



January 2023

# INFORMATION TECHNOLOGY

## IRS Needs to Complete Modernization Plans and Fully Address Cloud Computing Requirements

Accessible Version

# GAO Highlights

Highlights of [GAO-23-104719](#), a report to the Honorable Gerald E. Connolly, House of Representatives

## Why GAO Did This Study

IRS relies extensively on IT to annually collect trillions of dollars in taxes, distribute hundreds of billions of dollars in refunds, and carry out its mission of providing service to America's taxpayers in meeting their tax obligations. This reliance on IT includes a significant amount of outdated legacy systems that pose risks. At the same time, IRS has increasingly used internet-based computing services (i.e., cloud services) to address its IT modernization needs.

GAO was asked to review IRS's legacy environment and cloud computing implementation. This report, among other things, 1) describes IRS's legacy IT environment; 2) assesses IRS's modernization plans; and 3) evaluates its cloud computing efforts.

To do so, GAO analyzed legacy applications, software, and hardware data; assessed plans for 21 modernization initiatives against practices identified in prior GAO work; and compared IRS's cloud computing documentation to relevant federal requirements. GAO also interviewed knowledgeable IRS officials.

## What GAO Recommends

GAO is making nine recommendations to IRS, including that it establish time frames to complete selected modernization plans, and fully address OMB's cloud computing requirements. IRS agreed with all nine recommendations.

View [GAO-23-104719](#). For more information, contact David B. Hinchman at (214) 777-5719, or [hinchmand@gao.gov](mailto:hinchmand@gao.gov).

January 2023

## INFORMATION TECHNOLOGY

# IRS Needs to Complete Modernization Plans and Fully Address Cloud Computing Requirements

## What GAO Found

The Internal Revenue Service's (IRS) legacy IT environment includes applications, software, and hardware, which are outdated but still critical to day-to-day operations. Specifically, GAO's analysis showed that about 33 percent of the applications, 23 percent of the software instances in use, and 8 percent of hardware assets were considered legacy. This includes applications ranging from 25 to 64 years in age, as well as software up to 15 versions behind the current version. As GAO has previously noted, and IRS has acknowledged, these legacy assets will continue to contribute to security risks, unmet mission needs, staffing issues, and increased costs.

Modernization best practices call for documenting plans that include three key elements: milestones, work to be performed, and disposition of legacy systems. As of August 2022, IRS had documented plans for the 21 modernization initiatives that were underway, including nine associated with legacy systems. All 21 plans addressed two key elements. However, the plans for six of the nine initiatives did not address the disposition of legacy systems (see table). Officials stated they would address this key element at the appropriate time in the initiatives' lifecycle; however, they did not identify time frames for doing so.

**GAO Assessment of the Internal Revenue Service's (IRS) Modernization Plans as of August 2022**

Modernization plan element	Yes	No	Not applicable
Includes milestones	21	0	0
Describes work to be performed	21	0	0
Includes disposition of legacy systems	3	6	12 <sup>a</sup>

Source: GAO analysis of IRS documents. | GAO-23-104719

<sup>a</sup>These initiatives were not associated with legacy systems.

IRS recently suspended operations of six initiatives, including two which are essential to replacing the 60-year old Individual Master File (IMF). The IMF is the authoritative data source for individual tax account data. GAO has reported that IRS has been working to replace IMF for well over a decade. According to officials, the suspensions were due to IRS's determination to shift resources to higher priorities; staff members working on these suspended initiatives were reassigned to other projects. As a result, the schedule for these initiatives is now undetermined. Accordingly, the 2030 target completion date for replacing the IMF that IRS announced last year is now unknown. This will lead to mounting challenges in continuing to rely on a critical system with software written in an archaic language requiring specialized skills.

IRS's cloud computing efforts fully addressed 11, partially addressed one, and did not address two requirements identified in the Office of Management and Budget's June 2019 cloud computing strategy. Key shortfalls include IRS not conducting regular evaluations of customer experiences and user needs. Until IRS fully addresses all cloud computing requirements, it will have less assurance that it is adopting cloud solutions that efficiently and effectively help it meet its mission needs and protect sensitive taxpayer information.

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**Abbreviations**

CADE 2	Customer Account Data Engine 2
COBOL	Common Business Oriented Language
FedRAMP	Federal Risk and Authorization Management Program
IMF	Individual Master File
IRS	Internal Revenue Service
OMB	Office of Management and Budget
TBM	Technology Business Management
TIGTA	Treasury Inspector General for Tax Administration

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January 12, 2023

The Honorable Gerald E. Connolly  
House of Representatives

Dear Mr. Connolly:

The Internal Revenue Service (IRS) relies extensively on IT systems to annually collect trillions of dollars in taxes, distribute hundreds of billions of dollars in refunds, and carry out its mission of providing service to America's taxpayers in meeting their tax obligations. In fiscal year 2021, the agency collected \$4.1 trillion in taxes and distributed more than \$1.1 trillion in refunds. More recently, IRS has also relied on IT to carry out its responsibilities under the CARES Act and other pandemic-related laws.<sup>1</sup> IRS reported spending \$3.3 billion in fiscal year 2021, and \$3.6 billion in fiscal year 2022 on IT. In addition, in August 2022, the Inflation Reduction Act of 2022 provided almost \$80 billion to IRS and related agencies to bolster taxpayer services and enforcement of the tax code, among other purposes.<sup>2</sup> This includes nearly \$4.8 billion for Business Systems Modernization, and over \$25.3 billion for Operations Support, which includes funding for the operations and maintenance of IRS's IT systems. The appropriated amounts are to remain available through the end of fiscal year 2031.

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<sup>1</sup>CARES Act, Pub. L. No. 116-136, 134 Stat. 281 (2020). The American Rescue Plan Act of 2021 required the Department of the Treasury to establish a program to make advance payments through the IRS of the child tax credit to eligible individuals to help address financial stress due to the pandemic. Pub. L. No. 117-2, title IX, subtitle G, § 9611(b), 135 Stat. 4, 145 (2021).

<sup>2</sup>Inflation Reduction Act of 2022, Pub. L. No. 117-169, title I, subtitle A, part 3, § 10301, 136 Stat. 1818 (2022).

IRS's IT includes legacy technology systems,<sup>3</sup> which we have previously reported can contribute to security risks, unmet mission needs, a shortage of staff with specialized skills, and increased costs.<sup>4</sup> Recognizing this, IRS has embarked on several efforts to modernize and retire its legacy systems. In doing so, it has, like other federal agencies, increasingly turned to cloud computing. Using the cloud can serve as a means to buy services more quickly and possibly at a lower cost rather than building, operating, and maintaining computing resources.<sup>5</sup>

In an effort to accelerate agency adoption of cloud services, in June 2019, the Office of Management and Budget (OMB) published its updated Federal Cloud Computing Strategy, called Cloud Smart.<sup>6</sup> As part of the strategy, OMB, among other things, required agencies to take steps in the area of security, procurement, and workforce to help ensure successful cloud implementation.

