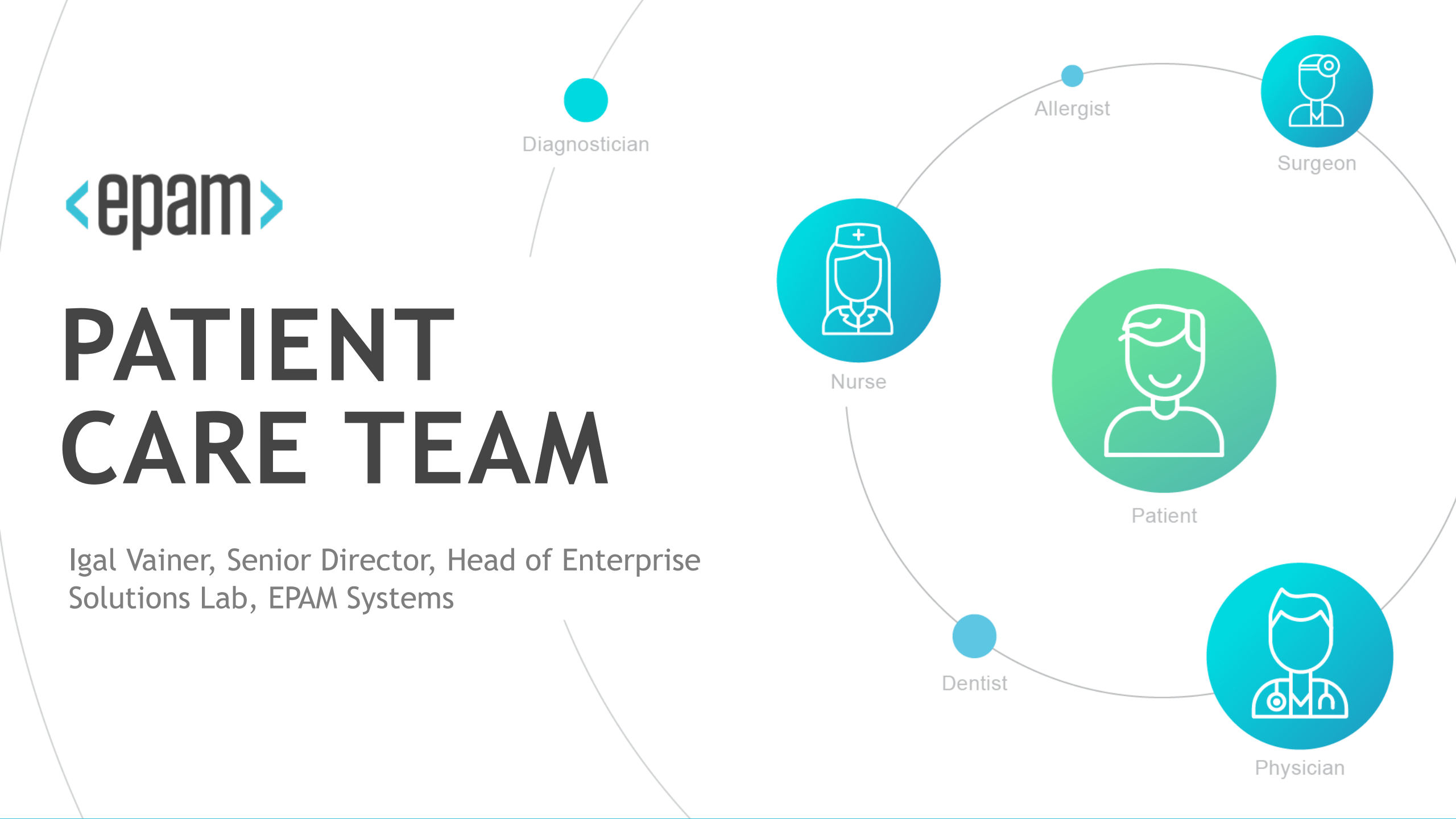

PATIENT CARE TEAM

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

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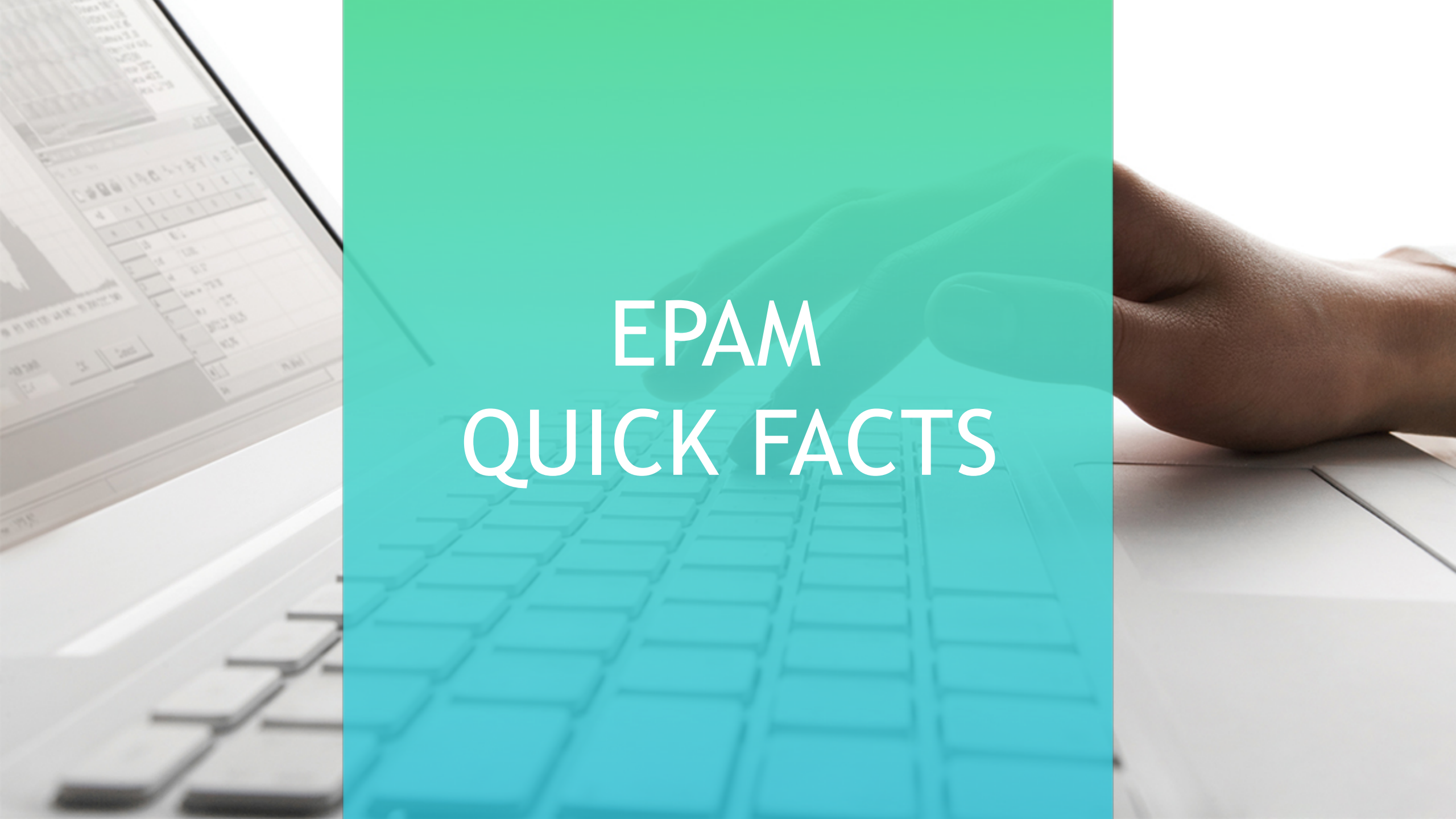
AGENDA

1. EPAM QUICK FACTS
2. CARE TEAM: PROBLEM STATEMENT AND KEY FEATURES
3. DATA SOURCES AND ARCHITECTURE
4. SOLUTION OVERVIEW



EPAM
QUICK FACTS

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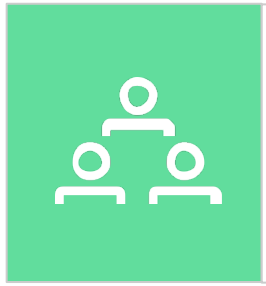
EPAM OVERVIEW

Fast-growing, sizeable opportunity in a global market



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

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

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

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

Proven ability to grow and sustain a strong profitability model

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WHO WE ARE

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.

