

Delivering Unemployment Assistance in Times of Crisis: Scalable Cloud Solutions Can Keep Essential Government Programs Running and Supporting Those in Need

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The COVID-19 public health emergency caused widespread economic shutdown and unemployment. The resulting surge in Unemployment Insurance claims threatened to overwhelm the legacy systems state workforce agencies rely on to collect, process, and pay claims. In Rhode Island, we developed a scalable cloud solution to collect Pandemic Unemployment Assistance claims as part of a new program created under the Coronavirus Aid, Relief and Economic Security Act to extend unemployment benefits to independent contractors and gig-economy workers not covered by traditional Unemployment Insurance. Our new system was developed, tested, and deployed within 10 days following the passage of the Coronavirus Aid, Relief and Economic Security Act, making Rhode Island the first state in the nation to collect, validate, and pay Pandemic

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Unemployment Assistance claims. A cloud-enhanced interactive voice response system was deployed a week later to handle the corresponding surge in weekly certifications for continuing unemployment benefits. Cloud solutions can augment legacy systems by offloading processes that are more efficiently handled in modern scalable systems, reserving the limited resources of legacy systems for what they were originally designed. This agile use of combined technologies allowed Rhode Island to deliver timely Pandemic Unemployment Assistance benefits with an estimated cost savings of \$502,000 (representing a 411% return on investment).

CCS Concepts: • **Applied computing** → **Computing in government**; • **Information systems** → *Enterprise applications*; • **Social and professional topics** → *Economic impact*;

Additional Key Words and Phrases: Unemployment insurance, pandemic unemployment assistance, COVID-19, CARES Act, cloud managed services, legacy systems

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1 INTRODUCTION

The COVID-19 public health emergency caused a historic rate of job loss across the United States as state and local governments imposed social distancing through school closures, restrictions on non-essential business operations, and stay-at-home orders. Between March and April of 2020, unemployment increased from 4.4% to 14.7% nationally, surpassing the peak unemployment rate of 10.0% during the Great Recession of 2007–2009 [10], and was projected to rise to 16.0% in the third quarter of 2020 [7]. Job loss has disproportionately impacted workers earning below the median income in service sectors such as food services, travel, transportation, entertainment, and retail—sectors characterized by a large number of independent contractors, self-employed workers, and sole proprietors [1].

In response to this crisis, Congress passed the Coronavirus Aid, Relief and Economic Security (CARES) Act [11], including a provision to expand unemployment benefits to roughly 16 million independent contractors and gig-economy workers who were previously ineligible for Unemployment Insurance. The introduction of this new program, called *Pandemic Unemployment Assistance*, drove a sudden increase in claims with new eligibility rules, straining the legacy systems used by state workforce agencies to collect, verify, and pay traditional Unemployment Insurance claims. Figure 1 shows this dramatic surge in new claims both nationally and in the State of Rhode Island, where the number of Pandemic Unemployment Assistance claims in the program's first week (ending April 11, 2020) was 5.5 times greater than the peak number of weekly Unemployment Insurance claims during the Great Recession.

The legacy systems still used by many states to administer the Unemployment Insurance program were originally created in the 1970s and 1980s [3], before the invention of the World Wide Web and at a time when claims were collected on paper forms. Modernization has been an ongoing priority at the federal and state level, in part because administrative data from the Unemployment Insurance program is instrumental for providing labor market information to the U.S. Bureau of Labor Statistics and other federal agencies [5]. As of September 2019, there were 20 states with completed modernization projects for their unemployment benefits systems, 13 with projects in development, and 17 in the planning stage (including Rhode Island) [2]. A modern system is defined as one that inherently supports web-based services, object-oriented programming, and relational database technologies; an earlier 2009 survey found that 90% of states were using COBOL-based or otherwise outdated