You asked us to review IRS's legacy IT environment and implementation of cloud computing services. This report:

1. describes IRS's legacy IT systems environment and its efforts to identify associated costs;
2. determines the extent to which IRS defined plans, including cost, schedule, and benefits for modernizing or replacing and retiring its legacy IT systems; and

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<sup>3</sup>IRS defines a legacy IT system as a system that may be based on outdated technologies but is still critical to day-to-day operations. This includes applications that are 25 years old or older, or written in an obsolete programming language such as assembly language code or Common Business Oriented Language. The provisions commonly referred to as the Modernizing Government Technology Act define a legacy IT system more broadly as a system that is outdated or obsolete. National Defense Authorization Act for Fiscal Year 2018, Pub. L. No. 115-91, division A, title X, subtitle G, § 1076(8), 131 Stat. 1283, 1587 (2017).

<sup>4</sup>GAO, *Information Technology: Cost and Schedule Performance of Selected IRS Investments*, [GAO-22-104387](#) (Washington, D.C.: Oct. 19, 2021); and *Information Technology: Agencies Need to Develop Modernization Plans for Critical Legacy Systems*, [GAO-19-471](#). (Washington, D.C.: June 11, 2019).

<sup>5</sup>According to the National Institute of Standards and Technology, cloud computing is a means for enabling on-demand access to shared pools of configurable computing resources (e.g., networks, servers, storage applications, and services) that can be rapidly provisioned and released.

<sup>6</sup>Office of Management and Budget, *Federal Cloud Computing Strategy* (June 24, 2019).

3. determines the extent to which IRS's current efforts and plans to move to cloud services are consistent with Office of Management and Budget guidance.

For our first objective, we reviewed IRS's definition of a legacy IT system for consistency with the definition in the provisions commonly referred to as the Modernizing Government Technology Act and prior GAO work.<sup>7</sup> We obtained, analyzed, and summarized IRS's legacy IT application, software, and hardware inventories. We also reviewed IRS expenditure plans and interviewed knowledgeable officials to identify operations and maintenance costs for fiscal years 2021 and 2022 and determine whether and how the agency specifically tracks these costs for its legacy systems. To determine the reliability of the application, software, and hardware data, we, among other things, reviewed the data for anomalies, and interviewed IRS officials to understand how the data are generated and maintained. We found that the data were sufficiently reliable for the purpose of our report.

For our second objective, we identified IRS's list of business capabilities and applications to be modernized and retired through fiscal year 2026. We then linked these with their associated programs. In doing so, we identified 26 modernization initiatives, including 21 that were underway. We corroborated this list with IRS officials. We requested plans for the 21 initiatives that were underway and reviewed them to determine whether they included key elements. Specifically, we determined whether the plans included (1) milestones to complete the modernization, (2) a description of the work necessary to modernize the system, and (3) details regarding the disposition of the legacy system. As we previously reported, these elements increase the likelihood of successful modernizations.<sup>8</sup> Finally, we reviewed the modernization plans and supporting planning documentation to identify replacement costs, schedule, and benefits.

For our third objective, we obtained and reviewed cloud computing documents from IRS to identify the agency's ongoing and planned cloud adoption efforts and the agency's overall strategy for moving to cloud services. We also reviewed other relevant cloud planning and execution documentation to understand IRS's activities for moving to cloud services.

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<sup>7</sup>National Defense Authorization Act for Fiscal Year 2018, Pub. L. No. 115-91, division A, title X, subtitle G, § 1076(8), 131 Stat. 1283, 1587 (2017).

<sup>8</sup>[GAO-19-471](#).

Further, we assessed IRS's cloud strategy, and cloud planning and execution documents against 14 key cloud computing requirements that we previously identified in OMB's June 2019 cloud strategy.<sup>9</sup> For any requirements that IRS had not fully addressed, we interviewed relevant officials to determine the causes as well as IRS's actions and plans to address them. A detailed discussion of our objectives, scope, and methodology can be found in appendix I.

We conducted this performance audit from May 2021 to January 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

The mission of IRS, a component agency within the Department of the Treasury, is to (1) provide America's taxpayers top quality service by helping them understand and meet their tax responsibilities, and (2) enforce the law with integrity and fairness to all.

While it relies extensively on IT to carry out this mission, IRS has reported that modernization is needed to improve its core tax administration systems, operations, and cybersecurity. IRS has also reported that modernization is critical to improving customer experience and providing the kind of service taxpayers have come to expect. For example, IRS has previously reported that modernization will help address business and technical challenges due to constraints with the Individual Master File (IMF) program it has been using since 1970.<sup>10</sup> These challenges include the inability to get a real-time view of the taxpayer account, quickly

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<sup>9</sup>GAO, *Cloud Computing: DOD Needs to Improve Workforce Planning and Software Application Modernization*, [GAO-22-104070](#) (Washington, D.C.: June 29, 2022). As part of this work, we analyzed OMB's June 2019 *Federal Cloud Computing Strategy* and identified 14 key requirements across three categories (security, procurement, and workforce) that agencies should address as part of their cloud computing strategy. We confirmed the list with staff in OMB's Office of Federal Chief Information Officer.

<sup>10</sup>IMF is IRS's system for processing individual taxpayer account data. The agency uses this system to update accounts, assess taxes, and generate refunds, as required, during each tax filing period.



respond to tax code changes, provide enhanced analytical capabilities, and provide additional taxpayer account information to more effectively combat fraud and identity theft.

To support its IT modernization efforts, in April 2019, IRS issued a high-level business plan that identified modernization initiatives through fiscal year 2024.<sup>11</sup> The plan was not a comprehensive strategy for modernizing and replacing IRS's legacy IT systems. Rather it defined a six-year plan for four major categories of work that IRS considered necessary to transform the agency's technology and deliver a modernized taxpayer experience. The categories were taxpayer experience, core taxpayer services and enforcement, modernized IRS operations, and cybersecurity and data protection. The plan identified key objectives, programs, and initiatives for each category.

In addition, the plan defined two phases for completing the work: the first phase was scheduled to occur between fiscal years 2019 and 2021, and the second phase was to occur between fiscal years 2022 and 2024. IRS noted that successful implementation of the plan was dependent on obtaining certain hiring flexibilities and required multiyear funding at predictable levels. IRS has stated it is updating the plan and expects the update to be finalized in early calendar year 2023.

IRS reports quarterly to the Congress and other stakeholders on its progress in implementing the modernization plan.<sup>12</sup> These quarterly reports summarize accomplishments for the past quarter and identify plans, including associated costs and schedules for the upcoming quarter. IRS also issues a publicly available annual status report and, in July 2022, issued its third report.

Subsequent to the April 2019 modernization plan's issuance, IRS experienced funding changes that impacted its modernization portfolio. For example, in March 2021, Congress and the President enacted the

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<sup>11</sup>Internal Revenue Service, *IRS Integrated Modernization Plan Business Plan*, (Washington, D.C.: April 2019).