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FACTS

FOUNDED IN

1993

US HEADQUARTERED PUBLIC COMPANY (NYSE:EPAM)

FY 2016 REVENUE

$1.16B

2017 REVENUE GUIDANCE

$1.4B

20+%

YOY CONSTANT CURRENCY ORGANIC GROWTH

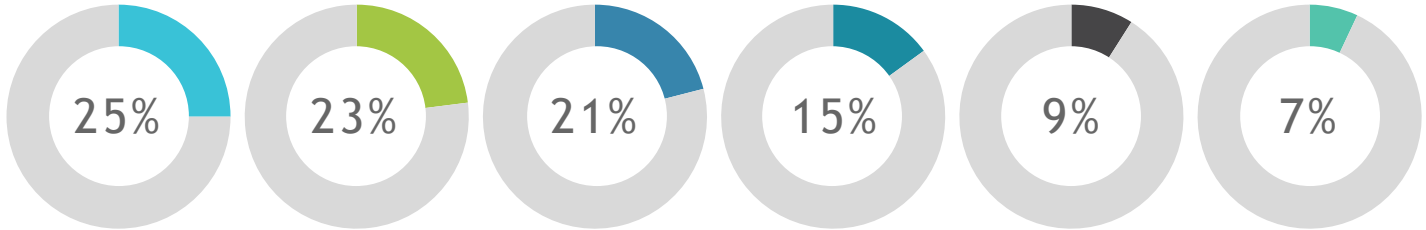
REVENUE BY GEOGRAPHY*

NORTH AMERICA | EUROPE | CIS | APAC

25+ COUNTRIES

20,400+ Engineers | 24,000+ EPAMers

VERTICAL FOCUS*



FINANCIAL SERVICES | TRAVEL & CONSUMER | SOFTWARE & HI-TECH | MEDIA & ENTERTAINMENT | LIFE SCIENCES & HEALTHCARE | 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

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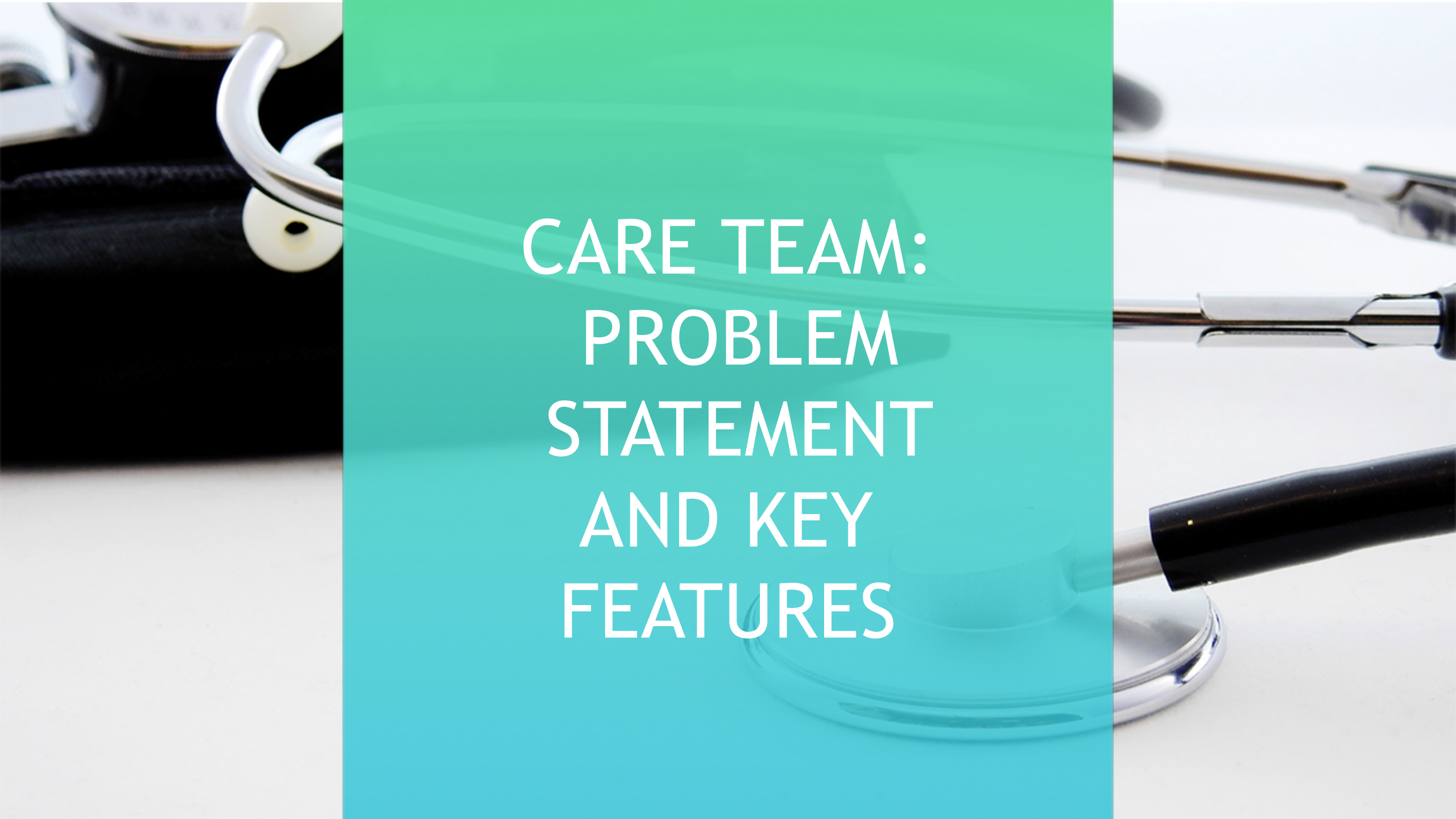

CARE TEAM: PROBLEM STATEMENT AND KEY FEATURES

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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

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

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

Compliance departments do not have a real-time view as to whether a staff member's patient record access is relevant to their job

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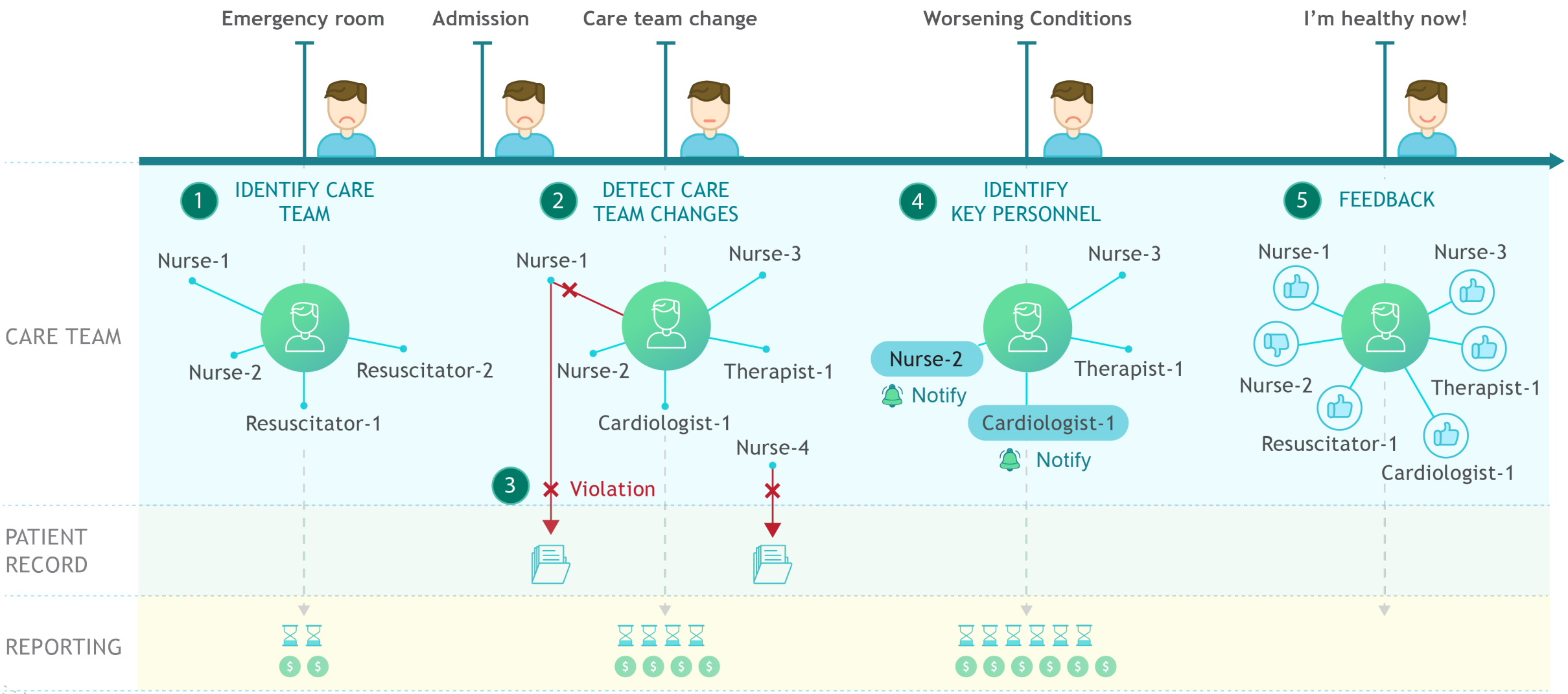
IDEA OF CARETEAM



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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

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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

Healthcare Domain

File Formats ADT, ORM,CCD, RTLS log files

Custom generators to generate input data

4 user roles

8 entries (dashboards)

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

PHI data masking.

