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Addressing the Evolving COVID-19 Landscape To Registry Function

HL7 Message Processing

Meet the Presenters

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PART I: PROBLEM STATEMENT

PART II: TRIAL, ERROR AND BREAKTHROUGH

- Initial Hypothesis
- Telemetry and War Rooms
- Solutions

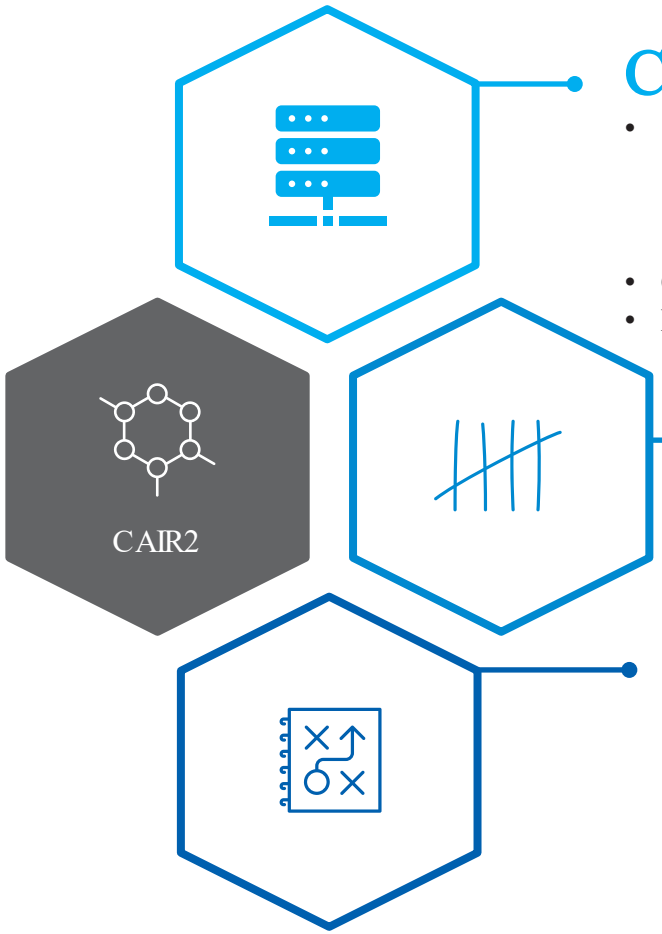
PART III: LESSONS LEARNED

Pre-COVID-19 Landscape

Configurations, Message Counts and Planning

Like all of you, the California Department of Public Health took a hard look at their **infrastructure and capacity** in the run up to the release of the COVID-19 Vaccines.

Pre-COVID, CAIR2 was a solid footing based on the current conditions but soon would be tested by the change in immunization landscape and the expanded role of HL7 messaging.



Configurations

- Servers
  - 2 x 2 x 2 x SAN
  - 3 x 3 x 2 x SAN
  - 5 x 7 x 2 x SAN
- Operating System – Linux / WebLogic
- Database – Oracle 12C

HL7 Message Numbers

- Immunizations (VXU) - 44k / day
- Query Patient History (QBP) - 167k / day

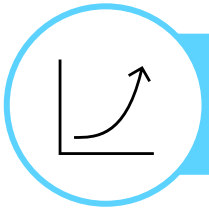
COVID-19 Planning and Preparations

- Expand Server Configuration
  - 12 x 14 x 2 x SAN
- Refresh Infrastructure (hardware, Operating System, Database
- Add an HL7 Message Broker
  - Implemented Rhapsody (Routing, Recovery and Querying)

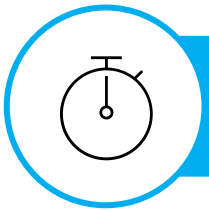
Problem Statement: A Crack in the Armor

What change in with the COVID-19 Vaccine Rollout

The CAIR2 Team anticipated many of the potential COVID-19 impacts to IIS operations but some impacts were under estimated and others were unforeseen.