<sup>12</sup>Pursuant to H.R. Rep. No. 117-79, at 32 (2021) incorporated by the joint explanatory statement of conference, 168 Cong. Rec. H1709, H2349 (daily ed. Mar. 9, 2022) (statement of Chair DeLauro), specifically referenced in § 4 of the Consolidated Appropriations Act, 2022, Pub. L. No. 117-103, § 4, 136 Stat. 49, 51 (2022), IRS is instructed to report on major IT project activities within 30 days of the end of each quarter for calendar year 2022.

American Rescue Plan Act, which provided almost \$1.5 billion to continue to develop “integrated, modernized, and secure IRS systems,” among other things.<sup>13</sup> IRS subsequently allocated \$1 billion to accelerate existing initiatives, address initiatives scheduled to begin in phase 2 of the 2019 modernization plan, and introduce new initiatives. In addition, in July 2022, IRS officials stated that agency leadership had reallocated \$416 million of the funds to cover IT operations and maintenance needs and address taxpayer assistance needs with record paper inventory levels. As a result of these new priorities, IRS suspended six programs, including the Customer Account Data Engine 2 (CADE 2) Target State and IMF Acceleration; reduced the funding for six others; added one program; and increased funding for two programs. Six other programs remained at the same funding level.

In addition, as previously stated, the Inflation Reduction Act recently provided nearly \$4.8 billion to IRS for Business Systems Modernization and \$25.3 billion for Operations Support, which includes funding for the operations and maintenance of IRS’s IT systems. The appropriated amounts are to remain available through the end of fiscal year 2031.

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## Legacy IT Poses Risk

As stated above, we previously reported that legacy systems have contributed to security risks, unmet mission needs, a shortage of staff with specialized skills, and increased costs.<sup>14</sup>

**Security risks.** Legacy systems may operate with known security vulnerabilities that are either technically difficult or prohibitively expensive to address. In some cases, vendors no longer provide support for hardware or software, creating security vulnerabilities and additional costs.

**Unmet mission needs.** Legacy systems may not be able to reliably meet mission needs because they are outdated or obsolete. For example, system outages potentially caused by hardware failure may halt tax processing, thus creating backlog.

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<sup>13</sup>American Rescue Plan Act of 2021, Pub. L. No. 117-2, title IX, subtitle G, § 9601(d), 135 Stat. 4, 144 (2021).

<sup>14</sup>[GAO-19-471](#).

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**Shortage of staff with specialized skills.** In order to operate and maintain legacy systems, staff may need experience with older technology and programming languages, such as Common Business Oriented Language (COBOL). Agencies have had difficulty finding employees with such knowledge and may have to pay a premium to hire specialized staff or contractors. Further, having a shortage of expert personnel available to maintain a critical system creates significant risk to an agency's mission.

**Increased costs.** The cost of operating and maintaining legacy systems increases over time. In an era of constrained budgets, the high costs of maintaining legacy systems could limit an agency's ability to modernize and develop new or replacement systems.

Further, federal agencies have struggled with appropriately planning and budgeting for modernizing legacy systems; upgrading underlying infrastructure; and investing in high quality, lower cost service delivery technology.

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## GAO and Treasury Have Reported on Federal and IRS Management of Legacy IT Systems

We have previously reported on federal agencies' legacy IT and management of those systems.

- In 2015, we designated improving the management of IT acquisitions and operations as an addition to our biannual High Risk List. We identified this area as a particular concern because of the increasing level of information technology spending on operations and maintenance. This made less funding available for development or modernization.<sup>15</sup> We also found the federal government had spent billions on failed and poorly performing information technology investments due to a lack of effective oversight.

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<sup>15</sup>GAO, *High-Risk Series: An Update*, [GAO-15-290](#) (Washington, D.C.: Feb. 11, 2015). GAO's high-risk program identifies government operations with vulnerabilities to fraud, waste, abuse, and mismanagement, or in need of transformation to address economy, efficiency, or effectiveness challenges. Every 2 years, we issue an update that describes the status of these high-risk areas and actions that are still needed to assure further progress. We also identify new high-risk areas needing attention by Congress and the executive branch. Financial benefits to the federal government due to progress in addressing high-risk areas from fiscal years 2006 through 2018 totaled nearly \$350 billion.

- In addition, our prior work has emphasized the importance of managing legacy IT and the need for the federal government to develop modernization plans for critical legacy systems. For example, in June 2019,<sup>16</sup> we reported on the 10 most critical federal legacy systems in need of modernization.<sup>17</sup> We also reported that documenting modernization plans in sufficient detail increases the likelihood that modernization initiatives will succeed. According to government and industry best practices, and prior GAO reports on the modernization of federal IT,<sup>18</sup> agencies should have documented modernization plans for legacy systems. These plans should, at a minimum, include three key elements: (1) milestones to complete the modernization, (2) a description of the work necessary to modernize the legacy system, and (3) details regarding the disposition of the legacy system. We reported that a majority of the agencies that house the 10 most critical legacy systems lacked complete modernization plans. As such, we recommended that these agencies ensure that they document modernization plans for the selected legacy systems. The agencies agreed with our recommendations and have efforts planned and underway to address them.
- In October 2021, we reported on IRS's use of outdated assembly language code and COBOL for its IMF, and on the status of the agency's efforts to replace the program. We noted that IRS had a plan for replacing and retiring IMF, with a 2030 milestone for full replacement. The milestone, however, meant that for many years IRS would still have to contend with the numerous challenges associated with the system's age and reliance on an old programming language. Further, given the past significant delays and other challenges in developing the Customer Account Data Engine (CADE) 2, a

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<sup>16</sup>[GAO-19-471](#).

<sup>17</sup>The Department of the Treasury, which includes IRS, was included in the report as an agency responsible for one of these legacy systems.

<sup>18</sup>General Services Administration, Unified Shared Services Management, *Modernization and Migration Management (M3) Playbook* (Washington, D.C.: Aug. 3, 2016); *M3 Playbook Guidance* (Washington, D.C.: Aug. 3, 2016); American Technology Council, *Report to the President on Federal IT Modernization* (Washington, D.C.: Dec. 13, 2017); Office of Management and Budget, *Management of Federal High Value Assets*, M-17-09 (Washington, D.C.: Dec. 9, 2016); American Council for Technology-Industry Advisory Council, *Legacy System Modernization: Addressing Challenges on the Path to Success* (Fairfax, VA: Oct. 7, 2016); Dr. Gregory S. Dawson, Arizona State University, IBM Center for The Business of Government, *A Roadmap for IT Modernization in Government* (Washington, D.C.: 2018); and [GAO-19-471](#).

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significant component of the IMF replacement, consistent high-level management attention was warranted.<sup>19</sup>

The Treasury Inspector General for Tax Administration (TIGTA) has also reported on the status of IRS's legacy IT systems.