~20 lookups

>30 saved searches

Data-Driven Documents

BACKBONE.JS

Extensive customization on UI side

<2s response time

3 search heads

Full-functional application

which is easy to maintain and extend.

Mutable (KV Store) and Immutable (Index) data

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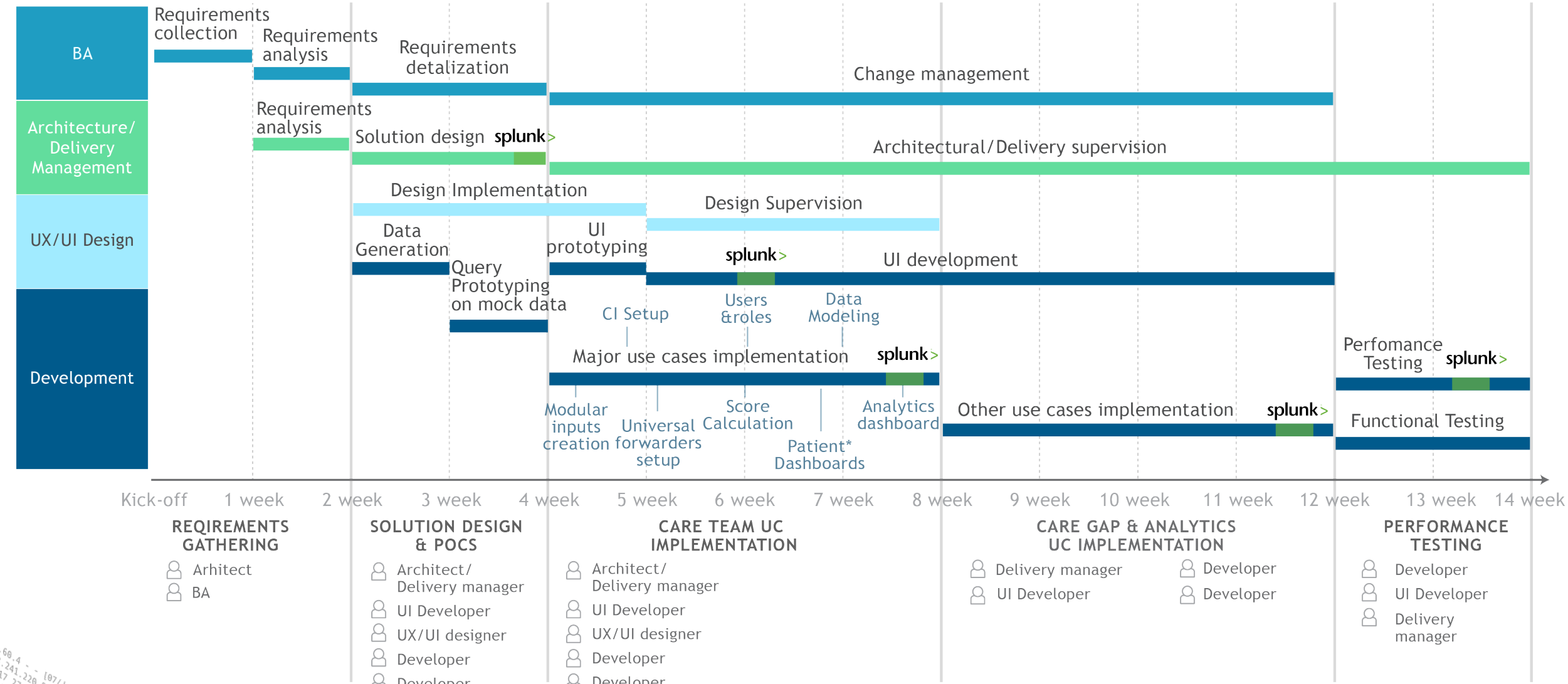
OUR APPROACH



REQIREMENTS GATHERING
- Arhitect
- BA

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

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

CARE GAP & ANALYTICS UC IMPLEMENTATION
- Delivery manager
- UI Developer
- Developer
- Developer

PERFORMANCE TESTING
- Developer
- UI Developer
- Delivery manager

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SPLUNK TEAM SUPPORT IN PRODUCT IMPLEMENTATION

	SOLUTION DESIGN & POC	CARE TEAM UC & CARE GAP & ANALYTICS IMPLEMENTATION	PERFORMANCE TESTING
Architecture/ Delivery Management	Proper storage selection for mutable data (KV store was chosen)	Application packaging best practices (appInspect utility)	Solution review & GA
UX/UI Design		Global UI customization (Proprietary code modification, tips and tricks)	
Development	Business Rules processing add-on.	Performance optimization advices (replace joins with stats,stats with tstats, queries acceleration, …)	

DATA SOURCES AND ARCHITECTURE

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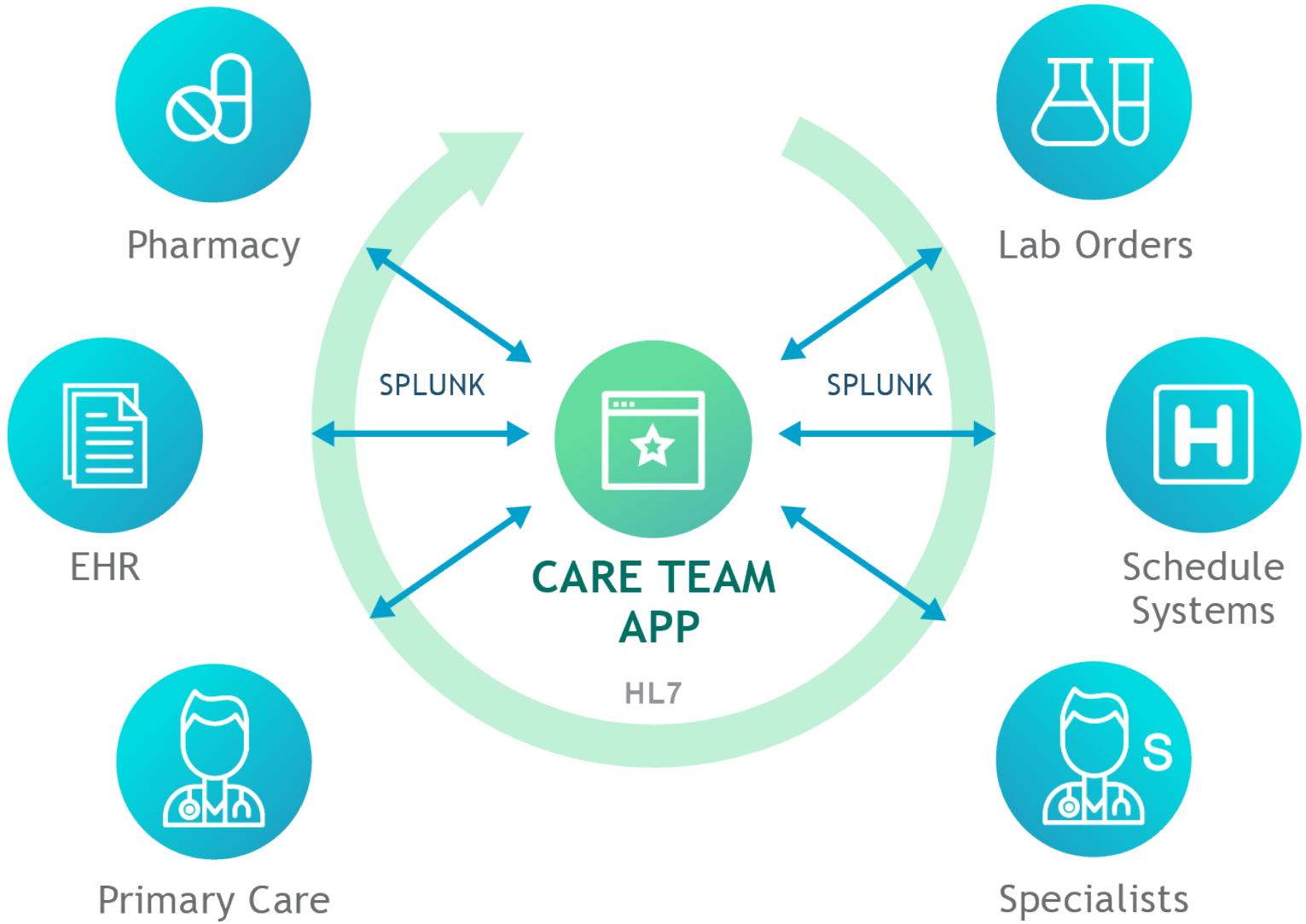
DATA SOURCES USED TO IDENTIFY CARETEAM



