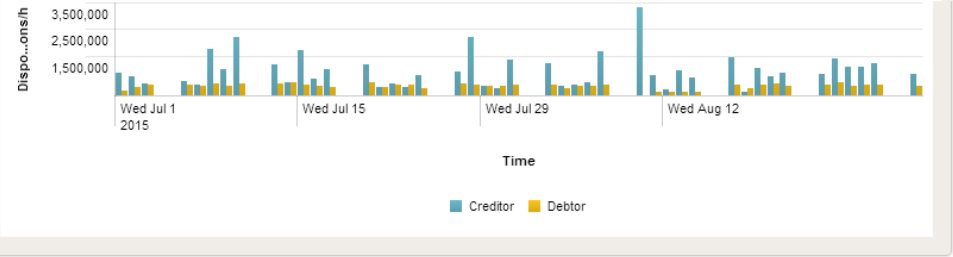
Creditor booking

The results are related to the first booking job of the day

Export

- Keep an eye on **several** critical **transactions**
- Raise an **alert** when time taken is higher than a statistical threshold

End time	Count	Amount	Duration	Trans/Hour	JVM
31/08/2015 04:14:57	1,011,780	490,420,682.56	01:14:56	820,362	C000GPEP603
28/08/2015 03:17:18	346,472	98,289,322.36	00:17:18	1,222,842	C001GPEP203
27/08/2015 04:24:57	1,513,029	177,970,351.47	01:24:55	1,080,735	C000GPEP203
26/08/2015 03:13:47	229,839	138,808,003.02	00:13:46	1,060,795	C000GPEP203



See the forest *AND* the trees

Key takeaways

- **Multi-layer**, multi applications single monitoring tool
- Splunk flexibility is awesome: execute scripts, gather results, collect data from many different sources and **get insights**, keep historical trends
- **Aggregation** made easy
- Navigation sets the **context** (and, therefore, forces which data has to be loaded in the template dashboard)