- In August 2020, TIGTA reported that IRS had not developed specific or long-term plans to address updating, replacing, or retiring most of its legacy IT systems.<sup>20</sup> Further, it did not have an enterprise-wide definition of a legacy system, a complete and accurate inventory of their legacy IT systems, nor did it generally capture operations and maintenance costs at the system or subsystem levels. TIGTA made five recommendations to, among other things, establish an enterprise-wide definition of a legacy system; implement a program to identify, prioritize, and execute the updating, replacing, or retiring of current and future legacy systems; and capture operations and maintenance costs for the current IT infrastructure at the subsystem level. IRS agreed with three recommendations, partially agreed with the other two, and identified plans to address the recommendations.

IRS has since taken action to address the TIGTA recommendations. For example, IRS established an enterprise-wide definition for legacy systems. According to the definition, a legacy system is an information system that may be based on outdated technologies but is critical to day-to-day operations. This includes aged software applications that are 25 years or older; legacy or obsolete programming languages that are currently specified as assembly language code, COBOL, or Visual BASIC; outdated development methodology or lack of Industry adoption; lack of vendor support; lack of resource and training; and outdated architecture adoption.

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## OMB Has Established Cloud Computing Guidance for Federal Agencies

Federal agencies have increasingly used cloud computing services to address their IT modernization needs. In December 2010, OMB made

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<sup>19</sup>[GAO-22-104387](#). We also reported on the IMF modernization in 2016, GAO, *Information Technology: Federal Agencies Need to Address Aging Legacy Systems*, [GAO-16-468](#) (Washington, D.C.: May 25, 2016).

<sup>20</sup>Treasury Inspector General for Tax Administration, *Legacy Systems Management Needs Improvement*, 2020-20-044 (Aug. 19, 2020).

cloud computing an integral part of its *25 Point Implementation Plan to Reform Federal Information Technology Management*.<sup>21</sup> The plan called for the development of a government-wide strategy to hasten the adoption of cloud services. To accelerate the efforts, OMB required agencies to identify three systems to migrate to cloud services, create a project plan for migration, and migrate all three systems by June 2012.

Subsequently, in February 2011, OMB issued the *Federal Cloud Computing Strategy*, that required each agency's Chief Information Officer to evaluate safe and secure cloud computing options before making any new investments.<sup>22</sup> The strategy provided:

- definitions of cloud services;
- benefits of cloud services, such as accelerating data center consolidations;
- a decision framework for migrating services to a cloud environment;<sup>23</sup>
- case studies to support agencies' migration to cloud services; and
- roles and responsibilities for federal agencies.

In 2012, OMB began requiring agencies to evaluate each investment, or components or systems within the investment, for cloud services regardless of the overall life-cycle stage of the investment.<sup>24</sup> Agencies were required to report the status of each investment's evaluation as part of the annual budget submission, consistent with OMB's annual capital planning guidance. Since 2018, OMB has required agencies to select an option regarding whether the investment, or a portion of the investment, was leveraging cloud computing, or indicate that cloud computing had not been considered for the investment.<sup>25</sup>

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<sup>21</sup>Office of Management and Budget, *25 Point Implementation Plan to Reform Federal Information Technology Management*.

<sup>22</sup>Office of Management and Budget, *Federal Cloud Computing Strategy* (Feb. 8, 2011).

<sup>23</sup>The decision framework, among other things, identified several key areas for determining the readiness for moving to a cloud environment, including the ability of the cloud service provider to address government security requirements.

<sup>24</sup>Office of Management and Budget, *FY 2014 Guidance on Exhibits 53 and 300* (Washington, D.C.: Aug. 3, 2012).

<sup>25</sup>Office of Management and Budget, *FY 2018 IT Budget—Capital Planning Guidance* (Washington, D.C.: June 30, 2016).

In June 2019, OMB issued an update to its Federal Cloud Computing Strategy in an effort to accelerate agency adoption of cloud-based solutions.<sup>26</sup> The strategy focused on equipping agencies with the tools needed to make informed IT decisions according to its mission needs. In addition, the strategy included key requirements for agencies to implement for the successful cloud adoption within three areas—security, procurement, and workforce.

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## IRS Has Established a Program to Manage Its Cloud Computing Efforts

In March 2021, IRS issued an updated cloud computing strategy that outlines the strategic goals and objectives for the agency-wide adoption of cloud computing.<sup>27</sup> Specifically, the strategy identified six goals and associated objectives. The goals include, among other things, product and technology, workforce, and security and compliance. The associated objectives identify that IRS plans to (1) create a secure multi-cloud environment featuring multiple cloud service providers and offer a wide array of services, (2) train teams to operate in the cloud and implement a cloud hiring strategy to meet the needs of moving to cloud, and (3) protect all data and digital assets in the cloud by embedding security and compliance into the cloud-based infrastructure and leverage data analytics to perform continuous monitoring and rapid response.

According to the strategy, the cloud environment is intended to enable the delivery of multiple cloud services, operations, and security using managed services as much as possible. For example, IRS's cloud environment includes the implementation of Infrastructure as a Service, Platform as a Service, and Software as a Service, the three types of cloud services.<sup>28</sup> In addition, IRS has defined a cloud roadmap that provides a three-year (fiscal year 2021 through 2023) view of activities required to

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<sup>26</sup>Office of Management and Budget, *Federal Cloud Computing Strategy* (2019).

<sup>27</sup>Internal Revenue Service, *IRS Cloud Strategy* (March 2021).

<sup>28</sup>Infrastructure as a Service—the cloud service provider delivers and manages the basic computing infrastructure of servers, software, storage, and network equipment. The agency provides the operating systems, programming tools and services, and applications. Platform as a Service—the cloud service provider delivers and manages the infrastructure, operating system, and programming tools and services, which the agency can use to create applications. Software as a Service—the service provider delivers one or more applications and all the resources (operating system and programming tools) and underlying infrastructure, which the agency can use on demand.

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progress towards the agency's cloud computing goals. The roadmap is organized into five distinct areas which align to IRS's cloud target state. These areas are (1) product and technology, (2) migration and support services, (3) processes, (4) governance and management, and (5) workforce. IRS also established a governance structure, including a Cloud Management Office, to implement its cloud program.

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## GAO Has Reported on Cloud Computing Efforts

We have previously reported on federal agencies' increasing use of cloud computing to perform their missions.

