PATIENT CARE TEAM

Igal Vainer, Senior Director, Head of Enterprise Solutions Lab, EPAM Systems
AGENDA

1. EPAM QUICK FACTS
2. CARE TEAM: PROBLEM STATEMENT AND KEY FEATURES
3. DATA SOURCES AND ARCHITECTURE
4. SOLUTION OVERVIEW
Fast-growing, sizeable opportunity in a global market

Ability to deliver a broad range of software engineering, digital engagement, consulting and IT services with a strong focus on innovative and scalable software solutions

Serving clients in over 25 countries across North America, Europe, Asia, Australia and Central and Eastern Europe

Deep talent pool of highly-skilled professionals delivering solutions through best-in-class engineering combined with strategy, consulting and innovation services

Industry solutions for Financial Services, Travel and Consumer, Life Sciences and Healthcare, Media and Entertainment, and Software and Hi-Tech

Proven ability to grow and sustain a strong profitability model
We are consultants, designers, architects and engineers who enable our customers to be competitive and disruptive in the marketplace through INNOVATIVE TECHNOLOGY SOLUTIONS while helping them to navigate successfully through multiple waves of technology change.

We help our customers be more competitive by delivering solutions through best-in-class engineering combined with strategy, design, consulting and innovation services.

We adopt a global growth strategy, thinking and acting like start-ups, working in multidisciplinary teams and delivering results. Relentlessly.
FOUNDED IN 1993
US HEADQUARTERED PUBLIC COMPANY (NYSE:EPAM)

1.16B
2016 REVENUE

$1.16B

2017 REVENUE GUIDANCE

$1.4B

YOE CONSTANT CURRENCY ORGANIC GROWTH

20+% REVENUE GROWTH

NORTH AMERICA
59%
EUROPE
35%
CIS
4%
APAC
2%

VERITCAL FOCUS*

20,400+ Engineers | 24,000+ EPAMers

25% FINANCIAL SERVICES
23% TRAVEL & CONSUMER
21% SOFTWARE & HI-TECH
15% MEDIA & ENTERTAINMENT
9% LIFE SCIENCES & HEALTHCARE
7%
EMERGING

SERVICE MIX

SOFTWARE ENGINEERING & PRODUCT/PLATFORM DEVELOPMENT
QA AND TEST AUTOMATION
MANAGED SERVICES
INFRASTRUCTURE & LICENSING

DIGITAL BUSINESS

PRODUCT ENGINEERING

MANAGED SERVICES

CONSULTING

* Data represents FY 2016 Earnings
CARE TEAM: PROBLEM STATEMENT AND KEY FEATURES
USER EXPERIENCE ISSUES. PROBLEM STATEMENT.

Patients are usually unaware of the size of their care team and the names of the staff that are treating them.

Clinical staff cannot quickly identify other relevant and available staff members in emergencies or for questions.

Hospital executives lack a comprehensive view of patient/staff interactions and resource utilization within the hospital.

Compliance departments do not have a real-time view as to whether a staff member’s patient record access is relevant to their job.
WHY WE CHOSE SPLUNK?

1. SINGLE TECHNOLOGY STACK
   • Some HC vendors already use SPLUNK
   • All-in-one solution

2. RAPID DEVELOPMENT
   • Fast TTM (Time To Market)
   • Relatively low cost of implementation

3. INTEGRABILITY
   • Out-of-the-box integration patterns

4. MAINTAINABILITY & EXTENDIBILITY
   • Out-of-the box mature maintenance solution
   • Easy to maintain code.
   • Fast and easy to extend functionality

5. SECURITY
   • Out-of-the-box Authorization and Authentication mechanisms
   • Support all modern and reliable approaches (SAML, LDAP, ..)

6. SCALABILITY
   • Proven scalability approach on both indexer and search head sides

7. CUSTOMIZATION
   • Deeply customizable on UI side
FACTS

Implementation Efforts
~300 man/days

Team of 6 people
- 2 Splunk developers
- UI developer
- UI designer
- BA
- Architect/DM

Time To Market
3.5 months

File Formats
ADT, ORM, CCD, RTLS log files

Custom generators to generate input data
4 user roles
8 entries (dashboards)

Jenkins as an orchestration tool to build, deploy and validate system on Splunk envs in 15 mins.

~20 lookups

>30 saved searches

Data-Driven Documents

Extensive customization on UI side

<2s response time

Full-functional application
which is easy to maintain and extend.

<2s

3 search heads

Healthcare Domain

 Mutable (KV Store) and Immutable (Index) data

PHI data masking.
OUR APPROACH

REQUIREMENTS GATHERING
- Architect
- BA

SOLUTION DESIGN & UI
- Architect
- Delivery manager
- UI Developer
- UX/UI designer
- Developer

CARE TEAM UC IMPLEMENTATION
- Architect
- Delivery manager
- UI Developer
- UX/UI designer
- Developer

CARE GAP & ANALYTICS UC IMPLEMENTATION
- Delivery manager
- Developer

PERFORMANCE TESTING
- Developer
- UI Developer
- Delivery manager
### SPLUNK TEAM SUPPORT IN PRODUCT IMPLEMENTATION