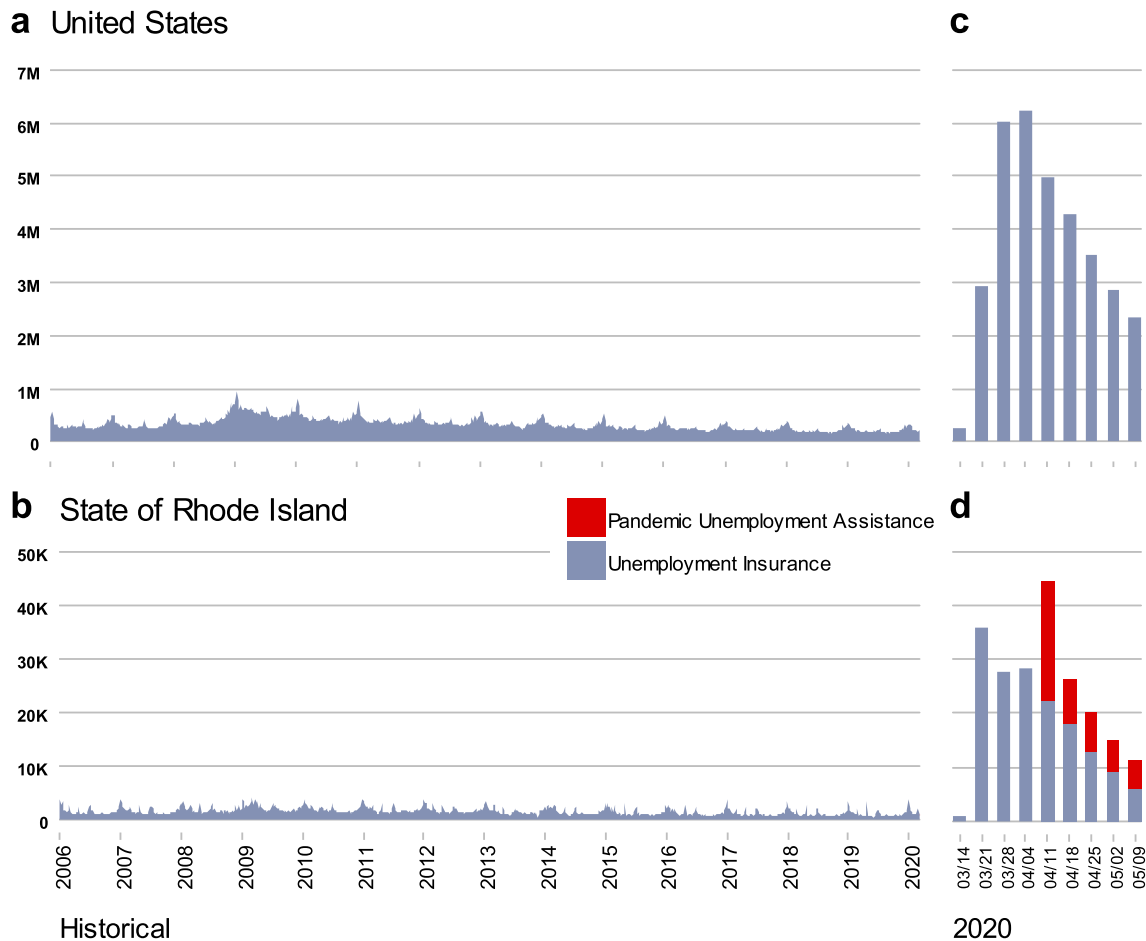


Fig. 1. Weekly number of new claims for unemployment benefits over the previous 14 years (a, b), with a focus on the nine weeks at the start of the COVID-19 public health emergency in the United States (c, d). The number of Unemployment Insurance claims surged the week ending March 21, 2020, both across the United States (c) and in Rhode Island (d), as states began imposing COVID-19-related restrictions. Rhode Island was the first state to begin accepting Pandemic Unemployment Assistance claims the week ending April 11 and experienced a similar surge for this new type of claim (d). Note: Data on Unemployment Insurance claims comes from the U.S. Department of Labor Employment and Training Administration (<https://oui.doleta.gov/unemploy/claims.asp>).

benefits systems that lacked these modern features [4]. The average age of these systems was 22 years, and the oldest was 42 years.