- In December 2019, we reported on 24 federal agencies' use of the Federal Risk and Authorization Management Program to authorize the use of cloud services.<sup>29</sup> The Federal Risk and Authorization Management Program (FedRAMP) developed a security assessment framework to be used by cloud service providers and agencies seeking to obtain cloud services. While agencies increased their use of the Federal Risk and Authorization Management Program, many refrained from using authorized cloud services. Further, OMB required agencies to use the program, but did not effectively monitor agencies' compliance with this requirement. As such, we recommended that OMB enhance oversight, and other selected agencies should, among other things, clarify guidance to agencies and cloud service providers on program requirements and responsibilities. Two of the agencies agreed with our recommendations; one generally agreed; one generally disagreed; and one agency neither agreed nor disagreed. To date, selected agencies have taken action to implement the recommendations. For example, in response to our recommendation the General Service Administration's Director of the FedRAMP took actions to clarify guidance to agencies and cloud service providers on program requirements and responsibilities.
- In June 2022, we reported on OMB's cloud computing requirements and the Department of Defense's plan for addressing them.<sup>30</sup> As part of our review, we identified 14 key requirements for agencies to implement cloud adoption in OMB's June 2019 Federal Cloud Computing Strategy. The requirements were intended to bolster

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<sup>29</sup>GAO, *Cloud Computing Security: Agencies Increased Their Use of the Federal Authorization Program, but Improved Oversight and Implementation Are Needed*, [GAO-20-126](#) (Washington, D.C.: Dec. 12, 2019).

<sup>30</sup>[GAO-22-104070](#).



federal IT modernization efforts by improving the return on investment, providing enhanced security, and producing higher quality services for users. The requirements were grouped into three primary areas; security, procurement, and workforce. We determined that the Department of Defense's plan for cloud services addressed a majority of these requirements, but gaps remained. As such, we recommended that the department address these shortfalls needed for an enterprise-wide cloud environment. The Department of Defense agreed with one, partially agreed with seven, and disagreed with one of our recommendations. The department stated that it had ongoing or planned actions to address most of the recommendations.

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## IRS Has Identified Its Legacy IT Environment

IRS's legacy IT environment includes applications, software, and hardware, which, according to IRS's definition, are outdated but still critical to day-to-day operations.<sup>31</sup> Specifically, our analysis of IRS definitions and associated data showed that about 33 percent of the applications, 23 percent of the software instances in use (according to IRS, one percent of the software products), and 8 percent of the hardware assets were considered legacy. While IRS tracks the costs for its applications, hardware, and software, it does not separately track the costs associated with its legacy IT assets. However, according to officials, the agency has efforts underway that should provide them with additional insights into legacy IT costs.

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### IRS's Legacy IT Environment Includes Applications, Software, and Hardware

IRS has identified a number of legacy applications, software, and hardware it continues to use on a day-to-day basis. According to the agency, applications are IRS-built software programs that automate business functions. An example is the Generalized Mainframe Framework application that validates and perfects data from a variety of input sources including tax returns, remittances, and information returns. Software

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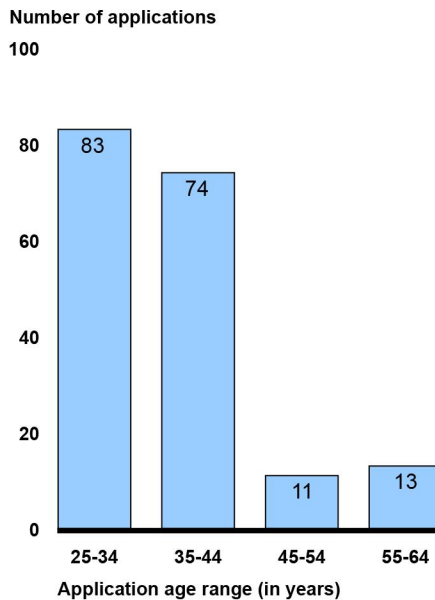
<sup>31</sup>IRS uses the term non-current to describe its software that is two versions or more behind the vendor's most recently released version. According to the agency, a version represents a specific baseline and each version features added functionality from the previous version. IRS also uses the term "aged" to describe its hardware that has reached a specific age. We are using the term "legacy" for consistency.

includes non-IRS built software and commercial off-the-shelf software (for example, Microsoft Windows 10 operating system). Hardware is physical information technology infrastructure, such as mainframes and servers.<sup>32</sup> According to officials, these assets together support mission-critical business functions such as processing tax returns, processing refunds, responding to taxpayer inquiries, and conducting collection activities.

### About 33 Percent of IRS's Applications Are Legacy

IRS defines an application as legacy when it is 25 years or older, or written in an obsolete programming language. As of June 2022, IRS data showed that 259 out of 776, or about 33 percent, of its applications as meeting one or both of those criteria. Specifically, 181 of the applications, or about 23 percent, are 25 years or older. Figure 1 below identifies the age ranges of the 181 applications.

**Figure 1: Age Range of the Internal Revenue Service's Legacy Applications that are 25 Years and Older as of June 2022**



Source: GAO analysis of Internal Revenue Service data. | GAO-23-104719

<sup>32</sup>Internal Revenue Service, *IT Footprint Reduction Strategy, version 4.0*, (Washington, D.C.: Oct. 2021).

**Accessible Data for Figure 1: Age Range of the Internal Revenue Service’s Legacy Applications that are 25 Years and Older as of June 2022**

Application age range (in years)	Number of applications
25-34	83
35-44	74
45-54	11
55-64	13

In addition, all 259 applications identified as legacy (including the 181 aged applications) use one or more obsolete programming language, such as COBOL or assembly language code.

**IRS’s Legacy Software Represents About 23 Percent of Its Inventory**

IRS defines software as legacy when it is two versions or more behind the current version. As of September 2022, IRS identified that 1,111,419 out of 4,821,033 software instances in use,<sup>33</sup> or about 23 percent of its most frequently used commercial off-the-shelf software, were considered legacy.<sup>34</sup> Further, 359,520 instances, or over 32 percent of IRS’s legacy software is at least four versions behind the current version, with some instances 15 versions behind.<sup>35</sup> IRS stated that the legacy software represented 40 out of 3,505 or one percent of the products in use. Table 1 shows the number of versions behind the current version and the total instances currently in use.

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<sup>33</sup> IRS defines “instances in use” as installations of a product version that can be installed on multiple servers or workstations.

<sup>34</sup>We obtained IRS’s list of the 20 most frequently used commercial-off-the shelf-software running on servers, desktops and laptops. IRS refers to the software running on its servers as tier 2 software and the software running on its workstations as tier 3 software.

<sup>35</sup>IRS has organized its legacy software into industry standard categories defined in the software catalog the agency uses as part of its infrastructure currency program. These categories include business intelligence, collaboration, IT management, multimedia and graphics, operating systems, productivity, software development, utilities, and virtualization. Each category may have several different software versions associated with it.

**Table 1: Number of Versions behind for Internal Revenue Service’s Legacy Commercial Off-the-Shelf Software as of September 2022**

Number of versions behind	Total instance count in use
15	5,943
7	96,044
6	106,808
5	72,196
4	78,529
3	318,731
2	433,168
<b>Total</b>	<b>1,111,419</b>

Source: GAO analysis of Internal Revenue Service software data. | GAO-23-104719

About 8 Percent of IRS’s Hardware Is Considered Legacy

IRS defines hardware as legacy when it has reached a specific age based on industry standards. As of July 2022, IRS reported that 9,280 out of 115,377 hardware assets (for example, firewalls, mainframes, and desktops), or about 8 percent, were considered legacy. Of the 45 categories of hardware, 24 had over 25 percent of their assets identified as legacy and eight categories had over 75 percent of the assets identified as legacy. We analyzed detailed information on the categories and number of legacy assets but IRS deemed it too sensitive to publicly report. Table 2 below identifies the percentage range of legacy hardware assets in the 45 categories.

