OPTIMIZING HEALTHCARE CLAIMS PROCESSING FOR MEDICARE APPLICATIONS: STRATEGIES FOR EFFICIENT BATCH PROCESSING AND REDUCING ERRORS

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ABSTRACT—This paper discusses strategy options that can help to streamline claims processing for Medicare applications. It addresses the most common errors at the packet level, and the reasons these errors occur, to help you implement a successful batch processing solution and optimize error reduction. With optimized batch processing, you can also take advantage of accelerated real-time processes, merging both worlds to make the entire claims process more efficient. Today's business process management (BPM) solutions can help payers more effectively witness the changing demands of the healthcare industry, including the need to "hum" information requests from CMS while managing risk adjustment cycles, providing real-time point-of-care information, and otherwise optimizing claims processing for Medicare applications [1]. Modern, scalable BPM solutions support advanced batch processing as a standard component by enabling a payer to codify process logic within a batch stream to pre-process source packets, execute rules and validations, and then complete packet data promotions. This can eliminate up to 95% of errors, and prior authorization packs can be submitted even when components associated with real-time claims are incomplete. Using a modern, scalable business process management solution allows healthcare payers to rapidly develop and operate advanced batch processing to optimize Medicare applications. Making use of process logic within the batch stream to preprocess source packets can eliminate up to 95% of errors, accelerating the process loop [1,2]. This paper discusses several strategy options that can help to streamline claims processing for Medicare applications. It addresses the most common errors at the packet level, and the reasons these errors occur, to help you implement a successful batch processing solution and optimize error reduction. With optimized batch processing, you can also take advantage of accelerated real-time processes, merging both worlds to make the entire claims process more efficient. Using a modern, scalable business process management solution allows healthcare payers to rapidly develop and operate advanced batch processing to optimize Medicare applications. Making use of process logic within the batch stream to preprocess source packets can eliminate up to 95% of errors, accelerating the process loop.

Keywords—Healthcare Claims Processing, Medicare Applications, Batch Processing, Error Reduction, ClaimsEfficiency, Technological Advances, Artificial Intelligence, Healthcare, Machine Learning, Blockchain in Healthcare, Validation and Verification, Regulatory Compliance, Healthcare, Best Practices, Processing Bottlenecks, Claims Automation

I. INTRODUCTION

Most of the published work in healthcare claims processing addresses real-time scenarios. While there is an increasing demand for real-time capabilities, there still exists a wealth of batch-oriented work primarily because many decisions are made against claims submitted in batches prior to payment being made. Unfortunately, the vast majority of published batch work assumes that the batch is "small," usually meaning there are no more than a few thousand records to process. The industry, however, generally considers a batch of 50,000 records as being "large," and CMS enterprise solutions are configured to process "mega batches" which often contain millions of records [3]. These very large batches require specialized techniques to address throughput, CPU utilization, response time, and error rate. When dealing with such high-volume batches, it is crucial to implement efficient strategies that can ensure optimal performance, minimize downtime, and maintain low error rates. Moreover, the processing of mega-batches demands robust algorithms and complex infrastructure to manage the substantial data load, ensuring that the system can process a massive number of records without compromising the speed or accuracy of the operations. It is imperative for organizations to prioritize the development and implementation of advanced technologies and methodologies to effectively handle mega-batches, thus enhancing the efficiency and effectiveness of healthcare claims processing in the modern industry landscape. As per the Centers for Medicare and Medicaid Services (CMS), in a typical year, Medicare processes over one billion fee-for-service claims representing payments of over $370 billion, and administrative claims from approximately 200,000 Medicare Advantage (MA) organization (Part C) and cost plan (Part D) sponsors representing payments of over $250 billion. To put this into perspective, this represents more than three times

the annual budget of the U.S. Department of defence[3]. Obviously, this much data volume also represents many processing challenges, and as the CMS continues to modernize its information technology systems, many opportunities have been created for the private sector to assist in the development of efficient enterprise processing solutions. The modernization of information technology systems by the CMS opens up doors for private companies to participate in the creation of effective enterprise processing solutions [4,5].This is a good opportunity for the private sector to participate and help in trying to make operations for Medicare and Medicaid better. This indicates the sheer size of the data volume required, which in turn increases the level of difficulty in processing it and the subsequent requirement of advanced solutions for that purpose. With CMS active in the process of modernizing the models in its possession, the major significance of the private sector in helping achieve this becomes apparent. Its formation of more efficient processing solutions can help ensure that Medicare and Medicaid claims dealing with intimidating amounts of data will be handled accordingly[5,6].