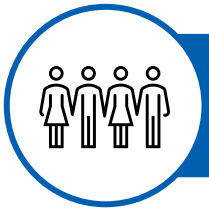


Volumes increased – both doses entered and patients



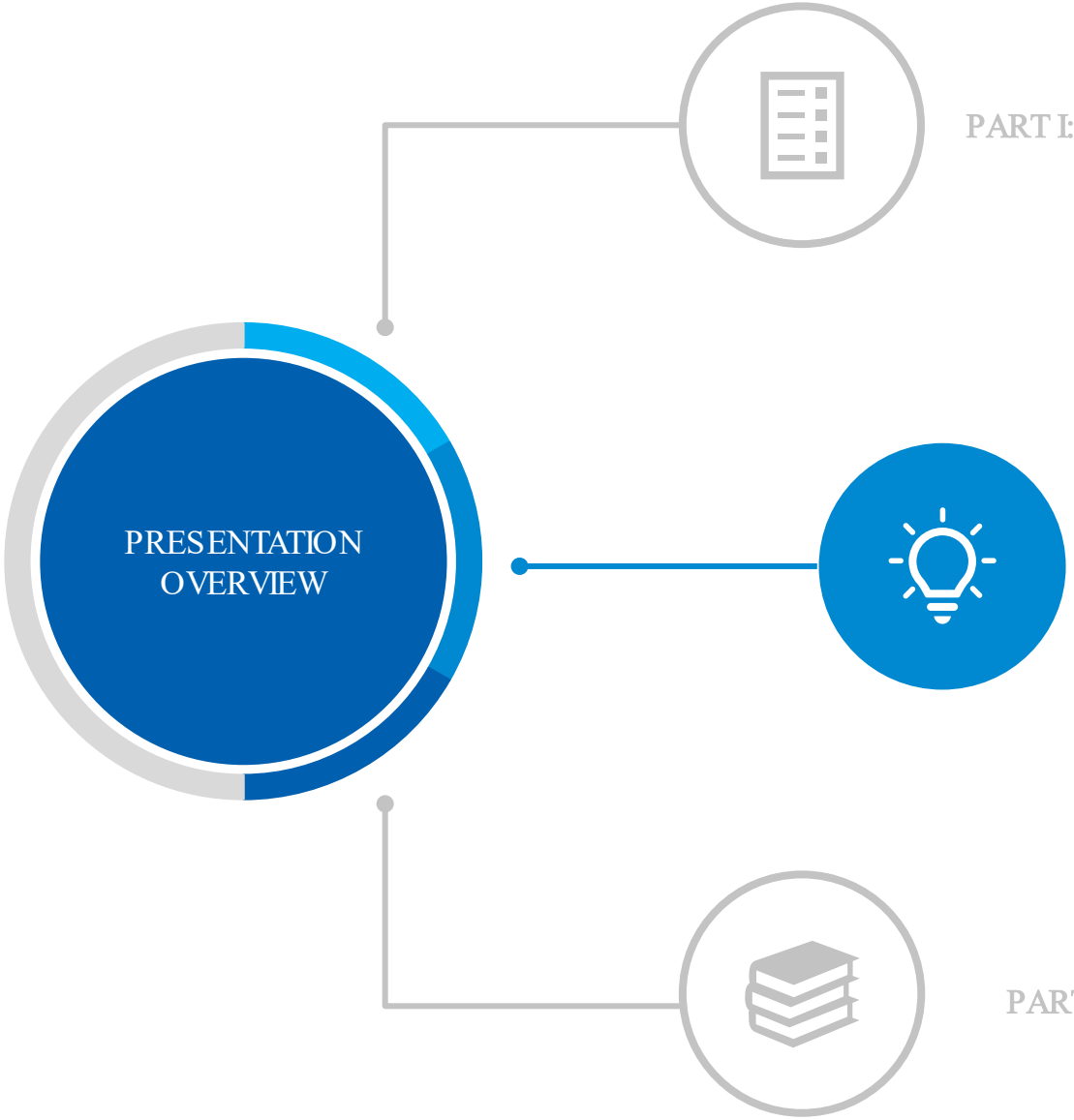
Timing and throughput was critical –
CDC requirements, State data needs, Stakeholder such as contract tracers