Rhode Island's 40-year-old Unemployment Insurance system would have been unable to process the unprecedented spike in claims in a timely and stable manner. Anticipating the constraints of the existing system, our organizations partnered on March 26, 2020 (in anticipation of passage of the CARES Act the next day) to develop a strategy for offloading the collection of Pandemic Unemployment Assistance claims and weekly certifications from the COBOL-based mainframe system to a new cloud solution so that qualified claimants would be paid quickly and accurately.

Our broader goal for this cross-sector collaboration was to address the immediate crisis while also paving the way for improved services and cost savings in the unemployment benefits system in the future, according to the following tenets:

- Implement all appropriate security controls and safeguards (e.g., IRS Publication 1075) before beginning any effort that stores or processes sensitive data.
- Work efficiently and effectively to begin accurate payments as quickly as legally possible to Pandemic Unemployment Assistance claimants in crisis.
- While maximizing immediate impact, also value actions and approaches that support lasting, iterative improvements to the Unemployment Insurance system.
- Do no damage, and leave all systems at least the same if not better than they were before the response to the crisis.
- Earn and keep government leaders' trust by listening attentively to their immediate needs and working backward from these needs to both immediate and long-term solutions.

Because there are many potential challenges for partners from different sectors to collaborate under a tight timeline for a product release, we also took immediate steps to implement best practices for project management. We identified a single point of contact at each organization to invite to all project meetings, who could then effectively bring in the required team members from that organization. We established daily stand-up meetings to surface and rapidly address any coordination issues among the organizations. Finally, we deployed an open chat room to ensure real-time communication across organizations.

2 ARCHITECTURE

We designed a scalable cloud architecture to meet five key needs for successfully tackling the Pandemic Unemployment Assistance claims surge and providing accurate and timely relief to thousands of people in crisis. These needs were to (1) securely collect claims over the Internet, (2) securely store and process the submitted claims, (3) clean and correct claims for input to the legacy system, (4) verify claims in a timely and cost-effective manner, and (5) handle the corresponding surge in weekly certifications for continuing claims. Because of the urgent timeline, we chose to use managed cloud services wherever possible for this application. A managed service is an offering from a cloud provider that solves a specific technical need and can be deployed with minimal configuration and build-out time. The cloud provider manages the design, maintenance, monitoring, scaling, patching, and other aspects of the service. Managed services encapsulate best practices for security and reliability, and because of economics of scale, they can be more cost effective than implementing customized solutions.

First, we needed a way to securely collect claims containing sensitive information from individuals in a scalable way so that the website would not crash, especially right after launch. For scalability, we chose to render the claim form on the client side using React.js and an open source form-building library called *Tripetto* [9] because of its support for authoring complex multi-page and conditional form logic in an easy-to-use graphical editor. This editor enabled our project management team and government partners to develop, share, and refine the claim form independently from the rest of the technical development. We used a managed content delivery network service to distribute the client and a managed secure endpoint and serverless computing to accept and store submitted claims (Figure 2). These services, which have their roots in the technology developed to handle surges in hits to Amazon's retail website (e.g., on Black Friday), ensure that our website could elastically and reliably capture claims during peak demand.

Second, claims needed to be securely collected, stored, and owned by Department of Labor and Training because of the sensitive data they contain, which includes social security number and bank account information. Another reason for choosing *Tripetto* is that it allows for complete control over how and where the client posts the form data. In contrast, many hosted survey platforms exist with sophisticated graphical editors, but they