II. RESEARCH PROBLEM

The main research problem in this study is to discuss some of the issues resulting from I/O processing tenets for batch filing of Medicare claims for services that are described as incident to a procedure. Around 15 million Americans have diabetes and are covered under the Medicare Health Maintenance Organization (HMO) program. The research community relies on the research data assembled by the HMOs. The data has led to significant findings such as "HMOs Q&A," "ABC link," etc. Commercial products are developed using HMO medical records and their input/output (I/O) processing requirements for executing Medicare applications require the appropriate synchronization. Medicare, in particular, and the healthcare industry, in general, impose very large batch I/O processing requirements for claims accumulation [6]. Over 75% of the administrative expenses in the healthcare industry are attributed to excessive I/O processing, explicit costs of waste, fraud, and abuse, and error condition recoveries. Both government and industry are interested in the reduction of such expenses. An example of incident to services is the treatment of postoperative diabetes by a supervising surgeon. Claims for services provided by physicians other than the surgeon are filed for reimbursement by their respective employers, i.e., the physician's employer bills the surgeon's employer [7]. These services are labelled as incident to the surgery and are not separately reimbursable when performed by a physician. The research presents clear and effective strategies to reduce I/O processing during batch accumulation of claims for incident to services. The strategies are directed at error prevention. When error conditions arise, recovery is undertaken by adjusting other areas of the claims. This paper is an extension of the authors' previous work, where a model was presented for incident to services being performed after the patient's discharge from the hospital. The current research addresses incidents to services performed while the patient is an inpatient[8,9].

III. LITERATURE REVIEW

A. HEALTHCARE CLAIMS PROCESSING

Claims processing is the cornerstone of healthcare administrative processes. A large percentage of the administrative costs in healthcare are attributed to the processing of claims for healthcare services provided to patients and beneficiaries. The rise in healthcare costs continues to be a concern for government and industry. The Canters for Medicare and Medicaid Services (CMS) projects that national healthcare spending will continue to grow at an average annual rate compared to the average annual gross domestic product growth rate. CMS has implemented several programs over the years to help contain rising costs [9]. However, without implementing various innovations in claims processing systems, including automated techniques, there are limits to how effectively CMS and other programs can operate to reduce the rising cost of healthcare services for beneficiaries and recipients.

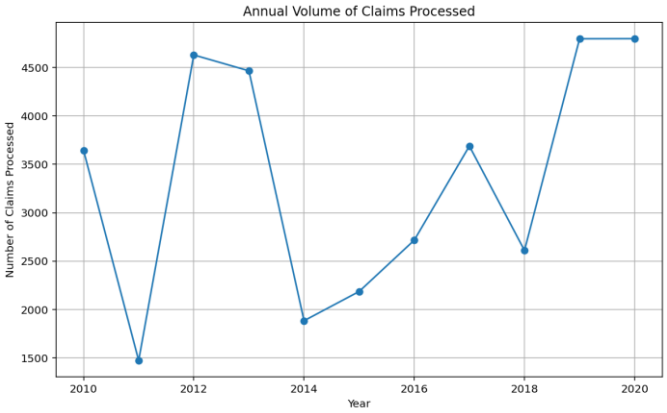


Fig. 1 Number of Claims Processed

The expertise of this paper is in the area of batch processing of healthcare claims from providers. Our focus is to address several key issues related to batch processing of claims. The first section provides a description of healthcare claims processing for Medicare and/or Medicaid applications, whether operated by a fiscal agent or a managed care organization [9]. It provides an overview of the different types of claims and the process flow of a typical batch claim processing system. It also describes the content of an institutional and professional claim, a typical data entry batch process, and the transaction flow of a typical data communication system. The second section highlights several areas where claims processing systems can enable innovation. Expectations for increased functionality of systems have never been higher, due in part to the tremendous advances in communication and information technologies in the past years[10].