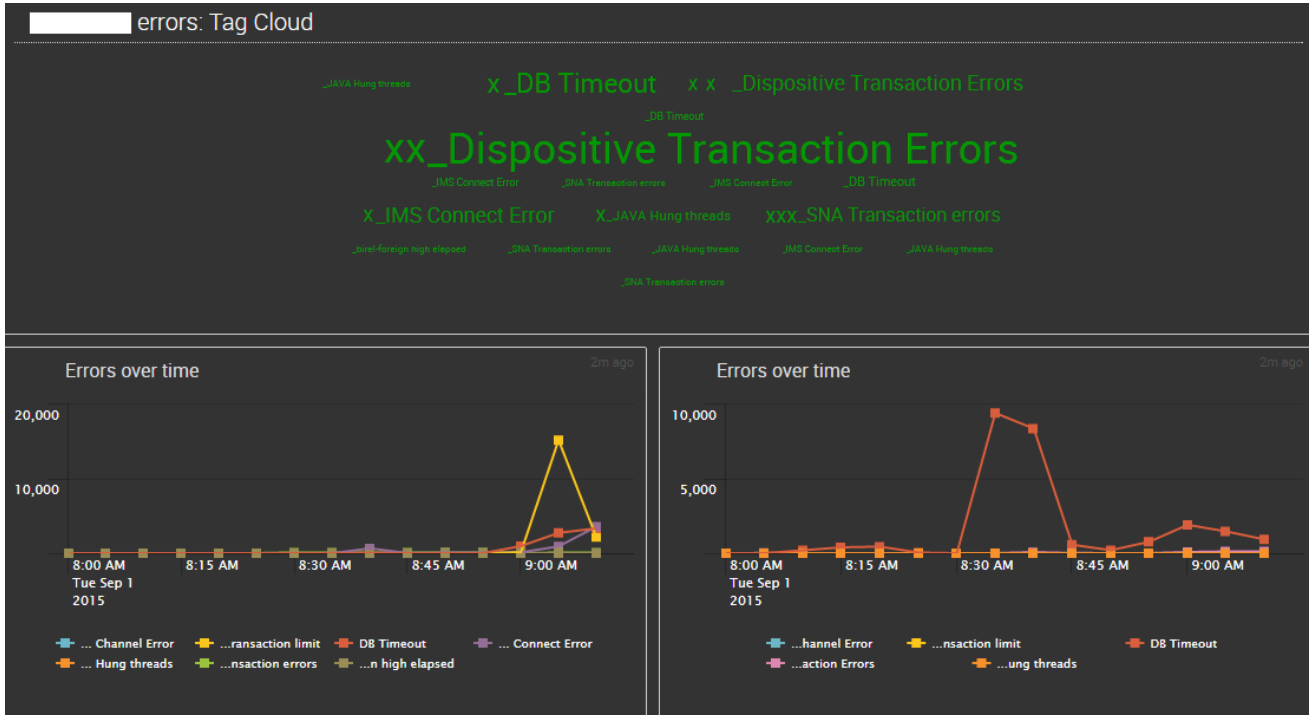
Next Steps

- Same approach will be used for other payments related applications
- Aggregate statistical and performance metrics
- Migrate everything to Splunk 6 (heavy visual customizations – CSS/HTML)

IT Operational Analytics:
Proactive is way better than reactive

Proactive is way better than reactive

Focus: known errors monitoring

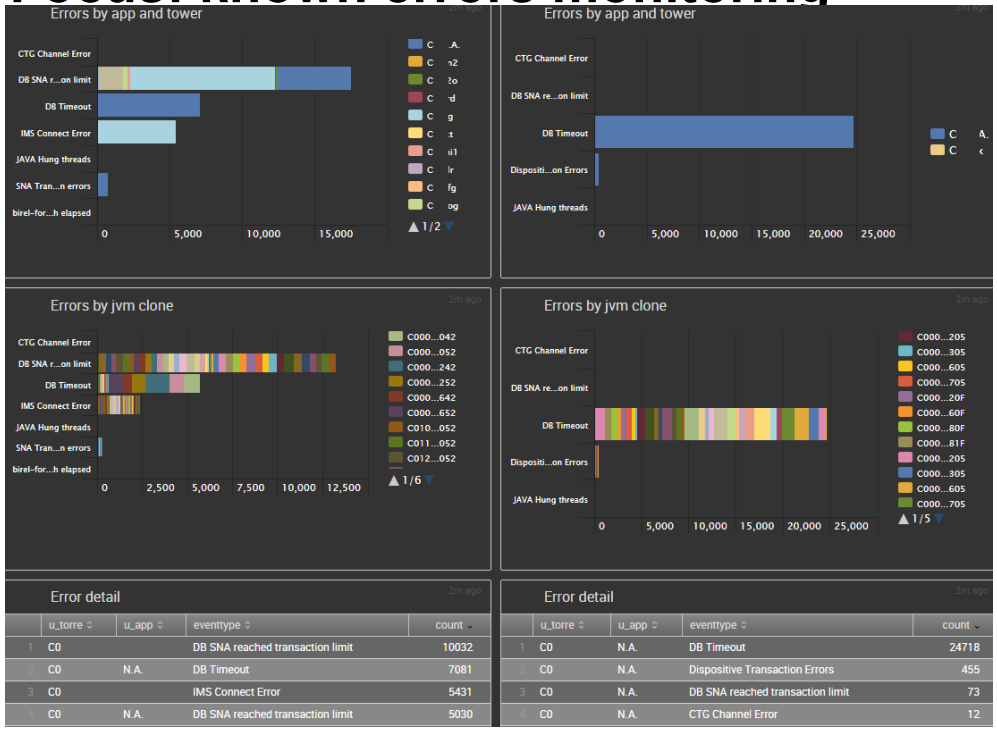


How it works:

- Visualize time distribution and stats of an eventype which aggregates known errors
- It shows only matching event categories
- Service Reliability members collaborate to add more and more event categories

Proactive is way better than reactive

Focus: known errors monitoring



Values:

- Immediate notification about common problems
- Historical or real-time analysis
- See trends and stop disruptive behavior before incidents happen
- It learns day by day by adding new categories to «monitoring» eventype

«Still one of the most value-adding dashboards ever!» **Service Reliability Team**

Proactive is way better than reactive

Focus: Apache HTTP status, or how we substituted an «old but gold» tool based on Cacti aimed to monitor Apache Httpd server status

How it works:

- A custom script retrieves and parses http://server:port/server-status output
- Parsed output is written to a log file which is collected by Splunk