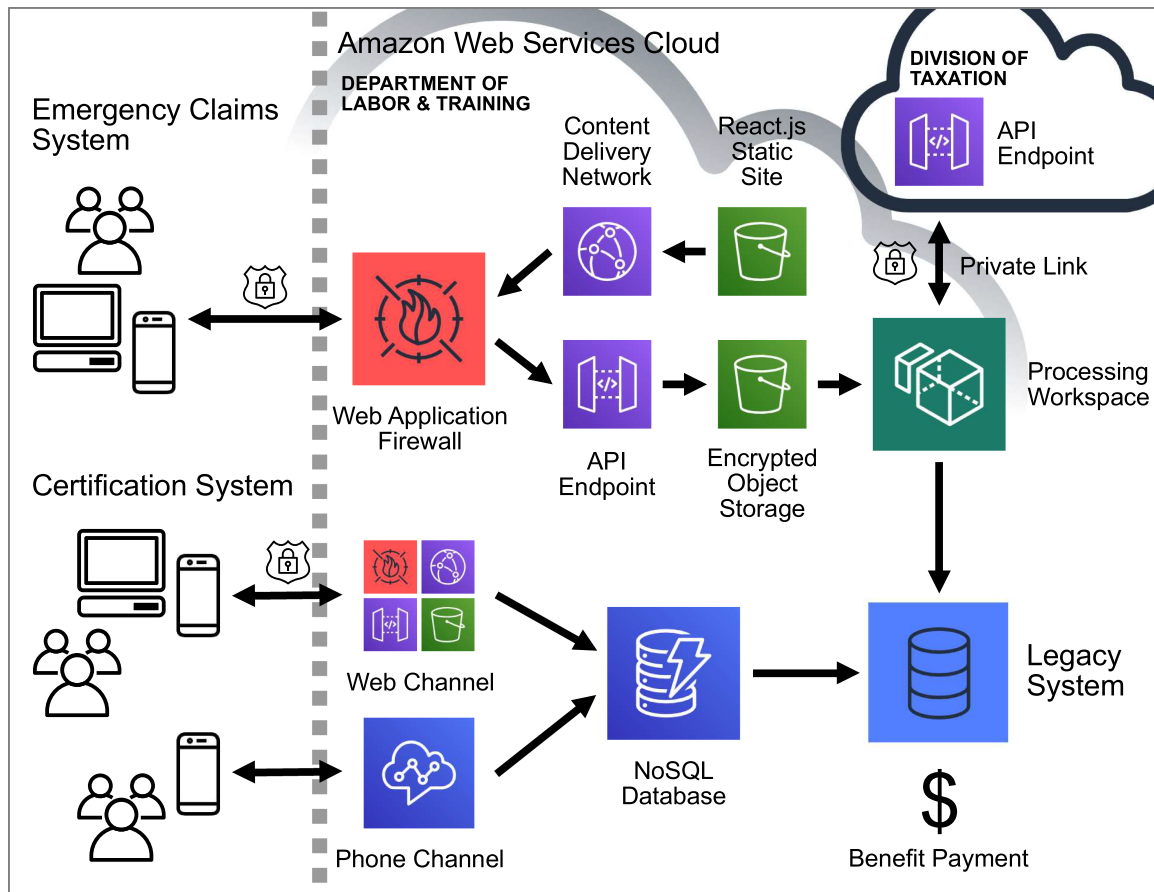


Fig. 2. Architecture diagram of the cloud-based emergency claims system and cloud-enhanced certification system. The emergency claims system interacts during claims processing with the Division of Taxation's endpoint to automatically verify adjusted gross income. Both systems interact with the legacy system to finalize claims and issue benefit payments.

collect and store survey responses on their own systems. A key security and legal requirement in this application was for the Department of Labor and Training to directly collect responses so that sensitive data were not shared with any other parties. We protected the secure endpoint with a managed web application firewall and configured the serverless computing to immediately sweep submitted claims to encrypted object storage. Subsequent processing and verification of the encrypted claims is performed in a secure enclave that provides a remote workspace with audit logging and security controls that prevent data egress, all implemented with managed services.