Population-based queries more common - shots not always owned by the provider



Different cohort - adult participating in registry for the first time
represented larger proportion of transactions

Many new providers to the registry –lots of users going through learning curve



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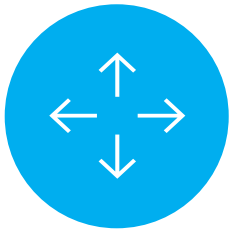
Trial, Error and Breakthrough

Initial Hypotheses – What's Failed / What Changed the Approach

1. Initial Hypotheses | 2. Telemetry and War Rooms | 3. Solutions

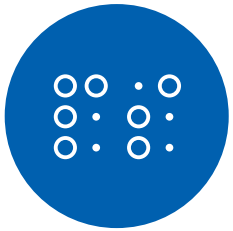


CAIR 2 Environment

- Ecosystem, Network – Separate Applications (e.g., Rhapsody, myCAvax , etc.)
- Servers, Space/Capacity
- Operating System
- Database Tuning

Application Behavior

- Recent Releases
- Change Management Review



Working Hard But Somewhat Blind

- The Team worked diligently to find the **quick fix**
- Became clear that the issue **deeper** than a quick fix could resolve
- Difficult **getting visibility** into the different moving parts

The CAIR2 Team performance tested the expanded solution architecture but the testing did not model the eventual real-world use patterns that eventually challenged our ability to process messages at the increased rates.

Trial, Error and Breakthrough

Telemetry and War Rooms – Slowing Down to Go Fast

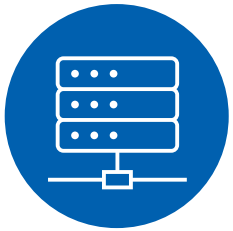
1. Initial Hypotheses | 2. Telemetry and War Rooms | 3. Solutions

Telemetry

- Gain performance metrics
- Isolation
  - Internal Processes, RunMatch, DB queries
- Latency

War Room

- Build Cross-functional Team
- Establish Dedicated Conference Call Meeting Room
- Management Support and Governance
- Room to brainstorm, plan, execute, measure and analyze solutions



Scientific Method (Go Old School)

- Narrowing the focus
- Evaluate Feasibility of each option
- Utilize every available subject matter experts (including internal and external)
- Engaged Oracle strike team and Rhapsody experts

Once we had the metrics we needed, we brainstormed without judgment, became hyper-focus on each option, measured and validated the measurements. We even ended up finding improvement though dumb luck.

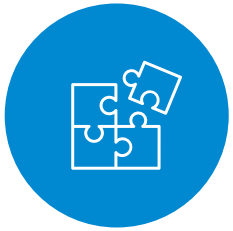
Trial, Error and Breakthrough

Solutions – The Eagle Has Landed

1. Initial Hypotheses | 2. Telemetry and War Rooms | 3. Solutions

Trial and Error

- Code and Load
  - Application, RunMatch, Java version, Database efficiency
- Network / Infrastructure / Rhapsody



Part and Pieces

- Infrastructure Changes
  - Mirror Environment, Production-Sized DB, True Situational Testing / Load
- Telemetry Alerts

Solution and Results

- Success!
  - Stubbed out portions of the application to isolate the culprit
  - Don't miss an opportunity to learn from dumb luck
- **Issue**: A resource shared by VXU and QBP message processing was locking at high message volumes
- **Solution**: Create separate resource for each so message types did not interfere with each other
- **Result**: Ability to process over 3 million message a day with less than 1 second average latency

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Lesson's Learned

These lessons are valuable during the pandemic but also apply to any complex technical issue