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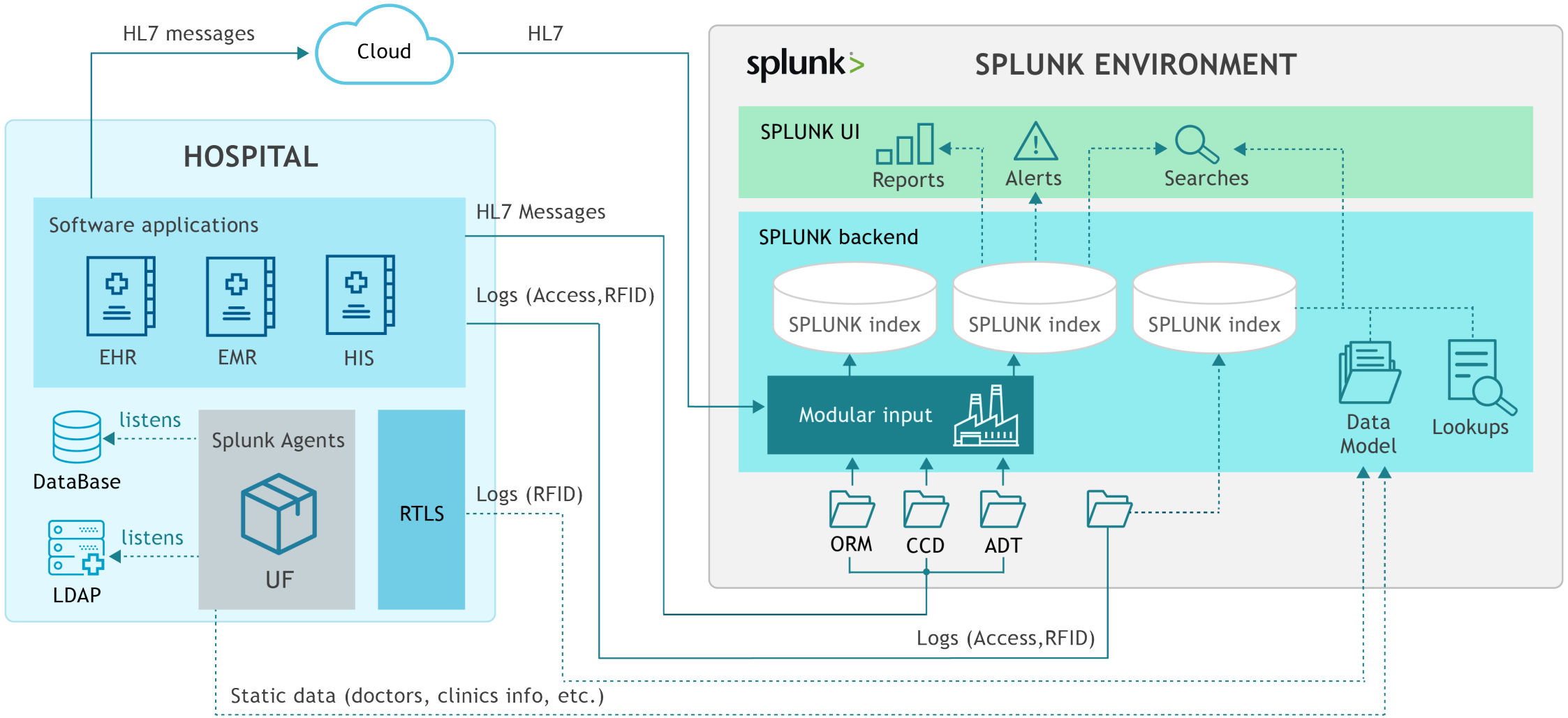
HIGH LEVEL ARCHITECTURE



SOLUTION OVERVIEW

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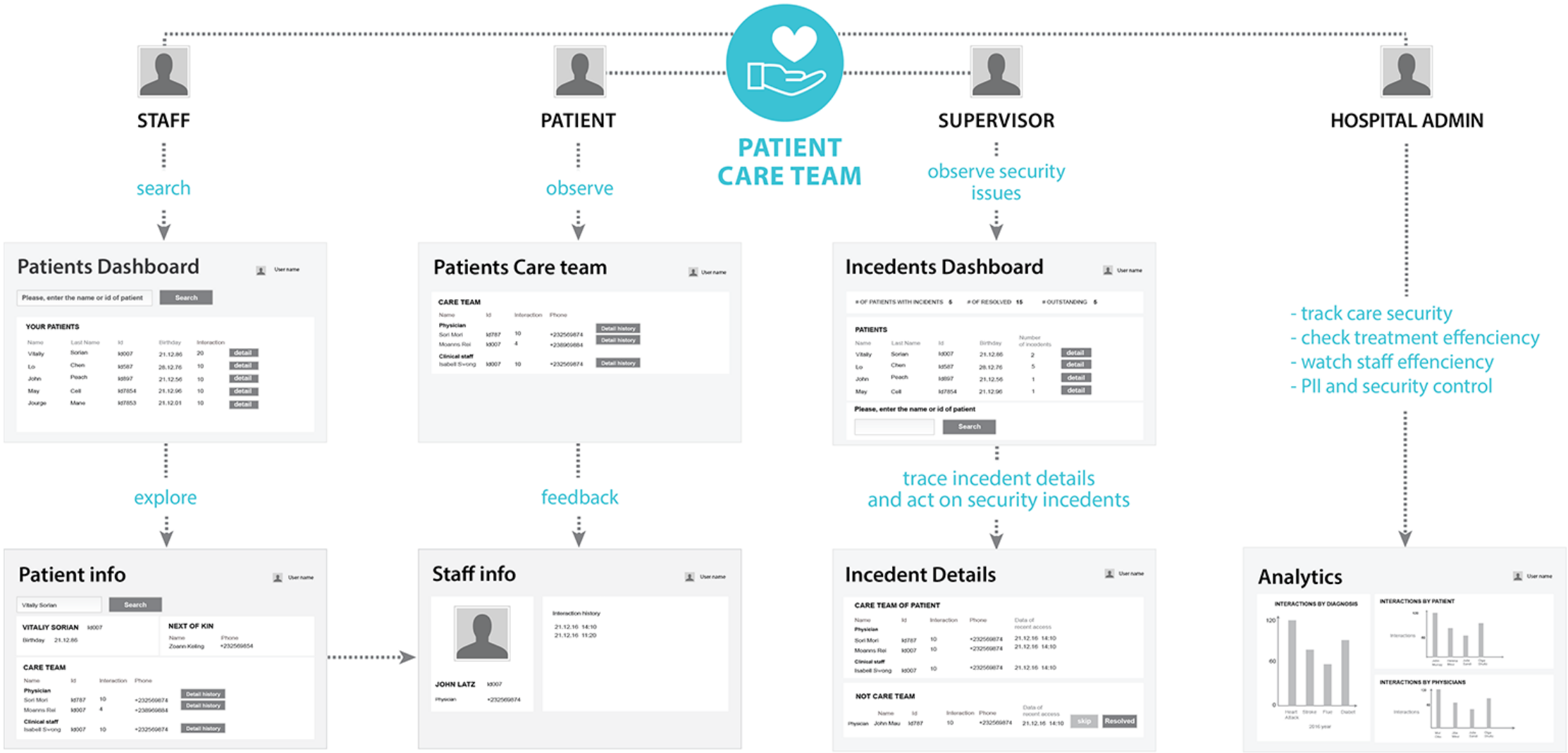
APPLICATION SITEMAP