Third, we needed to offload the complex logic of Pandemic Unemployment Assistance claims processing to a scalable system, to reserve the limited resources of the legacy system for what it was originally designed: simply paying verified claims and serving as a system of record. Offloading the claims processing would enable the legacy system to process payments for the surge of claims without failing. We implemented claims processing with an agile software development approach, creating a pipeline of R scripts that could be quickly adapted to the evolving legal and operational guidelines for the Pandemic Unemployment Assistance claims program (final guidance was released by the U.S. Department of Labor on April 5 [6], 8 days after the passage of the CARES

Act). Agile approaches are a necessity for spinning up new systems quickly during a crisis while policy leaders are still determining and updating guidelines and requirements.

This approach to processing the claims before sending them to the legacy system also created opportunities for additional validation. When claims are entered into the legacy system with erroneous information, the system either rejects the claim or accepts it but encounters an error during payment. Rejected or failed claims require costly manual review and follow-up with the claimant. A common type of payment failure is caused by an invalid bank routing number. We used the American Bankers Association's checksum test to verify bank routing numbers during processing, and we created an automated process for claimants with invalid bank routing numbers to correct them before sending the claim to the legacy system. We used a managed email campaign service to automatically notify claimants and electronically coordinate corrections. Corrections that might have taken 20 minutes of staff time each over the span of weeks or months were now completed in batch by this automated system with almost no staff time required.

Fourth, we needed to verify claims according to the legal and operational guidelines for the Pandemic Unemployment Assistance program. Traditional Unemployment Insurance claims cover approximately 62% of prior wages. Claimants submit their wages in the claim and attest that they are true, but the Department of Labor and Training directly verifies reported wages against Unemployment Insurance tax records collected from employers on a quarterly basis. Verification helps ensure that fraudulent wage claims are not paid. In contrast, independent contractors and gig-economy workers are self-employed and do not pay Unemployment Insurance tax. Therefore, the only way to verify their reported income is against annual income tax forms collected by federal or state tax authorities.

To solve this verification challenge, we partnered with the Rhode Island Division of Taxation to verify the 2018 and 2019 state income tax records against the adjusted gross income reported in the Pandemic Unemployment Assistance claims. Because of the statutory limitations on sharing tax records, even among state agencies, we implemented this functionality with another managed endpoint hosted in a separate cloud account, administered by the Division of Taxation. We created a secure, private link from the Department of Labor's account so that batches of Pandemic Unemployment Assistance claims can be submitted to the Division of Taxation's endpoint for verification against the claimant's latest adjusted gross income. The authority for this inter-agency collaboration and use of tax records to support Pandemic Unemployment Assistance was granted under Rhode Island Executive Order 20-19 [8] on April 9, 2020, and the ability to quickly stand up a separate cloud account linked through a secure endpoint was crucial to complying with the requirements of the executive order. With the verification of the reported income, we can "pre-validate" claims and avoid downstream work, enabling claims to be paid in a more efficient and streamlined manner.

Finally, we needed a way to collect and process updates from claimants, who are required every week to certify and attest to their continued need for unemployment benefits, either through a web form or an interactive voice response phone system. Again, the legacy system could not handle the volume, and the existing phone system was constrained by physical phone lines and a limit on the number of simultaneous users. Individuals may certify at any time during the week, which runs from Sunday to Saturday. However, Sundays consistently see the largest volume of certifications (Figure 3). In addition to capturing certifications via a web-based form using a similar paradigm to the emergency claims system, we also deployed a cloud-based telephone solution, offering an alternate channel for those who prefer to use the phone or do not have Internet access (see Figure 2). This solution allows callers to provide their certification details or to route to the existing call center during its hours of operation. Rather than pre-provisioning the infrastructure required to accommodate this surge in traffic expected on Sundays, we paired serverless computing and a managed NoSQL data store to capture and securely store certifications, which are asynchronously transferred back to the legacy system to continue weekly payments for certified claims.