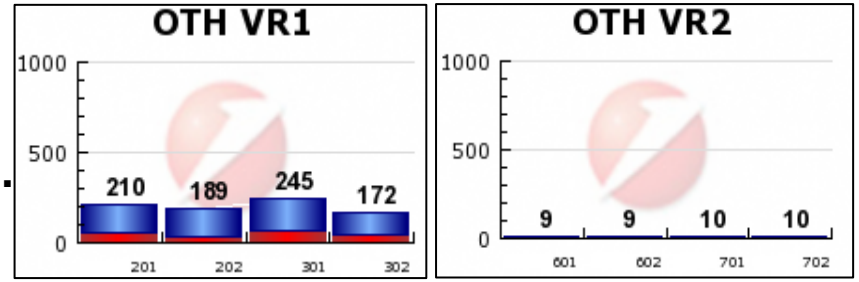
Added values:

- Historical Values
- Possibility to reuse data on oth

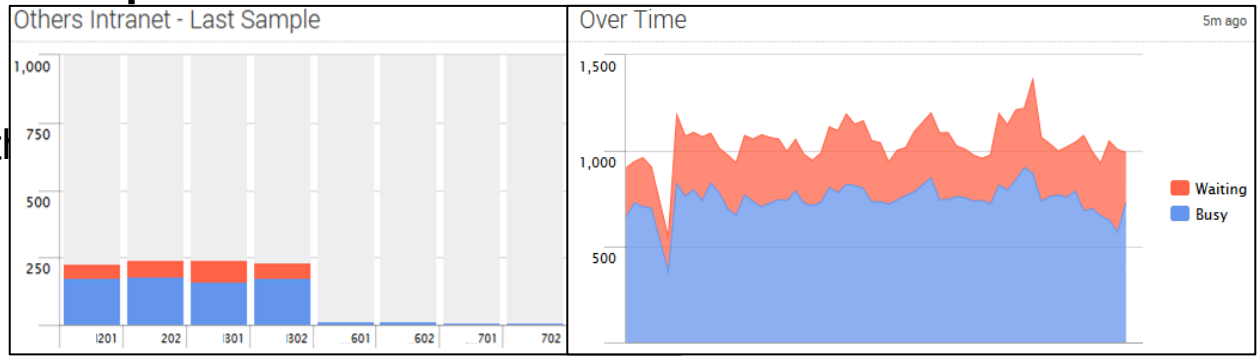
dashboards

- Alerting

From Cacti..