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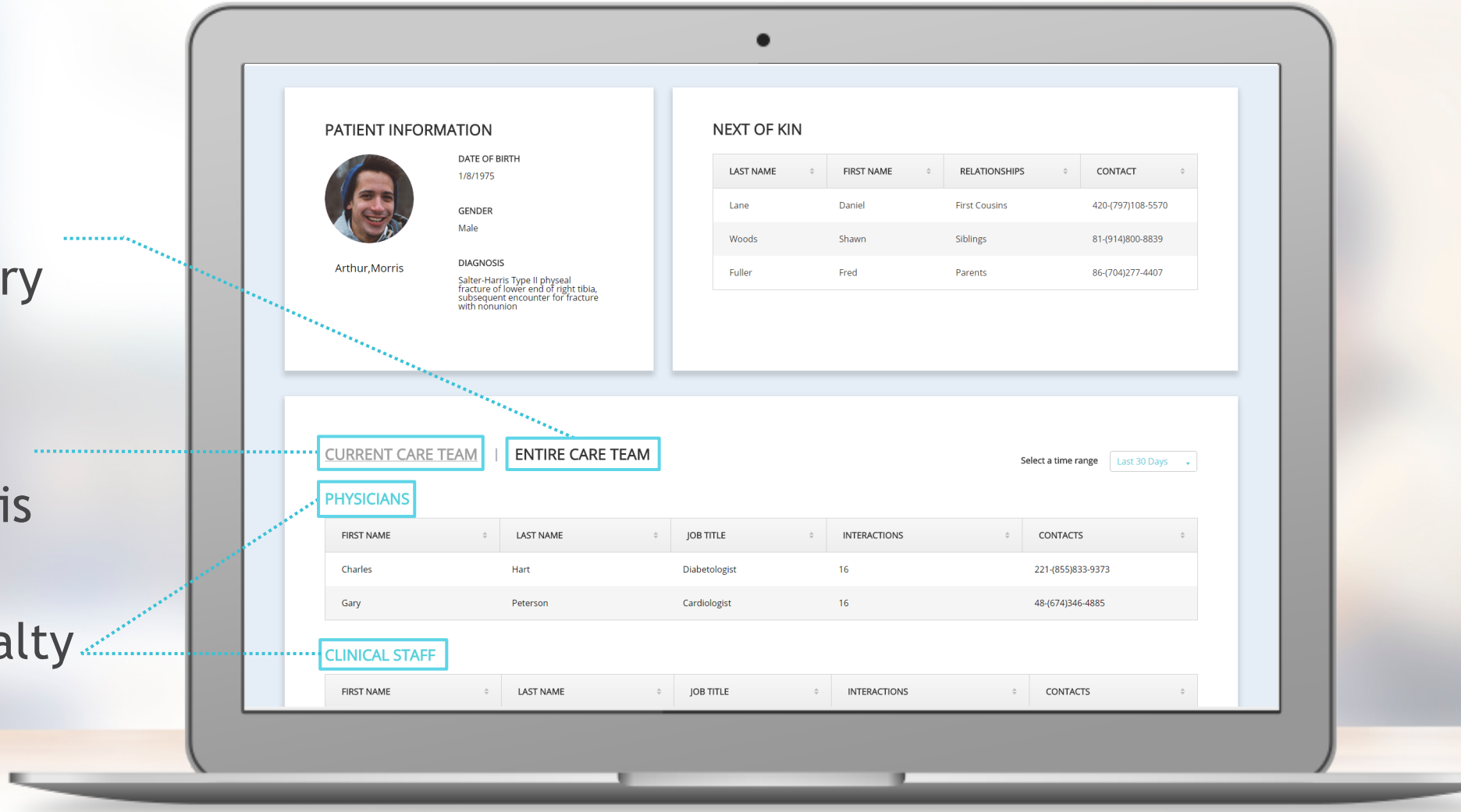
CARE TEAM IDENTIFICATION

Care team based on full admissions history

Care team based on most recent diagnosis

Breakdown by specialty



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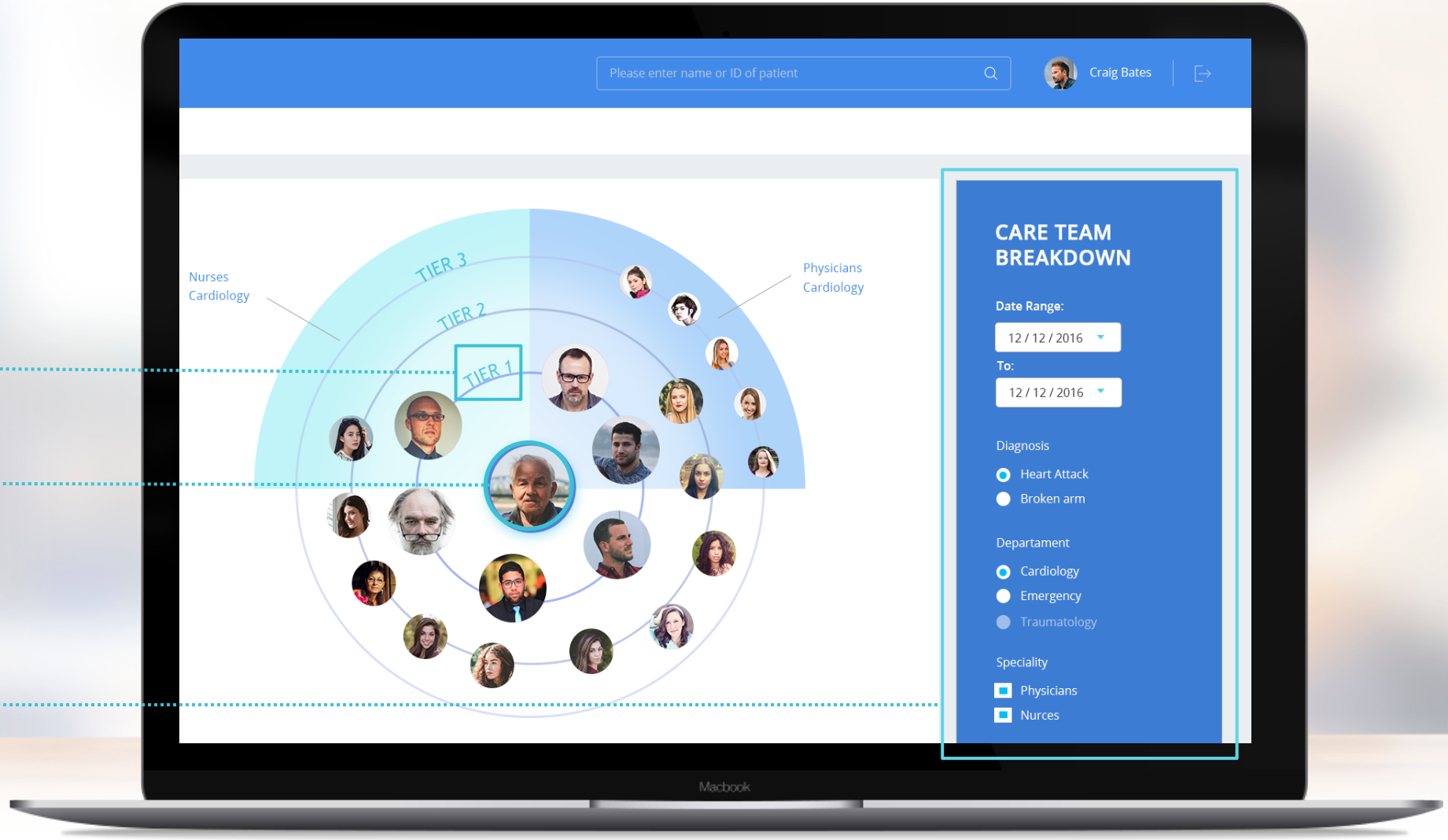
IDENTIFY KEY PERSONNEL

Key personnel (tier-1)