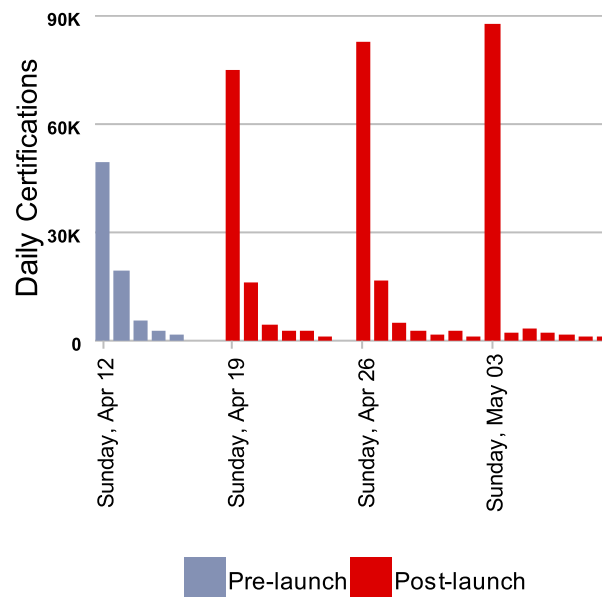


Fig. 3. Daily number of certifications for continuing Unemployment Insurance and Pandemic Unemployment Assistance in the weeks surrounding the launch of the cloud-based certification system on April 18. Certification is required weekly for benefit continuation, between Saturday and Sunday.

3 RESULTS

We staged the release of the emergency claims system with two soft launches of increasing size (100 invitees on April 3 and 1,000 on April 5), followed by a publicly announced launch on April 7. The system collected 10,950 Pandemic Unemployment Assistance claims within 12 hours of the launch on April 7, with no reported errors. The cloud-based certification solutions, both web and telephone, were deployed the evening of April 18. The next day, a Sunday, the two channels accepted 74,830 certifications, a 52% increase over the previous Sunday when the existing phone system was still in use. The elastic provisioning of the cloud-based phone system overcame the limitations of the existing phone system and was also readily updated to accommodate evolving legal requirements and guidelines for certification following the April 7 launch. On April 17, the first Pandemic Unemployment Assistance claims were loaded into the legacy system, and the first payments were made on April 19 following weekly certification. Daily call volume at the Department of Labor and Training's general call center rose in the weeks leading up to the April 7 launch and then declined following the launch (Figure 4).

The public reaction on social media during the soft launches and April 7 launch had both positive and negative responses (Appendix A.1). Positive comments praised the promptness and availability of the emergency claims system, especially relative to neighboring states. Negative comments identified confusing aspects of the application process and the challenges that self-employed workers can face when applying to government programs. One comment identified an interface issue where the application dropped leading zeroes from the claimant's social security number when displaying a confirmation message; the issue was resolved through a hotfix later that same day, illustrating the tight feedback loop between users and developers that social media enables.

In addition to enabling timely payment of qualified benefits, the application achieved significant cost savings through its ability to verify adjusted gross income with the Division of Taxation and to allow claimants to correct invalid bank routing numbers without manual outreach or intervention (Appendix A.2 presents detailed calculations). As of June 11, 65,701 Pandemic Unemployment Assistance claims had been collected and 50,605 (or 77%) of

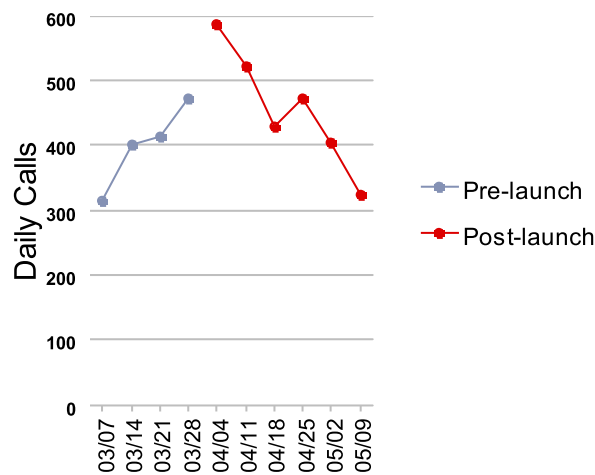


Fig. 4. Daily call volume to the Rhode Island Department of Labor’s call center in the weeks surrounding the launch of the emergency claims system on April 7. Call volume increased leading up to the launch and decreased after the launch.