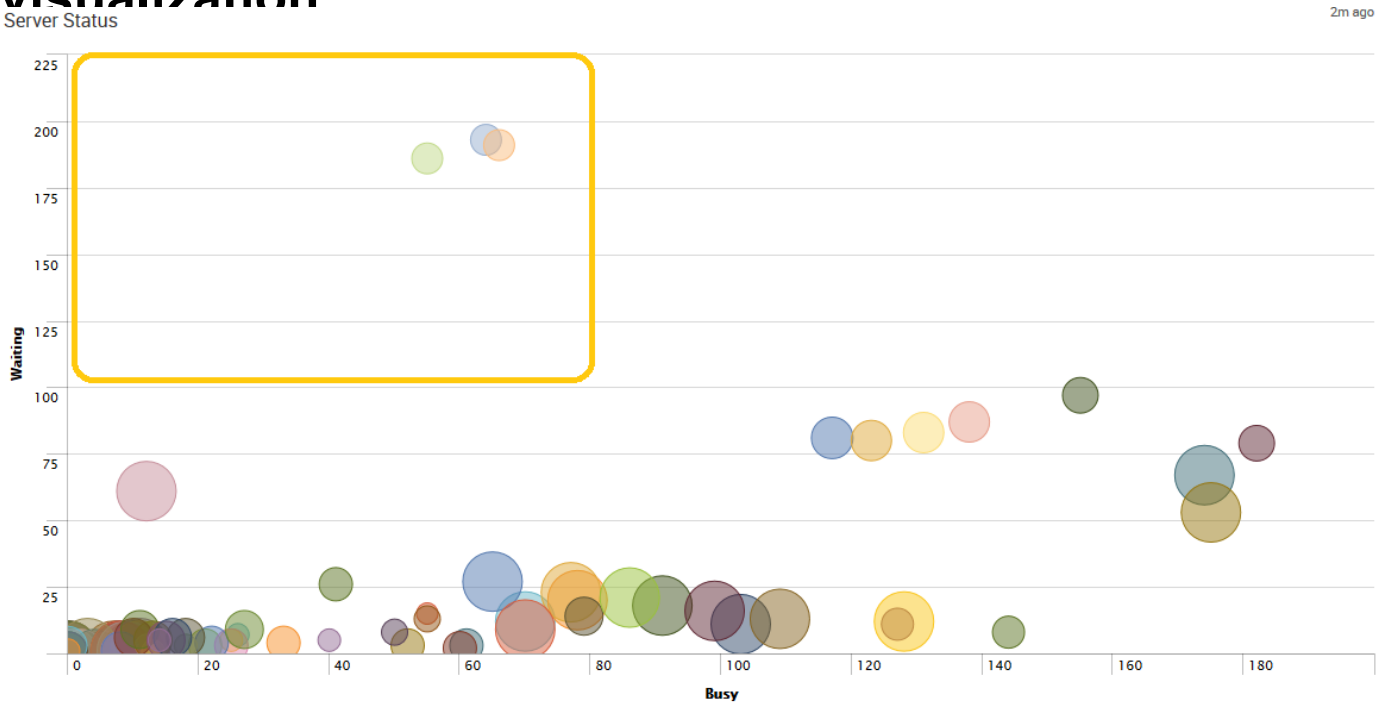


..to Splunk



Proactive is way better than reactive

Focus: Apache HTTP status.. See all server in the same graph with adv visualization



Waiting workers count
> Busy Worker count

Proactive is way better than reactive

Focus: simple search on firewall logs

Needs:

- Enable Network Security Specialists to access all firewall logs from a single point
- Access historical data and make it easy!

Answer:

- Collect firewall syslog in Splunk
- Spend less than one our to develop a form which simplify searches

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Proactive is way better than reactive

Focus: monitoring tools data in Splunk

Sitescope:

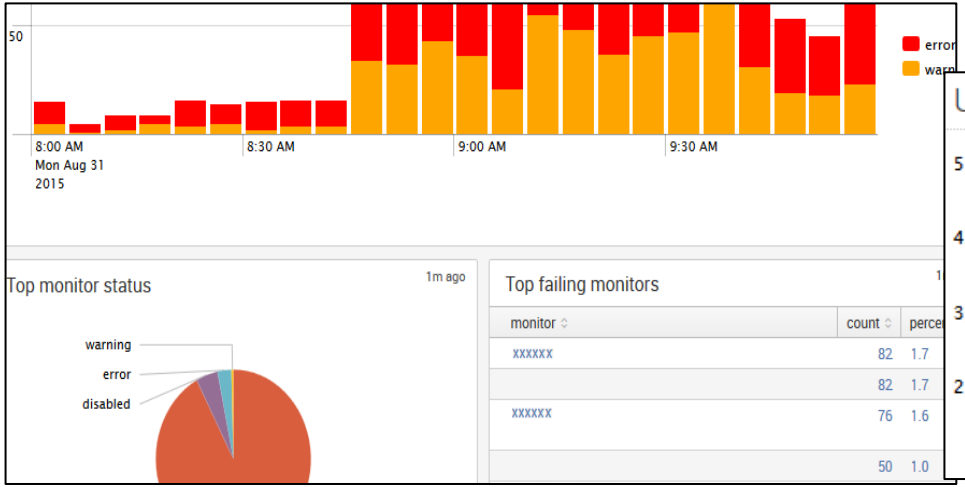
- Install UF on SiteScope Server
- Collect ...\logs\SiteScope*.log
- Take the best from «Splunk for SiteScope» app

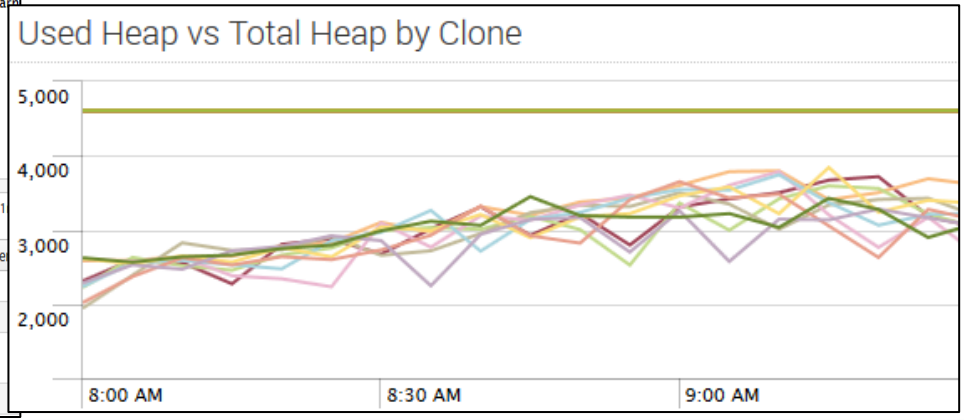
ITCAM:

- Use DBConnect to collect data from ITCAM db

Added value:

- Easily create status reports based on historical data
- Visualize events over time
- Integration: add SiteScope data in a Splunk dashboards
- Create advanced alerting (something OR smthelse NOT disabled AND field>X)





Proactive is way better than reactive

Key takeaways

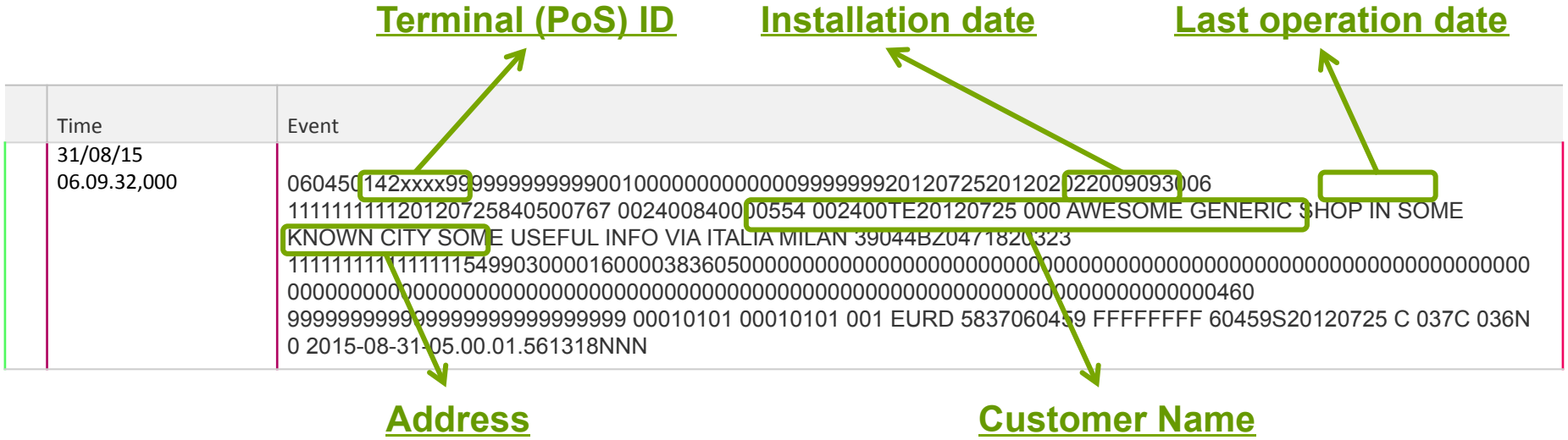
- Same **approaches**, different **purposes**
- DevOps re-mastered: IT Ops and Dev teams sharing the **same perspective**
- Always involve people who **knows** the data