**Table 2: Percentage Range of Internal Revenue Service’s Legacy Hardware Assets as of July 2022**

Percentage range	Number of hardware categories
0	4
1 to 25	17
26 to 50	12
51 to 75	4
76 to 100	8
<b>Total</b>	<b>45</b>

Source: GAO analysis of Internal Revenue Service hardware data. | GAO-23-104719

IRS officials described several programs they use to identify legacy applications, software, and hardware, and prioritize them for modernization, replacement, and retirement as resources allow. They

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include infrastructure currency programs and an IT footprint reduction strategy. Nevertheless, the agency's environment still includes many legacy assets which, we have previously noted, and IRS has acknowledged, will continue to significantly contribute to security risks, unmet mission needs, staffing issues, and increased costs, among other challenges.

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### IRS Tracks Total Costs of Its Applications, Software, and Hardware but Not Separately for Legacy Assets

While IRS tracks the costs of its applications, software, and hardware, it does not track specific costs for legacy assets. Instead, the agency categorizes its costs into cost pools<sup>36</sup> and IT towers<sup>37</sup> as part of the Technology Business Management (TBM) approach to budgeting. The Office of Management and Budget began requiring agencies to use TBM in fiscal year 2019.<sup>38</sup> The cost pools include hardware and software, and the towers include applications. For fiscal year 2021, the agency reported spending about \$617 million for operations and maintenance for applications, about \$274 million for software, and about \$103 million for hardware. Further, IRS plans to spend about \$635 million on applications, about \$324 million on software, and about \$115 million on hardware in fiscal year 2022 for operations and maintenance.<sup>39</sup>

Given OMB's direction to use TBM to track costs, IRS does not specifically track the costs for its legacy assets. In addition, according to IRS officials, capturing full costs for these assets would require full

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<sup>36</sup>The *TBM Taxonomy, Version 4.0* states that cost pools are low-level categories that make cost allocations easier by revealing the composition of costs. For example, application total cost of ownership can be broken down into hardware, software, internal and external labor, outside services, facilities, and telecom costs. Copyright © 2020 Technology Business Management Council.

<sup>37</sup>According to the TBM Council's *TBM Taxonomy, Version 4.0*, IT towers are the resources or building blocks of specific IT applications. Examples of IT towers include compute (e.g., servers, mainframe), network, application (e.g., application development, application support and operations) and IT management. Copyright © 2020 Technology Business Management Council.

<sup>38</sup>Office of Management and Budget, *Fiscal Year 2019 IT Budget – Capital Planning Guidance* (Washington, D.C.: Aug. 1, 2017).

<sup>39</sup>In October 2022, IRS provided its IT cost data which included actual costs through July 31, 2022 and estimated actuals for August and September 2022.

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activity-based costing, a method they are not currently using.<sup>40</sup> They stated, however, that they have been working with the Department of the Treasury to populate a reporting tool which should provide additional insight into their legacy technology costs. They further stated that they expect to go live with this reporting tool by the end of the first quarter of fiscal year 2023. The additional insight IRS expects to gain from using the new tool should provide the agency with additional information to support decision-making.

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## Key Elements of Modernization Planning Are either Missing or No Longer Valid

As previously noted, documenting modernization plans that include, at a minimum, three key elements increases the likelihood that modernization initiatives will succeed. These elements are (1) milestones to complete the modernization, (2) a description of the work necessary to modernize the legacy system, and (3) details regarding the disposition of the legacy system.<sup>41</sup>

As of August 2022, IRS had 21 IT initiatives in its modernization portfolio. To its credit, the agency documented plans for each of the 21 initiatives which addressed two of the three key elements—milestones and descriptions of the work to be completed—that best practices indicate should be included in a modernization plan. Of the nine plans for the initiatives associated with legacy systems, three plans included details regarding the disposition of a legacy system—the third key element—while six of the plans did not address this element. IRS officials stated that this element would be addressed for each of the six initiatives at a later point in their life cycle. However, the officials did not provide time frames for when this would occur. Without establishing time frames for addressing the disposition of legacy systems, IRS lacks accountability for completing this key element. For the remaining twelve plans, the third element was not applicable, because, according to officials, there was no corresponding legacy system to be retired.

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<sup>40</sup>Activity-based costing is a cost accounting method that measures the cost and performance of process related activities and cost objects. It assigns cost to cost objects, such as products, based on their use of activities. It recognizes the casual relationship of cost drivers to activities.

<sup>41</sup>[GAO-19-471](#).

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Table 3 identifies the 21 initiatives as well as the extent to which their plans were sufficiently detailed to include the three key elements. The six programs which, as previously noted, IRS had suspended as of July 2022 due to funding reallocations are shaded.

**Table 3: Extent to Which Internal Revenue Service’s IT Modernization Plans Included Key Elements**

<b>Program name</b>	<b>Includes milestones to complete the modernization</b>	<b>Describes work necessary to modernize system</b>	<b>Summarizes planned disposition of legacy system<sup>a</sup></b>
Cloud Execution	Yes	Yes	Not applicable
Customer Account Data Engine (CADE) 2 Transition State 2	Yes	Yes	Yes
Digitalization	Yes	Yes	Not applicable
Enterprise Case Management	Yes	Yes	No
Enterprise Data Platform	Yes	Yes	No
Identify & Access Management	Yes	Yes	Not applicable
Information Returns Modernization	Yes	Yes	No
Information Technology Service Management	Yes	Yes	No
Live Assistance	Yes	Yes	Not applicable
Network Expansion	Yes	Yes	Not applicable
Secure Access Digital Identity	Yes	Yes	Yes
Security Operations & Management	Yes	Yes	Not applicable
Taxpayer Accessibility	Yes	Yes	Not applicable
Vulnerability & Threat Management	Yes	Yes	Not applicable
Web Applications	Yes	Yes	Not applicable
Customer Account Data Engine (CADE) 2 Target State <sup>b</sup>	Yes <sup>c</sup>	Yes	Not applicable
Enterprise Anomaly Detection / Return Review Program <sup>b</sup>	Yes <sup>c</sup>	Yes	No
Individual Master File Retirement Acceleration <sup>b</sup>	Yes <sup>c</sup>	Yes	Yes
Robotics Process Automation / Intelligent Automation <sup>b</sup>	Yes <sup>c</sup>	Yes	Not applicable
Enterprise Tax Calculator Service <sup>b</sup>	Yes <sup>c</sup>	Yes	Not applicable
Workforce Infrastructure <sup>b</sup>	Yes <sup>c</sup>	Yes	No

Source: GAO analysis of Internal Revenue Service documentation. | GAO-23-104719

<sup>a</sup>Not Applicable = The modernization initiative does not have a legacy system with which it is associated.