these were successfully matched to adjusted gross income in 2018 or 2019. The alternative to this automated verification was to collect and manually review paper or electronic documentation of adjusted gross income from claimants. Using the Department of Labor and Training’s historical costs for processing complex claims with similar degrees of manual intervention (e.g., Unemployment Insurance claims that report out-of-state wages), we estimate the cost savings at approximately \$12.06 per verified claim. Out of 2,038 erroneous claims, we automated the collection of 1,446 corrections. Assuming that these erroneous claims had instead been addressed through manual review and outreach to claimants by phone, we estimate a cost savings of approximately \$9.65 per corrected claim.

Thus, the automated verification and error-correction functionality of the cloud solution saved approximately \$624,000 while costing only \$122,000 to deploy. The net savings of \$502,000 represents a 411% return on the Department of Labor and Training’s investment in the cloud solution. Moreover, these estimates are likely conservative because they assume that additional staff were available to perform manual review, which was not the case given the strain on staff time and productivity caused by the COVID-19 public health emergency.

Finally, building on the lessons we learned and the solution we developed in Rhode Island, we assembled a manual and packaged a code release of the emergency claims system for use by additional states. This packaged version was made available to all state workforce agencies through the National Association of State Workforce Agencies’ internal Information Technology Support Center website.

4 CONCLUSION

In Rhode Island, the COVID-19 public health emergency served as a catalyst for the changes needed to modernize the state’s Unemployment Insurance system, creating a more scalable, sustainable, and resilient system. Although the national effort to modernize unemployment benefit systems has focused on transitioning legacy mainframe systems to web- and server-based systems [4], we found that managed cloud services provided the most efficient solution to rapidly deploying an emergency claims system and bypassing the need to configure and build out server-based systems. Looking forward, cloud computing also has the power to create a new interactive and transparent relationship with claimants, which not only allows claimants to “own” and participate in the claim process to improve their experience but also allows the Department of Labor and Training and the Division of Information Technology to use artificial intelligence, especially machine-language techniques for combating

fraud. Fraudulent claims and payments are a crucial issue for any benefits application and preventing them is an active area of research and an important topic for future work.

Our application also highlights how the cloud can serve as a “digital commons,” a place where different organizations can access a common platform with secure, managed services to collaborate with sensitive data. In our case, this collaboration occurred between three agencies within the same state (Labor and Training, Taxation, and Information Technology), but future applications of this model might support partnerships between private-sector public service firms and government, between agencies from different states, between state and federal agencies, or between international organizations. Furthermore, the value derived from this cloud-enabled collaboration was substantial, yielding \$502,000 in estimated net savings and, more importantly, shortening the time to first payment of newly authorized assistance for families in crisis.

APPENDICES

A.1 Twitter Responses to Application Launch

A.1.1 *Positive.*

“My son applied Monday night, got confirmation letter in today’s mail!! Insane how quick y’all got this done!!”

[8:20PM, Apr 9, 2020; <https://twitter.com/hausmananderson/status/1248405529904336896>]

“Thank you for streamlining the process and for retooling your system to accommodate self employed folks like me. It was a frustrating wait, but worth it. Thank you!”

[4:37PM, May 2, 2020; <https://twitter.com/CarolMossa/status/1256684288386400257>]

“Mass is well behind @RI_DLT in rolling out CARES Act unemployment expansion Dept of Unemployment Assistance only says program for independent contractors, self-employed etc will be available “this month” RI launched it Monday; 14,000 have applied so far.”