Patient

Smart filtering



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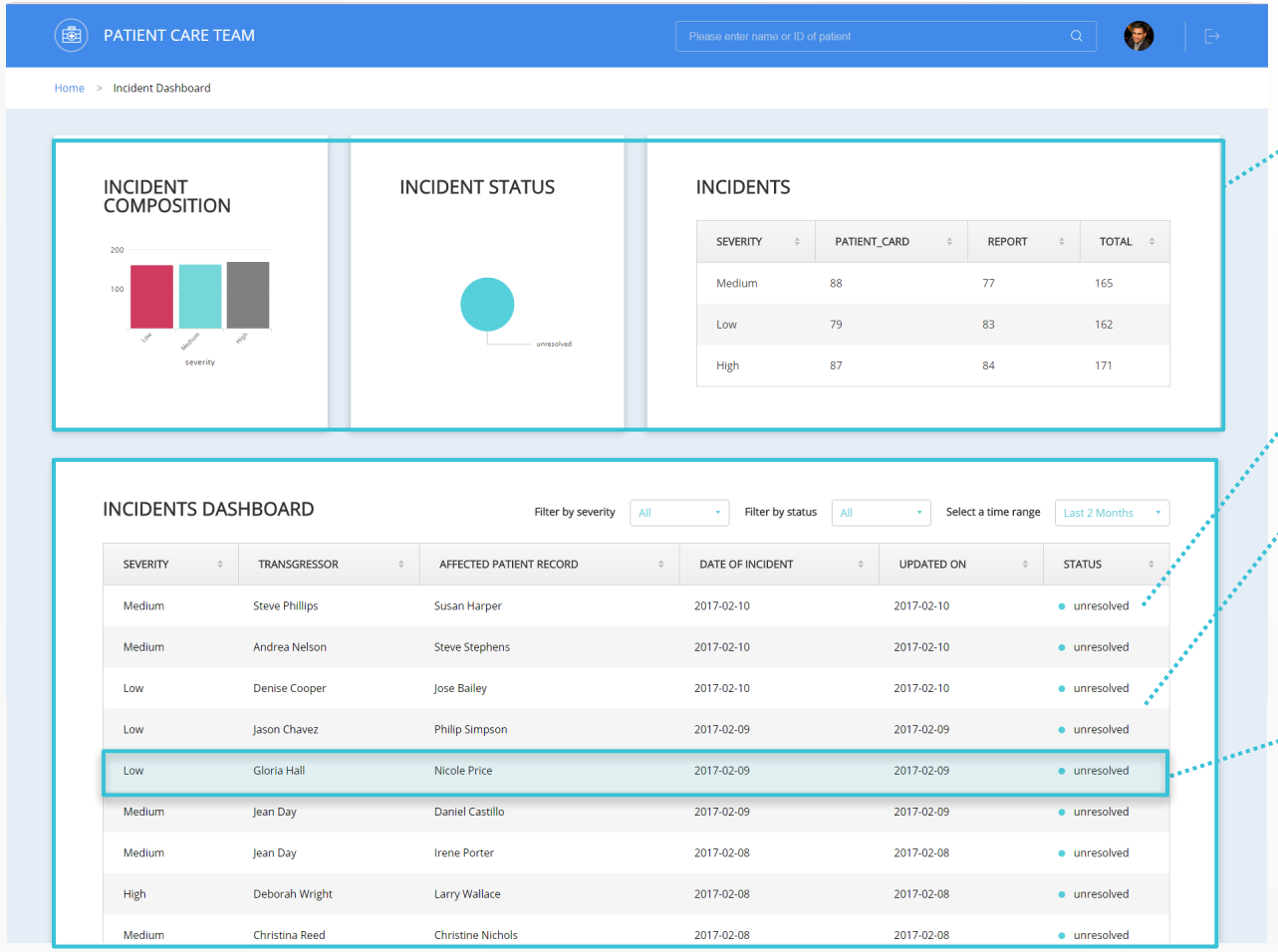
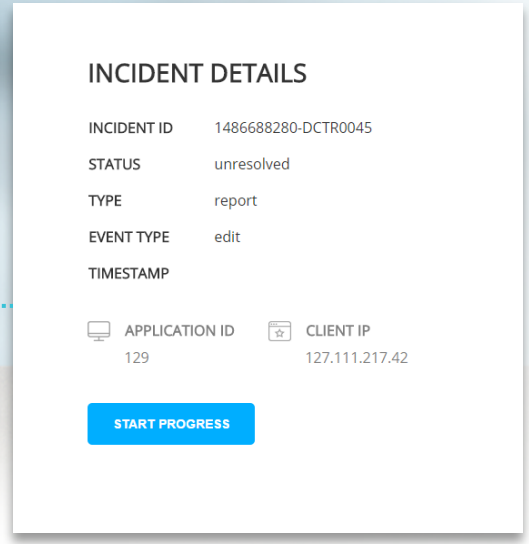
COMPLIANCE



Incidents summary & drilldown

Patient room access violation

Patient record access violation



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REPORTING

Interactions report

Interactions insights per diagnosis

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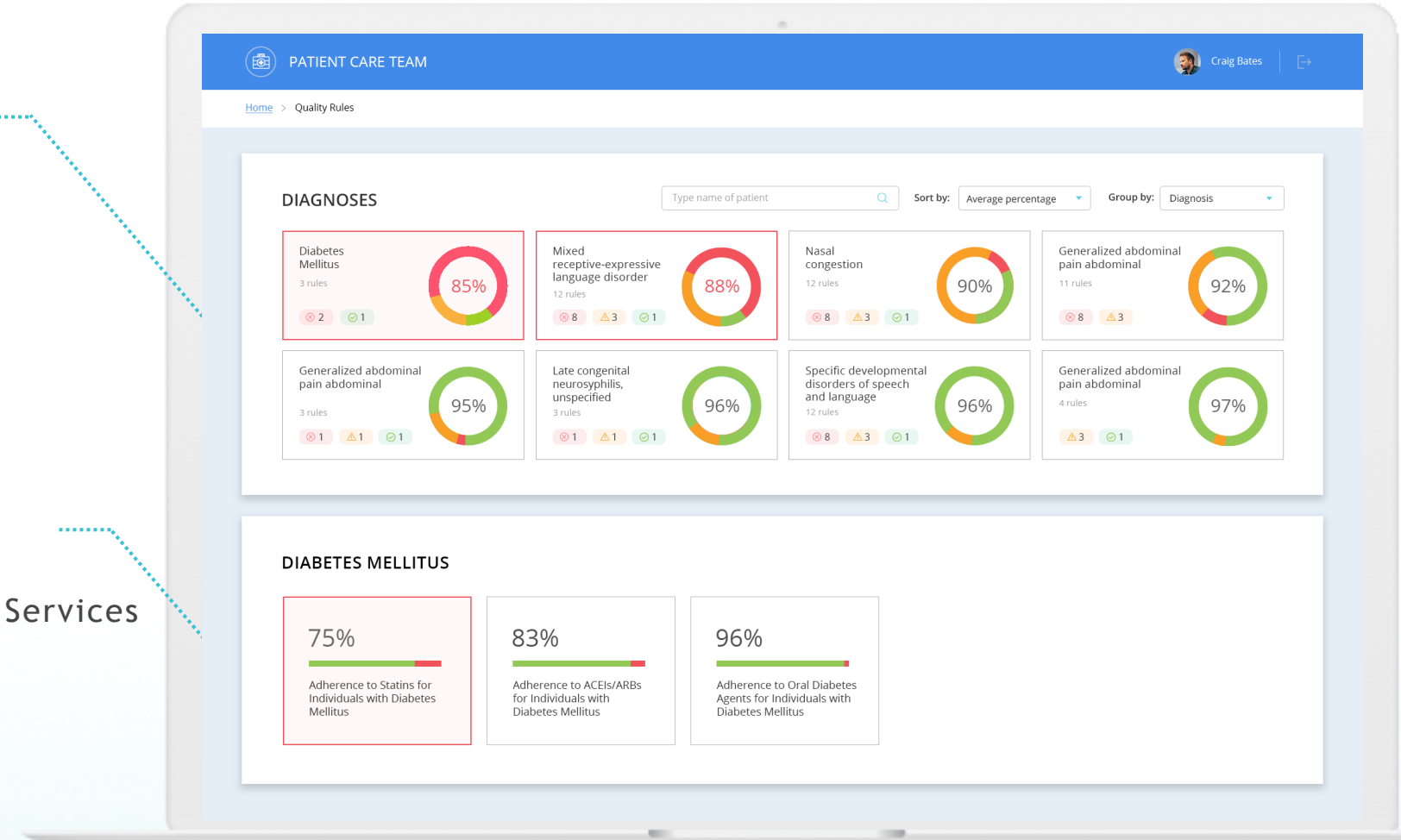
CARE GAP DETECTION

Care Gap Overview

Care Quality Rules

https://www.cms.gov
Centers for Medicare & Medical Services



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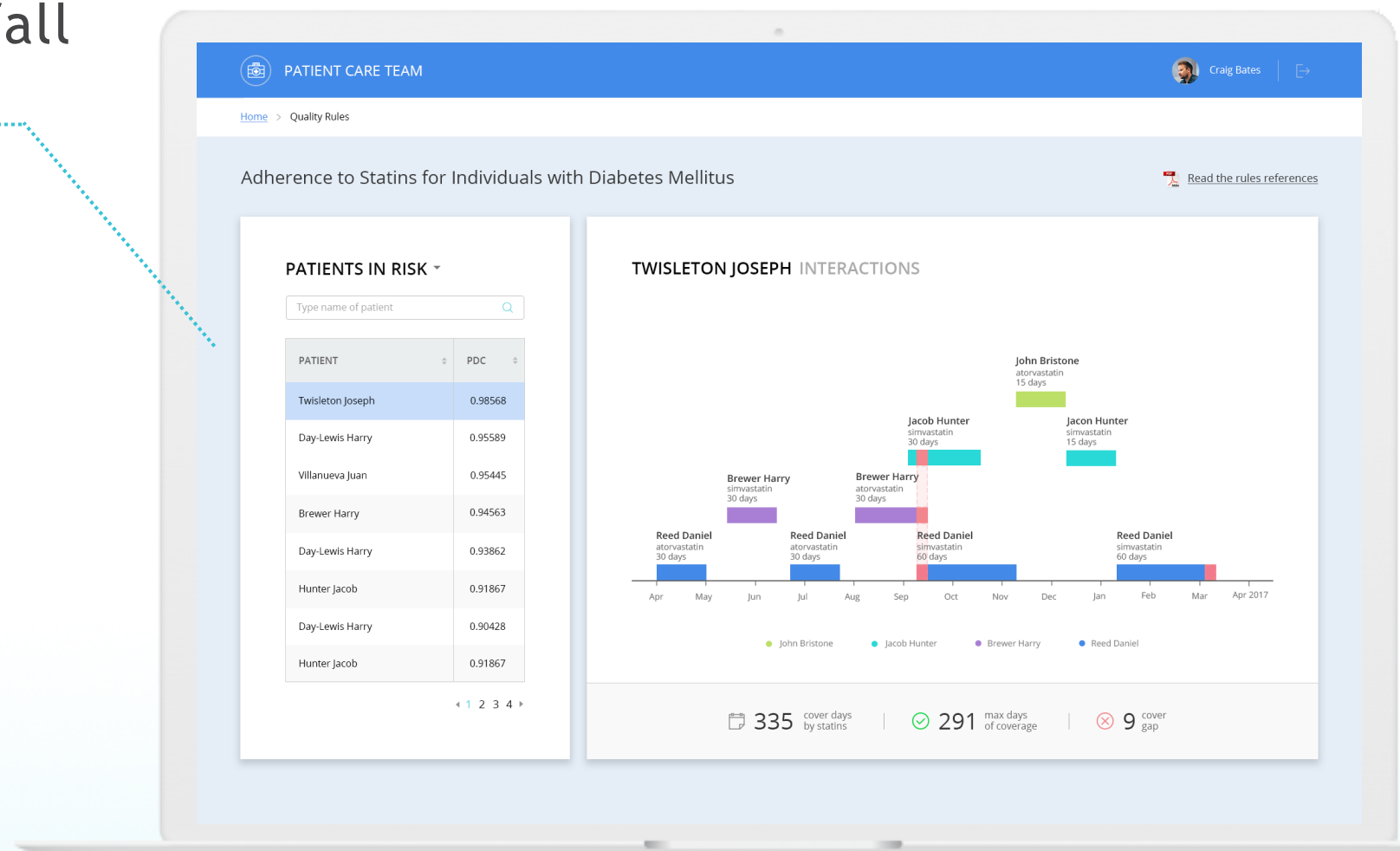
RULE LEVEL DETAILS