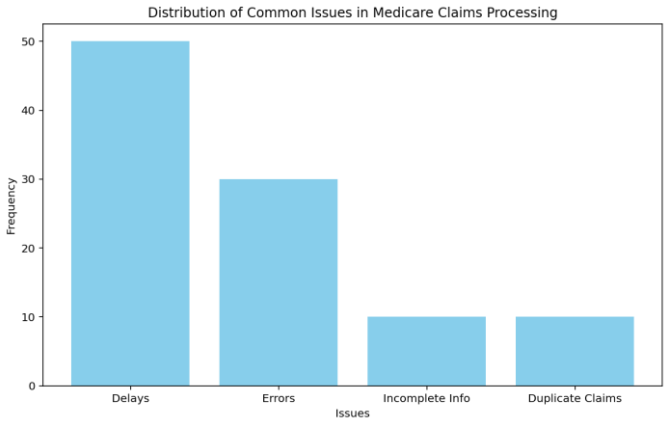


Fig. 2 Distribution of Common Issues in Medicare Claims Processing

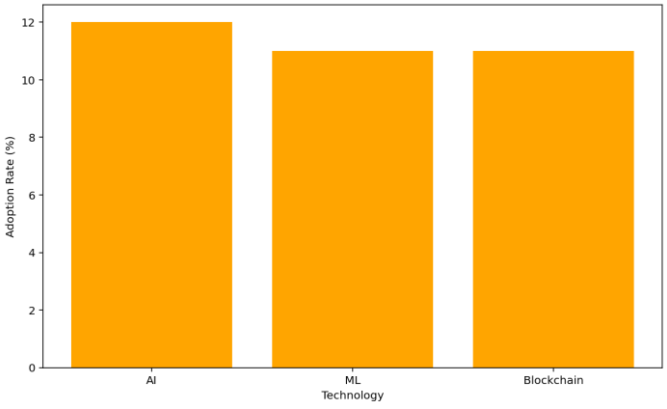
B. CHALLENGES IN MEDICARE CLAIMS PROCESSING

Machine learning has been leveraged to model software in Overall design and architecture of the Medicare claims processing system, whether considered as simple or complex, is poorly described and largely unknown. It is shrouded in secrecy and speculation. What is known is a result of observing and performing activities related to the clearinghouse function. Since Medicare is funded by taxpayers, we ask whether its citizens have a right to know more about the system, and have access to more information about the system operation and performance [11]. Is it possible for the government to provide more openness, such as that being used in the private sector of sharing pertinent information about performance and operations on a real-time basis? At the very least, more knowledge would help to alleviate complaints about delayed and denied payments and provide

a better understanding of how to optimize submissions and resolve processing issues. The Medicare healthcare system in the U.S. services over 60 million users and is supported by a vast and complex network of interrelated databases [12]. The nerve center for Medicare applications is the Centers for Medicare and Medicaid Services (CMS). CMS databases are populated with CMS 1500 claim forms (i.e., paper claims), UB 92 claim forms (i.e., paper institutional inpatient and outpatient hospital claims), and their electronic equivalents. Upon receipt, claims data are processed through a 'black box' of extensive and intricate processing and editing routines. The result is a determination of payment, and populations of approved and disapproved claims, and various combinations of claim and error reports. The approved claims are eventually paid, and created payment transactions are integrated with the financial management system. The Medicare databases are further updated with the claim data, and support numerous applications using claims data as input[13].