1. Communication is Key

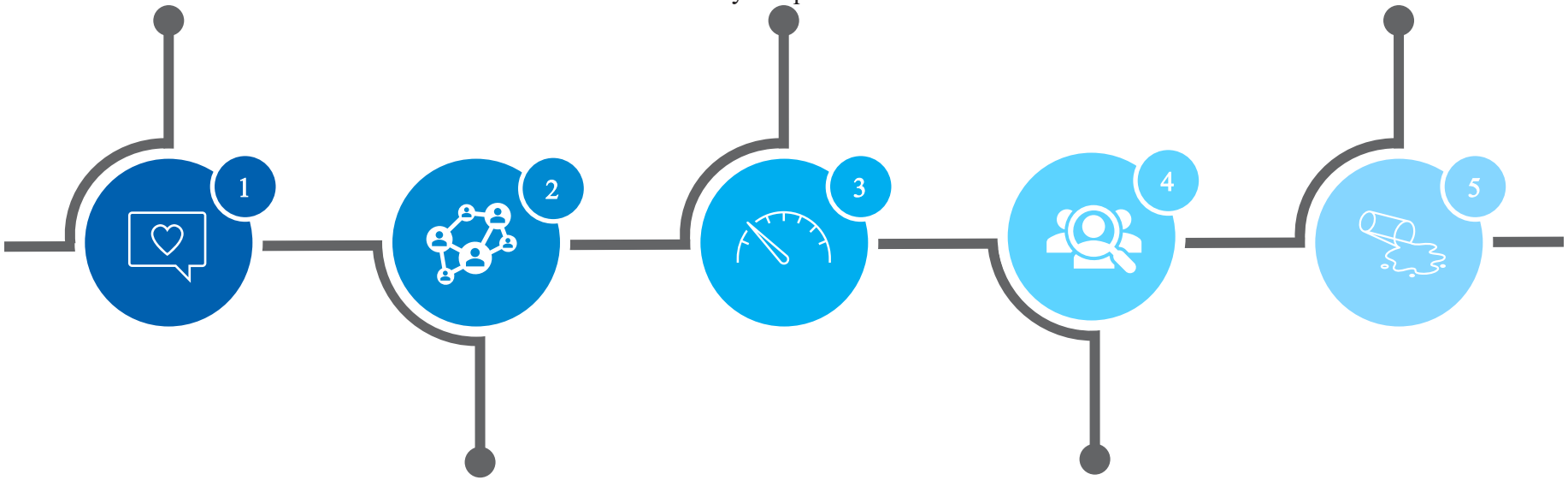
- Leadership
  (CA Dept. of Technology, Governor's Office)
- Support Vendors
  Strike team and management)
- System Stakeholders
  Ability to work with you vs. against

3. Go Slow to Go Fast

- Invest time in isolating the problem(s)
- Ensure quality
- Understand multiple cycles may be needed
- Not always a quick fix

5. Incident Response

- One-point person to manage all parties
- Centralize communications and activities.
- Strong leadership and facilitation
- Level of independence and power to direct front-line collaborators
- Technical familiarity w/ environment



2. Utilize Everyone

- Utilize your resources
- Be willing to think differently

4. Avoid the Blame Game

- Collaboration is key
- CA has strong collaboration between:
  CDPH-ITSD, Gainwell, Oracle, Rhapsody (Lyniate), CA Development of Technology

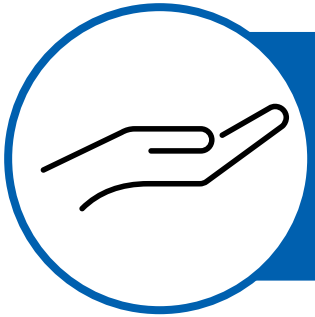
Summary

Key Takeaways from overcoming this challenge

Telemetry Matters

You can't address what you don't know.

- Have the tools/data necessary, to tell you what is going on at a detailed level across your ecosystem. You can't address what you don't know.



Volumes Matter

Test with simulated production volumes and load

- Need to represent your system's volume and load to have confidence in promoting all changes to your ecosystem.