<sup>b</sup>These programs were suspended as of July 2022 due to the American Rescue Plan Act funding reallocation.

<sup>c</sup>These milestones may no longer be valid due to the suspensions resulting from the American Rescue Plan Act funding reallocation.



According to officials, staff members working on the initiatives that were suspended were reassigned to other projects. Officials added that the schedules for these suspended initiatives were now undetermined.

The suspension of two of the initiatives—CADE 2 Target State and IMF Retirement Acceleration—considered essential to replacing the 60-year-old IMF is concerning. IMF is IRS’s authoritative data source for individual tax account data. As we reported last year, IRS has been working for well over a decade to replace IMF.<sup>42</sup> However, IRS has revised the program’s cost, schedule, and scope goals on numerous occasions, including seven times between 2016 and 2019. Given these continuing delays, IRS announced last year that IMF would not be fully replaced until 2030. However, that date no longer applies due to the suspensions; it is now unknown when IMF will be replaced. Accordingly, IRS will face mounting challenges in continuing to rely on a system that has software written in an archaic language requiring specialized skills that are increasingly difficult to find.

Regarding all six of the suspended programs, IRS developed modernization plans to varying degrees, as shown in table 3. If and when these programs resume, it will be important to update the applicable plans to reflect changes in key areas such as schedule, milestones, scope, and cost.

In addition to the 21 modernization initiatives whose plans we reviewed, IRS also initially planned to implement activities for five additional modernization initiatives between fiscal year 2022 and fiscal year 2026. However, IRS did not have modernization plans for these initiatives as of August 2022. According to officials, these initiatives are future efforts that currently have no proposed start dates. Table 4 identifies these five initiatives and a description of each.

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<sup>42</sup>[GAO-22-104387](#).

**Table 4: Internal Revenue Service’s (IRS) Future Modernization Initiatives and Descriptions**

Modernization initiative	Description
Artificial Intelligence / Machine Learning	This initiative is expected to enhance taxpayer service, automate repetitive tasks, optimize operations, and create predictive models and algorithms to analyze data more efficiently. IRS plans to develop of a cloud-based Artificial Intelligence / Machine Learning Platform that will offer a collection of services to enable both design and delivery of artificial intelligence into business applications and potentially support enterprise governance of distributed enterprise artificial intelligence activity.
Business Master File Modernization	The modernization of the Business Master File is expected to streamline access to business taxpayer data, improve business taxpayer analytics, provide the IRS with greater flexibility to respond to legislative tax changes, reduce overall maintenance costs, and decrease legacy technology footprint.
Direct e-File	This initiative is expected to provide taxpayers a free, online, and secure tax preparation and filing capability. This initiative is also expected to provide tax preparation assistance through different options such as fillable forms or pre-filled forms, and for-pay individual tax preparation products.
Generalized Mainline Framework Modernization	This initiative is expected to be modernized to be agile, flexible, scalable, and capable of supporting real-time tax processing and enable taxpayers to update their tax records and tax filing information in near real-time and understand the status of a return as it is processed. It is also expected to increase the average speed at which refunds are delivered to taxpayers who have submitted non-problematic returns.
Integrated Data Retrieval System Retirement	This initiative is expected to eliminate millions of lines of legacy code by modernizing the Integrated Data Retrieval System to act as a central hub for case management, account management, and customer management functions. The modernized solution will integrate seamlessly with other systems such as Enterprise Case Management, Customer Account Data Engine 2 (CADE 2), and the Enterprise Data Platform to enable a more digitally forward experience for customer service representatives and others who require access to case information.

Source: GAO analysis of Internal Revenue Service documentation. | GAO-23-104719

## IRS Has Identified the Cost, Schedule, and Expected Benefits for Its 21 IT Modernization Initiatives

IRS has identified costs, schedules, and expected benefits for its 21 IT modernization initiatives. Table 5 identifies the actual costs to date, actual start date, planned completion date, and expected benefits for the 15 ongoing modernization initiatives. IRS has been developing its initiatives incrementally and the planned completion dates are for the increment underway as of September 2022.

**Table 5: Summary of Internal Revenue Service’s (IRS) Reported Costs, Schedule, and Expected Benefits for Its Ongoing Modernization Initiatives, as of September 2022**

<b>Program name</b>	<b>Modernization actual cost through September 2022 (in millions)</b>	<b>Actual start date</b>	<b>Planned completion date</b>	<b>Expected benefits</b>
Cloud Execution	\$47.8	December 2018	December 30, 2022	Improve “time to market” agility, increase operational efficiency and resilience, increase innovation, and enhance or maintain security posture by migrating workloads to cloud platforms and services.
Customer Account Data Engine (CADE) 2 Transition State 2	\$1,670.94	December 2010	March 29, 2024	Modernize the taxpayer account processing environment and develop an integrated, near real-time processing environment to support tax returns, information returns, payments, and other transactions.
Digitalization	\$4.30	February 2021	September 30, 2024	Enhance electronic files; simplify and streamline the intake of paper forms and correspondence through the integration of scanned data and content management systems; and improve processing of taxpayer paper submissions and create efficiencies from not having to manually process, transcribe, and store documents.
Enterprise Case Management	\$369.03	October 2015	September 3, 2024	Provide an IRS-wide solution for streamlining case and workload management processes; digitize case information; automate work selection; and improve resource alignment.
Enterprise Data Platform	\$15.51	July 2021	December 31, 2022	Provide connected data by utilizing enterprise standard data transformations; retire data silos and duplicates by bringing enterprise data to a single access point available to all data consumers; increase data value by converting from system data to IRS domain data; derive intelligence from data to support the IRS mission by applying machine learning to IRS data; and treat data as a product that evolves through consumer feedback.
Identify & Access Management	\$117.53	October 2018	April 30, 2024	Prevent malicious or unintended access and disclosure of taxpayer and other sensitive data using a common platform for secure authorization and authentication services and encrypting sensitive data.
Information Returns Modernization	\$65.4	December 2020	January 1, 2023	Provide a modern intake database and applications to allow for improved document matching and improve intake consistency.