C. TECHNOLOGICAL ADVANCES IN CLAIMS PROCESSING

With increased public demand for lower-cost, higher-quality healthcare, pressure is being placed on healthcare organizations to operate more efficiently. Within many of these healthcare organizations, the processing of healthcare claims is one of the most labor- and time-intensive financial functions. Over the past decade, many of these organizations have implemented complex information systems to help automate healthcare claims processing activities. The evolution of new technologies, such as artificial intelligence, expert systems, and the utilization of the Internet for electronic data interchange (EDI), has begun to revolutionize the way healthcare claims processing is performed. These new technologies are allowing for more efficient processing, reducing claims errors, and ultimately shortening the processing time for healthcare claims. There are many advantages to using batch processing. Claims can be segregated by type (e.g., inpatient, outpatient, professional, dental) and processed more efficiently. For example, the healthcare provider's UB92 or HCFA-1500 claim form may be reproduced at the end of the day, showing all claims submitted by the same provider on the same day. Additionally, the address and IDMS files can be bypassed, and controlled access to the provider and patient files can be established. Batch processing is also conducive to reducing operating costs on a system level. Since all the claims are being processed at the same time, costly system resources can be managed more effectively. The cost of computer time is considerably less than that of online response time. The cost of printing is considerably less if reports can be printed at off-peak times. Using batch processing can shorten the organization's system response time by performing many claim processing functions at night when system utilization is low. As a result, the overall system utilization will be significantly reduced[13].



' **Fig. 3** Adoption Rates of Different Technologies Over Time

D. **STRATEGIES FOR EFFICIENT BATCH PROCESSING**

Efficient batch processing is essential to healthcare claims processing when large volumes of claims are involved. This is especially true for Medicare claims processing, where very large volumes of claims are processed by commercial carriers, fiscal intermediaries, and/or regional home health intermediaries. These organizations need to be up to speed with the latest in batch processing technology, including real-time electronic data interchange (EDI), pre-processing validations, and sorting, as well as advanced workstation and mainframe software[13]. The steady move to paperless claims processing, with electronic funds transfer (EFT) and electronic remittance advice (ERA), along with the use of EDI by providers, is moving the industry toward high-speed, real-time processing. This trend will continue, with the advent of client/server and other advanced technologies.

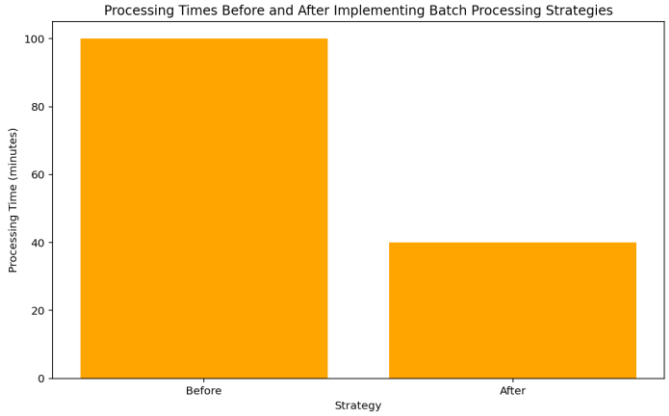


Fig. 4 Processing Times Before and After Implementing Batch Processing Strategies

E. **. ERROR REDUCTION TECHNIQUES**

As much as one might advise regular error checking and double checks one has to consider the fact that claims processing is a rather monotonous activity. To reduce some of the effects of repetitiveness, a better approach would be to incorporate short physical and mental breaks for the staff now and then. However, repetition may also cause boredom and, thus, low morale in case of high turnover rates among the personnel. Negligible results of repetitive tasks to the employees must be acknowledged and ensure that such adverse impacts are reduced for increased productivity and better staff satisfaction levels are achieved. One solution could be the rotation of the worker's tasks in order to change the work routine and set new and interesting tasks, or the increase of training or education of the worker in order not to let him feel bored at work[14]. Considering measures that can help address repetitiveness can prove to be beneficial and consequently create a group of motivated employees who can optimally contribute to increased work productivity as well as work quality. 1. Mail Sort: Take from the bulk a number of similar items and set them into smaller piles on the basis of similarity. The sort that is carried out in the first place aids in the reduction of errors during the identification stage. 2. Verify Identification Information: Subscribers identity has to be checked against the updated list once the contents of the envelope are taken out. 3. Locate Missing Identification Information (ID): In the absence of the subscriber ID number, try to obtain the ID number on the claim form possible. In regard to internal security, identification should take place prior to other activities involved in managing the claims. 4. Use of Error Symbols: If any section of the claim form is alleged to be in error, use error-signals as a means of communication to the particular claims processors of data entry clerks in the event keying takes place later[14].