Accounting:
Build reports like never before

Build reports like never before

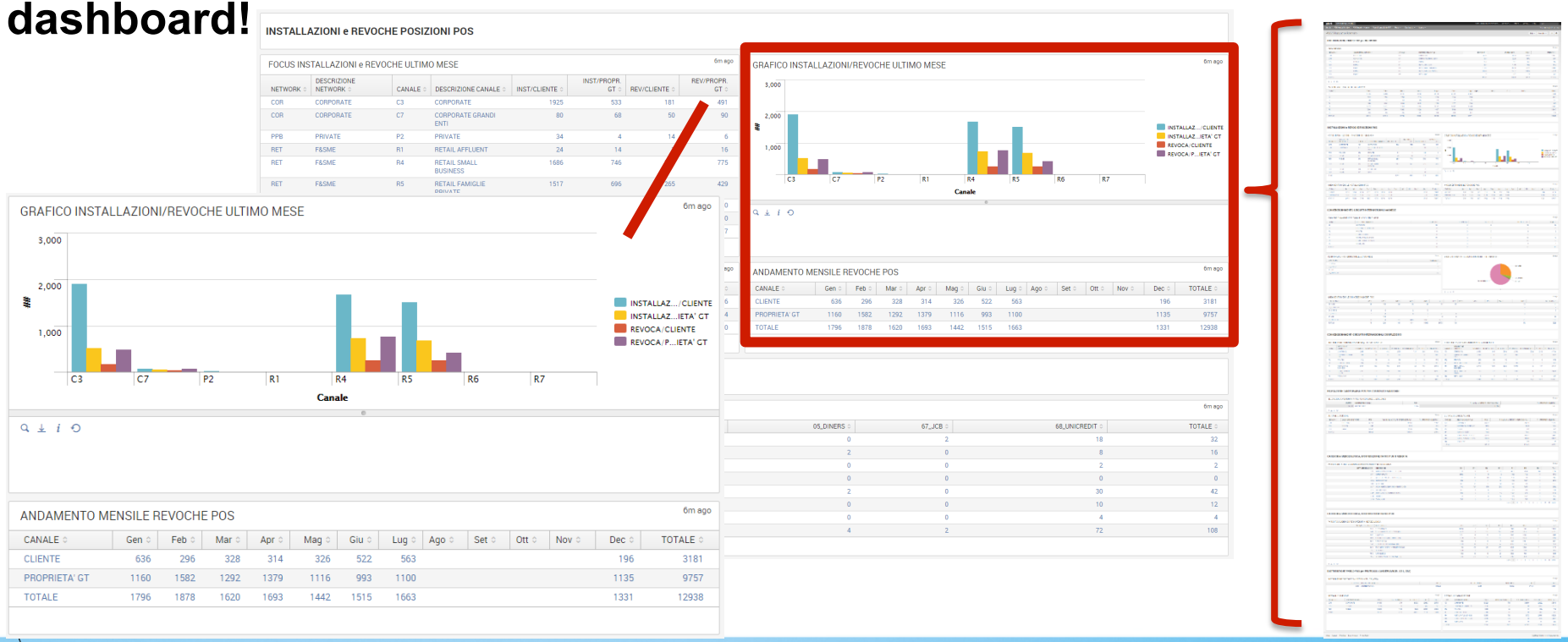
Data input for recording

- Mainframe log dumped with an FTP job: single string of data
- Fixed-length fields -> **EASY PARSING (FOR SPLUNK)**, they never change in size



Build reports like never before

Result: substitute that huge Excel report and welcome your interactive dashboard!



APInthusiasts:
From data collector to data engine

From data collector to data engine

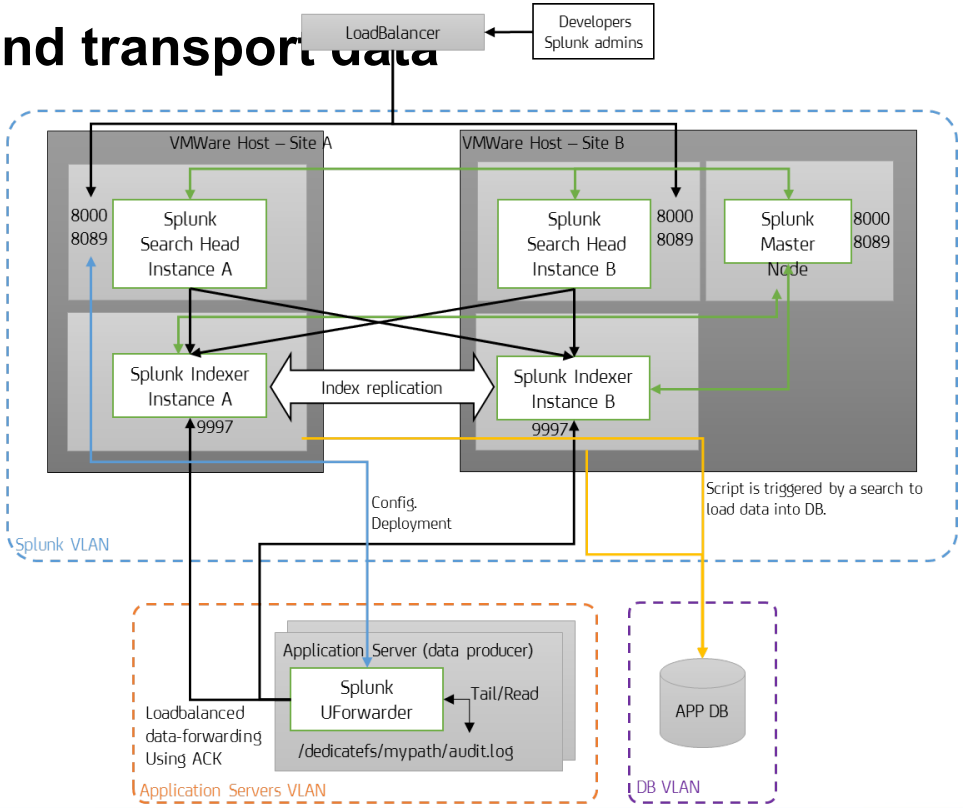
2014 Q4 – Splunk used to collect and transport data