Patients at risk that fall under specific rule



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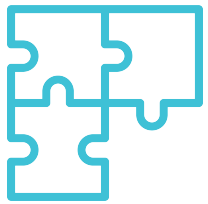
POTENTIAL AND FUTURE ENHANCEMENTS



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.

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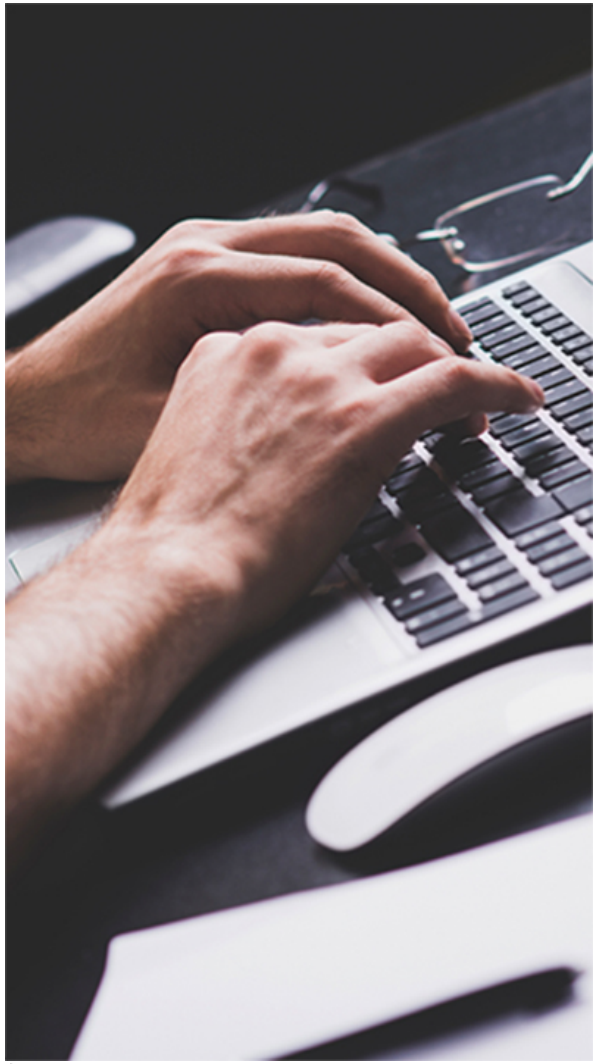
LESSONS LEARNED



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.

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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!

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Patient Care Team
The Journey

What did Splunk learn?

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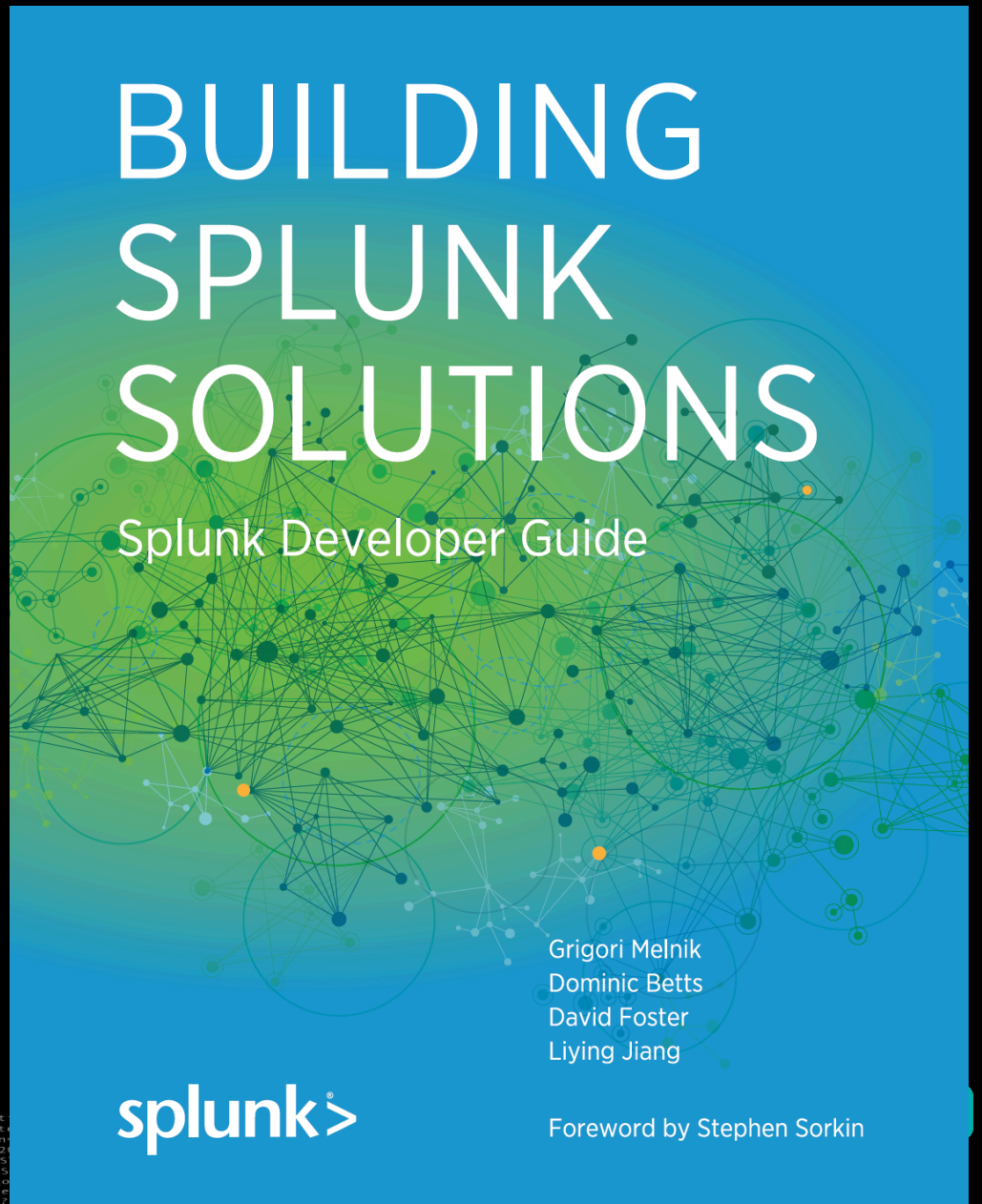
Getting Started

How did EPAM get started?