<table>
<thead>
<tr>
<th>Architecture/ Delivery Management</th>
<th>Proper storage selection for mutable data (KV store was chosen)</th>
<th>Application packaging best practices (applInspect utility)</th>
<th>Solution review &amp; GA</th>
</tr>
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<tbody>
<tr>
<td>UX/UI Design</td>
<td></td>
<td>Global UI customization (Proprietary code modification, tips and tricks)</td>
<td></td>
</tr>
<tr>
<td>Development</td>
<td>Business Rules processing add-on.</td>
<td>Performance optimization advices (replace joins with stats, stats with tstats, queries acceleration, ...)</td>
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<table>
<thead>
<tr>
<th>SOLUTION DESIGN &amp; POC</th>
<th>CARE TEAM UC &amp; CARE GAP &amp; ANALYTICS IMPLEMENTATION</th>
<th>PERFORMANCE TESTING</th>
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</table>
DATA SOURCES AND ARCHITECTURE
SOLUTION OVERVIEW
CARE TEAM IDENTIFICATION

- Care team based on full admissions history
- Care team based on most recent diagnosis
- Breakdown by specialty
IDENTIFY KEY PERSONNEL

Key personnel (tier-1)

Patient

Smart filtering
COMPLIANCE

- Incidents summary & drilldown
- Patient room access violation
- Patient record access violation
REPORTING

Interactions report

Interactions insights per diagnosis
CARE GAP DETECTION

Care Gap Overview

Care Quality Rules
https://www.cms.gov
Centers for Medicare & Medical Services
Patients at risk that fall under specific rule
AREAS FOR FURTHER DEVELOPMENT AND IMPROVEMENTS

• Commercialization.
• Additional features (quality of service, care circles detection, cost effectiveness, extended and detailed fraud detection analytic).
• Visualization improvements (drilldowns and multi-dimensional searches).
• Robust model for all X12 transaction types. Processing and ad-hoc data processing

EPAM + SPLUNK COOPERATION FOOTPRINT

• Ability to deliver SPLUNK - based solutions from within EPAM labs.
• Help in testing, prototyping, verification of early versions of Splunk products.
• Ability to deliver EPAM vertical industry solutions based on Splunk products and EPAM domain knowledge.
• Collaborative knowledge and key assets will be shared with Splunk community.

POTENTIAL AND FUTURE ENHANCEMENTS
LESSONS LEARNED

1. PERFORMANCE:
   - Scheduled searches for alerts usually impact performance so separate search head for them worth consideration.
   - Roles isolation (in our case patient/doctor) on Search head level was also very helpful and useful.
   - Use Job inspector for queries profiling. (It’s the basic one to detect performance problem)
   - Tstats command was very useful along with “walklex” cli command for efficient queries optimization.
   - Data Models should be used not only for further acceleration but even to keep your data in more structured way.

2. DEVELOPMENT:
   - UI. It was very useful to first concentrate on development using simple/extended Splunk dashboards. UI customization should be done only after prototype is working.
   - Use command line tools. Especially “btool”. It could take enormous amount of time to detect which config went wrong.
   - Data “mutability” with KV store for storing user interactions was really neat.
LESSONS LEARNED

3. SPLUNK CAN BE USED:
   • Splunk can be used much beyond its natural log aggregation and full-text search.

4. COST-EFFICIENCY:
   • Always plan for expected data load.

5. HEALTHCARE SPECIFICS:
   • PHI data masking for HIPAA compliance is supported out-of-the-box
   • Documents of HL7 v. 2.x can be successfully parsed and processed via Splunk Modular Inputs.
THANK YOU!
Patient Care Team
The Journey

What did Splunk learn?
How did EPAM get started?

- Building Splunk Solutions ebook
  - Dev.splunk.com for examples, tutorials

- New Quick Start
  - Guided “your first app” experience
New Quick Start bridges the gap

- http://dev.splunk.com/view/quickstart/SP-CAAAFC9
- Guided “your first app sequence”
- Certification with AppInspect
- Best practices

Getting Started
How did EPAM test the Patient Care Team app?

- Started with Splunk EventGen
  - [https://github.com/splunk/eventgen](https://github.com/splunk/eventgen)
- Built their own data generator for testing
- Saw bigger value with anonymized, real data

- SimData
  - Generate real-looking test data without samples
  - Here at Conf: “Fake Data for Real Apps”
    - Tuesday, 2:15 PM – 3:00 PM
Test Data

SimData

- Generate plausible data to test and demo apps
- Demonstrate patterns and trends in your app
- Create data from scratch with DSL

```
simulation webtraffic

entity WebServer(server_name) {
    self.alive = true
    self.capacity = 10.0
    self.load = 0.0
    self.ticks = 0
    self.pages_served = 0

action serve_page(page_name, ip_address) {
    page = one_of(Page[page_name=page_name])
    self.pages_served = self.pages_served + 1
    load_modifier = self.load + 1
    response_time = page.service_duration * random(0.8, 1.2) * load_modifier
    user = one_of(User[ip=ip_address])
    tell user response(page_name)
    timer {
        name: "webserver.response_time.{{self.server_name}}.{{page_name}}"
        value: response_time
    }
    log {
        sourcetype: "weblog"
        host: self.server_name
    }
```
How did EPAM get data in?

- Built inputs for each data source
- Focused on data pipeline

Splunk Add-on Builder

- Getting data in should be easy
- Getting your app certified should be easy
- Here at Conf: “From API to Easy Street Within Minutes Using Add-on Builder”
  - Wednesday, 1:10 PM-1:55 PM
Getting Data In

Splunk Add-on Builder

- Build:
  - Modular inputs
  - Alert actions
  - Field extractions
  - CIM mappings
  - Adaptive response actions

- Validate with AppInspect

Validate & Package

Click Validate to validate your add-on against best practices and other rules, and to determine whether your app is ready for Splunk App Certification. When you have finished creating your add-on, click Download Package to create and download the SPL package file. Learn more

Overall Health Report

Ready for certification

Congratulations, your add-on is ready to submit to Splunk App Certification.

Validation Results

- 0 Errors
- 0 Warnings
- 86 Passes
Thank You

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