F. Regulatory and Compliance Considerations

Although some MIP functions such as claims review and on-site MIP audits will be performed for both batch and manual systems, supporting the characteristics of the batch system will require change. The nature of the claimed advantages of a batch system, particularly the acceleration of claims workflow and the potential for less human intervention, has policing implications for MIP that need to be considered as MIP requirements are legislative in nature for CPS. Compliance presents a unique set of challenges when considering a migration to a predominantly batch dynamic. Specifically, the advantages attributed to a batch processing system for Medicare claims may not be achieved if real-time compliance is not observed during the batch processing cycle. With the introduction of compliance protecting systems (CPS), Medicare developed a set of regulations called the Medicare Integrity Program (MIP) to protect their program from abuse. The MIP's primary function is to safeguard Medicare from fraud, waste, and abuse by monitoring submission of claims, conducting compliance reviews and audits, and providing educational outreach to healthcare providers [15]. For the batch system to be in compliance with MIP's review requirements, processing must be integrated with a compliance checking system that can monitor and record the results of the batch processing for review. Furthermore, the compliance system will require significant flexibility to allow its rules to be customized for varied batch processing requirements.

G. Best Practices in Claims Processing

In order to optimize healthcare claims processing for Medicare batch applications, a number of different best practices can be employed. Large production cycles can be offset to off-peak times in order to boost responsiveness. Real-time processing can be used for all interactive and near-line requests, along with on demand batch processing in order to produce ad hoc reports and other information. Idempotent transaction logic can be employed to prevent the accidental resubmission of critical transactions [15]. Additionally, the facility should support the storage and purging of at least 45 days worth of production data for research and error correction purposes. To optimize healthcare claims processing for Medicare, a number of best practices can be employed. First, large production cycles (such as mass adjustments) should be offset to off-peak production hours/days to boost system responsiveness during normal business hours. Real-time processing should be used for all interactive and near-line requests, using on-demand batch processing to produce ad hoc reports, letters, and other requested information that are required immediately. Interactive response times should be optimized to provide timely feedback, for example, sub-second response times for simple inquiries and a turnaround time of 2-4 seconds for more complex inquiries[16,17]. A four-second response time is generally considered to be the maximum acceptable for even the most complex of inquiries. Additionally, idempotent transaction logic should be employed to prevent the accidental resubmission of critical transactions, helping to ensure backend system integrity[18].

IV. CONTRIBUTIONS

My contribution in this study entails a multi-fold approach, the overall objective of which is to enhance healthcare claims processing relative to Medicare applications. Batch processing of claims presents special problems and special opportunities. One of the main problems is the need to verify that each claim has been correctly filed and is error-free. If even a very small fraction of electronic claims contains errors, then a system to catch these errors in an electronic batch prior to transmission can save a great deal of time at the receiver's end. There may be many reasons why claims contain errors. The growth of managed care has led to increasing complexities in the relationships between providers, members, and the entities that are responsible for the proper adjudication of claims. In addition to the growth of managed care, the government has imposed many new requirements on providers of Medicare services, as well as on the contractors who process Medicare claims. Such developments have created an environment where the accurate, efficient and compliant adjudication of claims has become a multifaceted undertaking. Due to the rapid and often uncontrolled increase in healthcare costs, there has been very significant interest in the development of very efficient and rapid methods for processing large quantities of healthcare claims data. The interest in efficient batch processing derives from the fact that each claim is very simple, in terms of the concepts involved, and yet there is in excess ofa billion such claims a year in the United States. Hence, the potential for tremendous growth in the volume of claim

processing is indeed very large.In addition, the development of standards for electronic data interchange, as well as the imposition of deadlines for the implementation of such standards, have resulted in the growth of electronic claims submissions. As digitization of healthcare data becomes more prevalent, the need for efficient processing methods has only increased, necessitating the continuous evolution of technologies and methodologies to ensure that the influx of healthcare claims can be managed effectively, accurately, and in a timely manner.