- Building Splunk Solutions ebook
  - http://dev.splunk.com/view/dev-guide/SP-CAAAE2R
- Dev.splunk.com for examples, tutorials

- New Quick Start
  - Guided “your first app” experience



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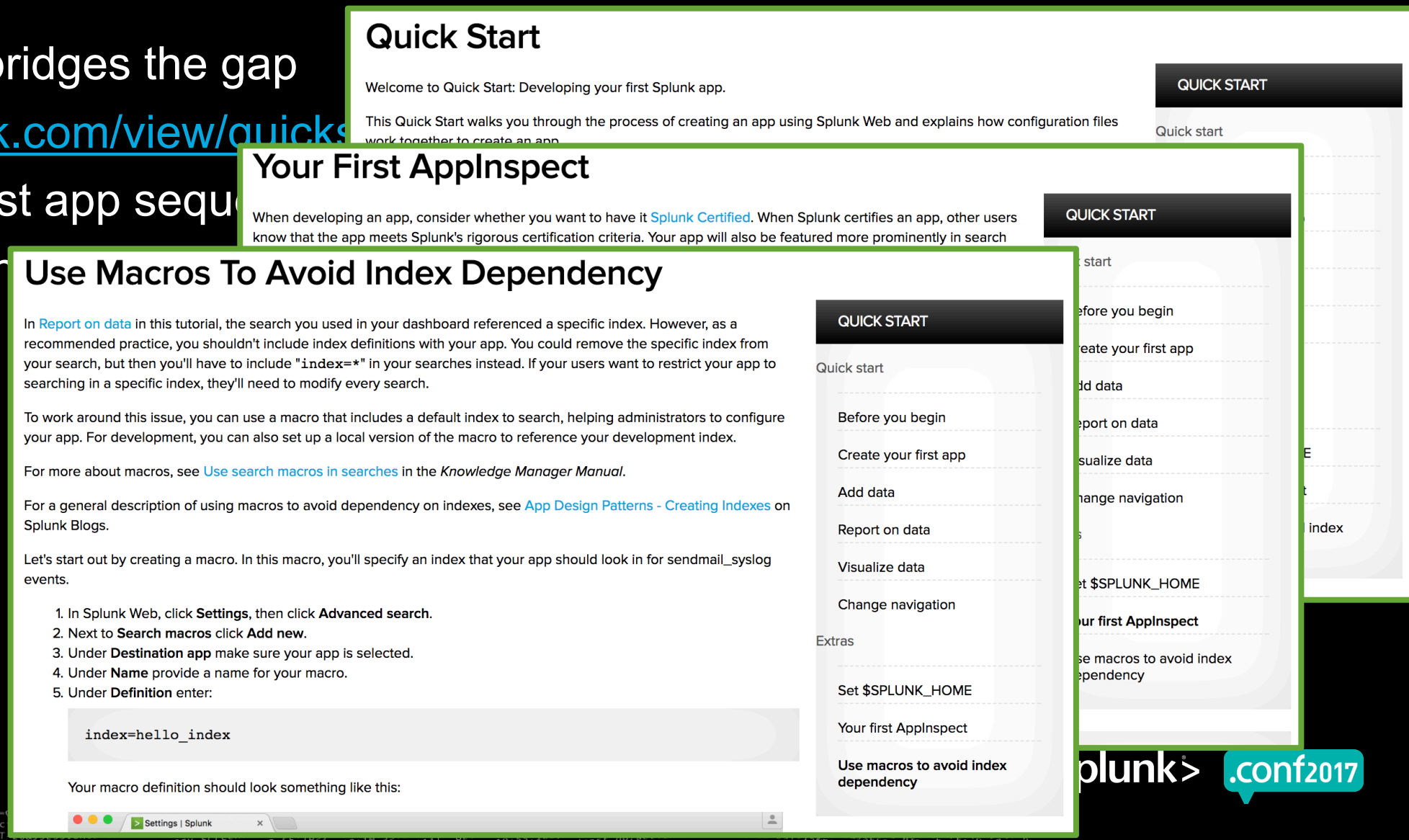
Getting Started

New Quick Start bridges the gap

- http://dev.splunk.com/view/quicks
- Guided “your first app sequ
- Certification with
- Best practices



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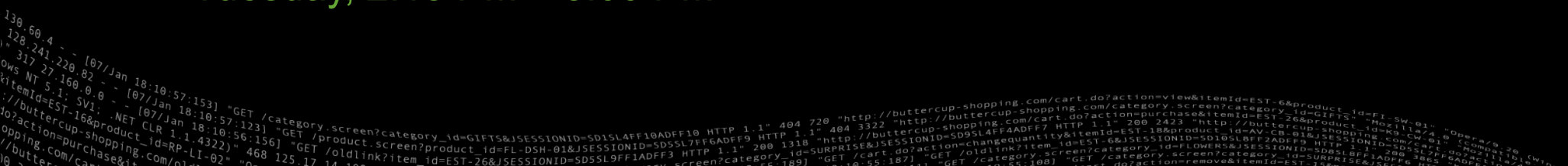
Test Data

How did EPAM test the Patient Care Team app?

- Started with 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



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Test Data

SimData

- Generate
- Demonstra
- Create dat

```
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
```

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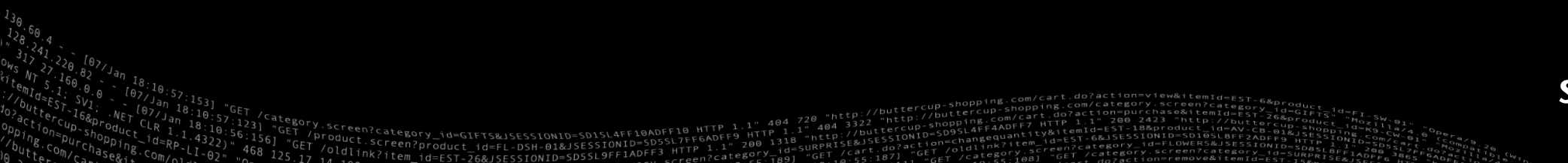
Getting Data In

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



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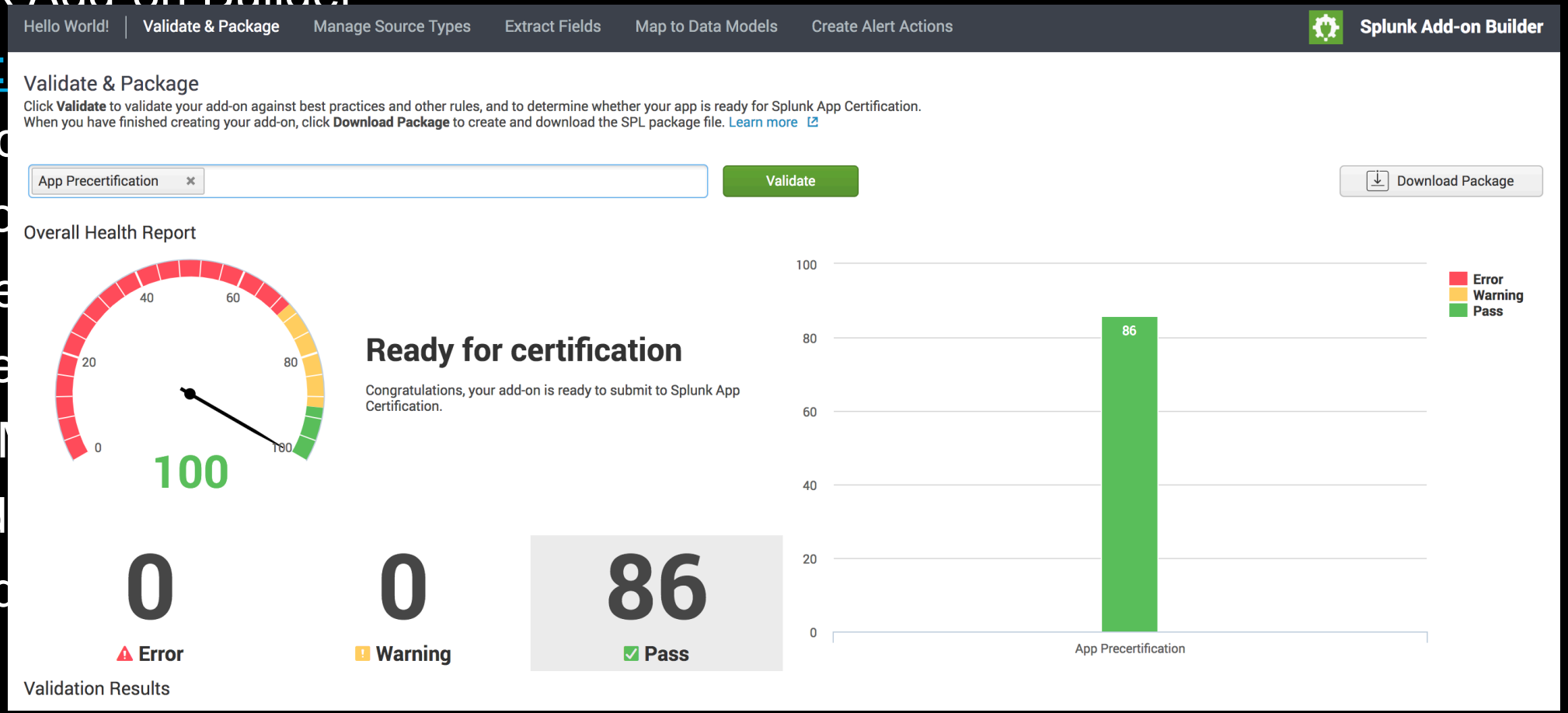
Getting Data In

Splunk Add-on Builder

- http:
- Build
  - Mo
  - Ale
  - Fie
  - CI
  - Ad
- Valid



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Thank You

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