[12:34PM, Apr 9, 2020; <https://twitter.com/TedNesi/status/1248288298465988608>]

“Just got email from constituent who thanked me for my newsletter, which included a link for gig workers like him (he drives for Uber). He applied for unemployment today under the CARES bill, got confirmation & says it’s easy unlike MA. Nice work & thank you @RI_DLT! #RIStrong”

[6:30PM, Apr 8, 2020; <https://twitter.com/RepDebRuggiero/status/1248015470151647233>]

“On the plus side, the form was quick to load, easy to navigate, no slow downs. From a technology perspective @RI_DLT did a great job.”

[8:19AM, Apr 7, 2020; <https://twitter.com/dadekian/status/1247499317767741440>]

“Application for extended benefits is up @RI_DLT PLEASE be patient this is new for everyone including the tech workers setting the website, the claims reps with nonstop calls all day, EVERYONE is working as quickly as they can and realize mistakes HAPPEN, they’re human”

[12:30AM, Apr 7, 2020; https://twitter.com/_withloveyabi/status/1247381275222122496]

A.1.2 *Negative.*

“If someone is self employed and filing...in the application its asks for employer information. I am confused...if you are self employed you may not have an employer so what are you supposed to put there????”

[12:50PM, Apr 7, 2020; <https://twitter.com/kbsbi/status/1247567506975404033>]

“Need to let @RI_DLT know that the Emergency UI Application that asks for AGI from most recent tax return completely ignores the reality of newly arrived refugees and immigrants. They can’t answer until they file for 2019, which isn’t due until July 15. Why is that necessary?”

[4:11PM, Apr 7, 2020; <https://twitter.com/BrianHullRI/status/1247618101287489538>]

“@RI_DLT your new UI website doesn’t recognize SSN’s that begin with a 0. BIG mistake on your part since almost all RI’ers begin with a 0. It only shows 8 numbers, not standard 9 @GovRaimondo”

[8:05AM, Apr 7, 2020; https://twitter.com/realR_Sherry/status/1247495832380887040]

“I’m not optimistic this will be handled correctly. I’ve had to deal with the state before (when getting a home through RI Housing) and, sadly, they just couldn’t comprehend the concept of a self employed event worker. I expect this to be the same, with lots of confusion.”

[11:32PM, Apr 6, 2020; <https://twitter.com/PaulSpetrini/status/1247366556411146242>]

“@ScottJensenDLT apparently unemployment insurance in RI is still not available for independent contractors who are out of work? @RI_DLT has told me it will be available ‘soon.’ When? Why is this taking so long? What is the exact date this application will be available?”

[12:58PM, Apr 3, 2020; <https://twitter.com/AstroNat90/status/1246120021761425411>]

A.2 Calculation of Net Savings Estimate

- 1) The average hourly rate for Department of Labor and Training support staff is **\$28.94**.
- 2) **50,605** claims were successfully matched to adjusted gross income in 2018 or 2019 using automated verification.
 - a) Department of Labor and Training estimates **25 minutes** of support staff time per claim for manual verification, based on historical costs for processing complex claims with similar degrees of manual intervention (such as Unemployment Insurance claims that report out-of-state wages).
 - a) Automated verification saved **\$12.06** per verified claim ($= 1 \times 2a \times 60 \text{ minutes} / \text{hour}$).
 - c) Automated verification saved **\$610,211.96** in total ($= 2 \times 2b$).
- 3) 1,446 claims were corrected through automated email response.
 - a) Department of Labor and Training estimates **20 minutes** of support staff time per claim for manual correction through outreach by phone to claimants.
 - b) Automated correction saved **\$9.65** per corrected claim ($= 1 \times 3a \times 60 \text{ minutes} / \text{hour}$).
 - c) Automated correction saved **\$13,949.08** in total ($= 3 \times 3b$).
- 4) The total estimated savings from automated verification and correction was **\$624,161.04** ($= 2c + 3c$).
- 5) The cost to Department of Labor and Training for developing, testing, deploying, and operating the cloud solution was **\$122,176.19**.
- 6) The net savings for Department of Labor and Training was **\$501,984.85** ($= 4 - 5$).
- 7) This net savings represents a **411%** return on investment ($= 6 / 5 \times 100\%$).

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