How:

- Application logs collected by Splunk from application servers log folders.
- Read and indexed by Splunk
- Sent to DB with a custom Python script performing export + load

Challenges:

- Very high performances needed
- High availability
- Dependency from a «custom script»
- Complex mapping between Splunk indexes and DB tables

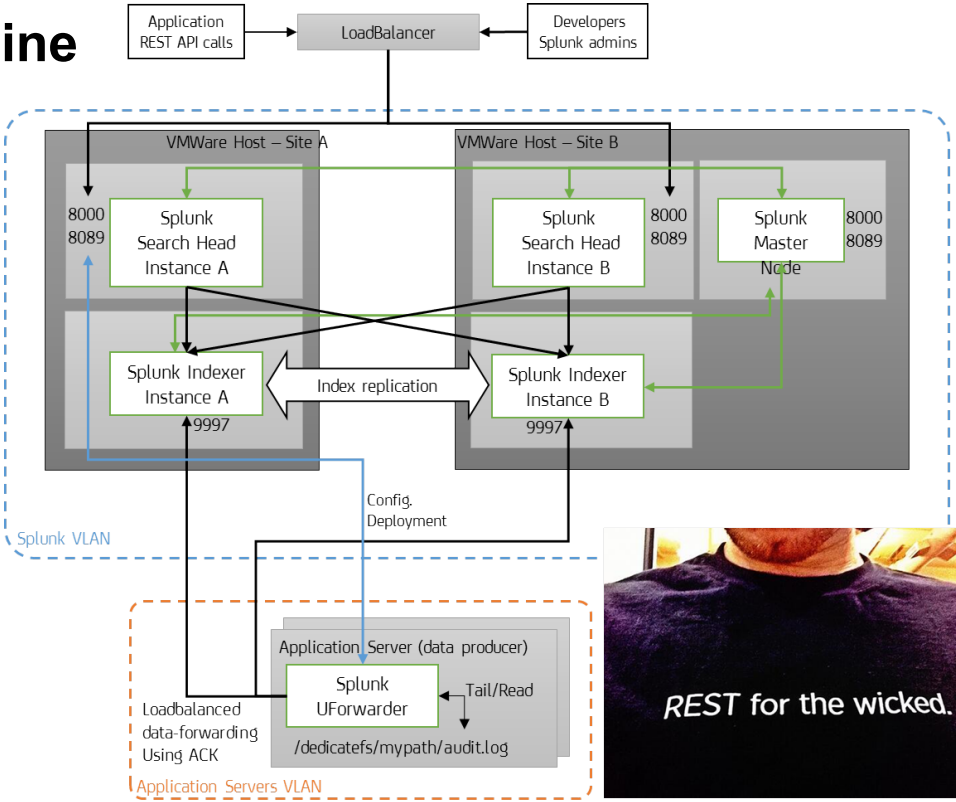


From data collector to data engine

2015 Q2 – Splunk as a data engine

Key differences:

- DB dependency removed
- Client application read data from Splunk using REST API; HTTP calls are simple!
- Fully dedicated Splunk deployment to answer use case needs: indexes replication, data ack, no downtimes, etc.



Recap and final takeaways

What we've learned and what we believe you should interiorize:

«Be sure to add as many information (i.e. fields) to every input stream available.
Only God (or your best data scientists) know how you can exploit them, in the future»
(Somewhere in the Bible)

«Knowledge is power, use it well (and often)»
(Someone in the far future, ca. 40,000 AD)

«Why do it with a random tool when you can do it with Splunk?»
(Mirko)

Questions?

THANK YOU!

Stefano Guidobaldi, Advanced Engineering – UniCredit Group ICT & Security Officer

Mirko Carrara, Service Reliability & Splunk Team – V-TServices

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#splunkconf – Las Vegas, 23rd September 2015

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