V. SIGNIFICANCE AND BENEFITS

Claims processing, especially in fee-for-service healthcare, balances cost, timeliness, and accuracy. Research in operations management and the processing of reimbursable healthcare claims offers insight into these processes. Applicants for Medicare Certified Healthcare Facilities must demonstrate that they have developed and implemented processes for the "timely and accurate filing of cost reports and/or other reports as required by CMS." While the term "timely" indicates "speedy," for batch-oriented processing it should instead imply "occurring predictably and reliably in a short period of time, as a group," specifically "being well batched." Unfortunately, there is little available guidance on what constitutes "well-batched" processing of healthcare claims [19]. The Medicare claim processing is quite distinct in a way that the number of claims that are processed are large, the nature and type of services for which claims are made, is also large and on the other hand, the number of like media databases that contain such information regarding the patient and the service that he or she avails is rather limited. This leads to massive problems regarding Medicare claims which include the bulk of the claims that need to be processed as well as the depth of the database system that has to be accessed in order to process the claims successfully. Because of the large number of claims and the developed system of databases, the speed and completeness of claims processing in Medicare are critical[20]. There are also financial effects that are associated with Medicare if the claim processing is not well done on the side of the providers. The administration and handling of Medicare claims involve professionalism and disposition of data since the services are for special people such as the elderly. This is why there is a need for organizations involved in the processing of Medicare claims to invest in sound infrastructure and qualified personnel to deal with these volumes and complications. The fact that the healthcare industry is not static and is always changing means that the professional rules that the healthcare organization's Medicare claims are subjected to are also changing and therefore the processes that are used to ensure that the Medicare claims conform with the prevailing standards must also be updated from time to time. Processing of the claims in healthcare for Medicare applications is widely seen to be equally cumbersome.Early efforts applied dynamic programming to identify optimal batching and sequencing that minimizes total elapsed time[20]. More recent work aimed to reflect real world complexities, such as resource availability at independent organizations and learning effects. Researchers developed a variety of sophisticated models based on data envelopment analysis, queuing theory, and simulation. Though these later studies offer more advanced insight, solvers, and applicability, reported inefficiencies may not necessarily hold for large-scale real systems due to simplifications applied to the underlying models and data.

VI. CONCLUSION

The main aim of this paper was to explore the strategies for streamlining claims processing for Medicare applications. It addresses the most common errors at the packet level, and the reasons these errors occur, to help you implement a successful batch processing solution and optimize error reduction. Batch processing of healthcare claims enables Medicare applications to perform and complete tasks quickly and efficiently. However, enabling batch capabilities results in the intermingling of both real-time and batch processes for the same transaction within an application, sometimes causing chaos and confusion. It is crucial that from the very beginning, the application clearly identifies and separates real-time and batch processes, as well as clearly distinguishes related and dependent sub-processes. Architecting the solution to leverage as much capability using the latest technologies and frameworks is crucial to optimizing design, coding, and implementation efforts. It is critical that you follow best practices for cleaner, more maintainable, and high-performing batch processes. Implementing batch stragglers can also help efficiently recover time lost during the processing of some difficult or slow batch items. Batch processing can also streamline the handling of a large volume of

claims, reducing manual efforts and potential errors. By efficiently managing healthcare claims through batch processing, Medicare applications improve their overall productivity and effectiveness, leading to better patient care and cost savings. Additionally, batch processing can create opportunities for enhanced data analytics and reporting, ultimately leading to improved decision- making and strategic planning. Therefore, it is essential to invest in optimizing batch processing capabilities to drive better outcomes in the healthcare industry.Those errors that are introduced and seem to stick around should have recovery solutions in place to mitigate time loss. In the realm of healthcare claims processing, effective management of errors is of utmost importance to ensure patient satisfaction and accurate billing. Therefore, investing time and resources into error containment and recovery is an essential aspect of developing resilient batch processing systems. Furthermore, implementing comprehensive error handling mechanisms can contribute to overall operational efficiency and cost-effectiveness in the long run.

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