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Program name	Modernization actual cost through September 2022 (in millions)	Actual start date	Planned completion date	Expected benefits
Information Technology Service Management	\$40.21	October 2021	July 31, 2023	Implement a modernized platform that includes the ability to perform analytics, support critical system availability and reliability, improve delivery of new products and services to customers, and reduce productivity disruptions.
Live Assistance	\$25.35	September 2018	June 30, 2023	Provide taxpayers with customer call-back, engage a redesigned customer voice portal, and enjoy improved identity verification. Future live assistance enhancements are expected to broaden service channels to include live text chat, virtual assistant capabilities, and video chat assistance.
Network Expansion	\$13.10	May 2022	December 29, 2023	Increase the bandwidth across IRS to ensure the availability of network and cloud technologies to accommodate capacity surges due to an increased workforce, new technology demands, and aging infrastructure.
Secure Access Digital Identity	\$20.33	October 2021	June 30, 2023	Improve the user experience by empowering taxpayers to engage online with the IRS by providing a simpler and more secure front-door for secure registration, identity proofing, authentication, and single-sign-on.
Security Operations & Management	\$110.53	October 2018	September 30, 2024	Enhance the ability to secure taxpayer data and systems through full visibility of hardware and software on the agency's network, and enhance incident response and detection of internal threats to data and systems.
Taxpayer Accessibility	\$2.54	October 2021	September 30, 2023	Implement technology enhancements that provide taxpayers with equal access to information, services, and documents through their desired media formats, such as a choice of multiple languages.
Vulnerability & Threat Management	\$100.12	December 2018	August 31, 2026	Enable IRS cybersecurity professionals to protect taxpayer data and systems, providing full visibility into endpoints and servers to monitor.
Web Applications	\$297.12	February 2015	June 30, 2024	Improve, in part, interactions and communications across taxpayers, employers, the IRS, and third parties by providing a broad range of self-service options, establishing secure information exchange options, and building internal capabilities.

Source: GAO analysis of Internal Revenue Service documentation. | GAO-23-104719

For the six programs that were recently suspended, table 6 identifies the actual costs to date, start date, planned or actual completion date at the time we reviewed them, and expected benefits. As previously noted,

planned completion dates for the suspended programs are now to be determined.

**Table 6: Summary of Internal Revenue Service’s (IRS) Reported Costs, Schedule, and Expected Benefits for Its Suspended Modernization Initiatives, as of September 2022**

Program name	Modernization actual cost through September 2022 (in millions)	Actual start date	Planned/actual completion date <sup>a</sup>	Expected benefits
Customer Account Data Engine 2 (CADE 2) Target State	\$17.82	October 2020	September 30, 2024	Allow direct visibility and access to taxpayer account details on a near real-time basis and furthers the overarching effort to retire the Individual Master File; and facilitate voluntary compliance and improve traceability of financial data from core accounting systems to IRS financial statements.
Enterprise Anomaly Detection / Return Review Program	\$1.77	July 2021	March 19, 2023	Provide the anomaly detection for the enterprise; provide a flexible and scalable system to support IRS’s enterprise approach to identify anomalies; support the data and analytical needs of both civil and criminal investigative employees; and support case selection and help maximize workload efficiency.
Enterprise Tax Calculator Service	\$0.11	January 2022	To be determined	Provide taxpayers with the same calculated result independent of how they choose to interact with the IRS.
Individual Master File Retirement Acceleration	\$7.84	December 2021	March 29, 2024	Allow for the modernization of individual taxpayer account information, providing digital options to address taxpayer needs and maintains the IRS digital footprint.
Robotics Process Automation / Intelligent Automation	\$8.3	December 2018	February 7, 2022	Allow for enhanced business process execution, speed, and accuracy through smart software designed to perform high-volume, repeatable tasks.
Workforce Infrastructure	\$3.69	October 2021	September 30, 2023	Provide a modernized and unified human capital experience that is expected to provide the IRS workforce with a single interface for operational support services; and consolidate processes and workflows to reduce redundancies and eliminate manual entry.

Source: GAO analysis of Internal Revenue Service documentation. | GAO-23-104719

<sup>a</sup>These dates may no longer be valid due to the suspensions resulting from the American Rescue Plan Act funding reallocation.

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## IRS Addressed Most of OMB's Cloud Computing Requirements

While IRS's cloud computing plans and efforts address most of OMB's security, procurement, and workforce requirements, shortfalls remain in fully addressing these. IRS does track some costs and has identified benefits for its cloud computing efforts.

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### IRS's Cloud Computing Efforts Fully Addressed Most OMB Requirements

In June 2019, OMB issued an update to its Federal Cloud Computing Strategy which aimed to accelerate federal agencies adoption of cloud-based solutions. This update, referred to as Cloud Smart,<sup>43</sup> includes 14 key strategic requirements for agencies to implement to help ensure successful cloud adoption and implementation.<sup>44</sup> The requirements are intended to bolster federal IT modernization efforts by improving the return on investment, providing enhanced security, and producing higher quality services for users. They are grouped into three primary areas:

- **Security.** Agencies should modernize their security policies to focus on risk-based decision making, automation, and moving protections closer to the data layer in addition to the network and physical infrastructure layers.
- **Procurement.** Agencies should improve their ability to purchase cloud solutions through repeatable practices and shared knowledge of acquisition principles and risk management practices.
- **Workforce.** Agencies should identify skill gaps, retrain current staff, and recruit key talent external and internal to the department for cybersecurity, acquisition, and cloud engineering.

As of October 2022, IRS had fully addressed 11 of the 14 key requirements, partially addressed one requirement, and had not addressed two requirements. Specifically, IRS fully addressed all of the four requirements in the area of security, three of the five in procurement,

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<sup>43</sup>Office of Management and Budget, *Federal Cloud Computing Strategy* (2019).

<sup>44</sup>[GAO-22-104070](#).

and four of the five in workforce. Table 7 summarizes IRS’s guidance and other documentation against OMB’s cloud requirements.

**Table 7: GAO Evaluation of Internal Revenue Service’s (IRS) Cloud Computing Efforts against the Office of Management and Budget’s (OMB) Key IT Cloud Requirements, as of October 2022**

Category	OMB requirement	Requirement description	GAO evaluation	Summary of assessment
Security	Implement identity, credential, and access management.	Agencies should implement modern identity, credential, and access management as an essential part of continuous data protection and awareness in cloud-based environments.	fully addressed	IRS’s December 2020 Cloud Target State Framework identifies identity and access management as an essential part of its cloud-based environment, which integrates cloud security and operations standards and processes. In addition, in its quarterly reports to Congress, IRS has reported that its new security initiative, Security Access Digital Identity, implements modern identity, credential, and access management ideology and is being used in its cloud-based environment.
Security	Use mature Agile development practices including development, security, and operations (DevSecOps). <sup>a</sup>	Agencies should utilize mature Agile development practices, including DevSecOps <sup>a</sup> (an iterative software development approach), in order to realize the security benefits of cloud infrastructure and scalability.	fully addressed	IRS’s March 2021 Cloud Strategy identifies cloud development through a DevSecOps pipeline as a key objective to build a rapid, secure, and highly automated cloud environment. In addition, IRS’s Cloud Target State Framework identifies DevSecOps as a core service in its cloud environment, which integrates cloud security and operations standards and processes. Further, IRS provided evidence of weekly meeting minutes that the DevOps Continuous Integration Continuous Delivery Pipeline Team participates in to discuss development operations. IRS also provided evidence of quarterly planning session the team holds to create and align priorities for DevOps and security.

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Category	OMB requirement	Requirement description	GAO evaluation	Summary of assessment
Security	Update business continuity and disaster recovery plans.	Agencies should update their business continuity and disaster recovery plans to include contingencies involving the sudden interruption or termination of service.	fully addressed	IRS's September 2021 Cloud Computing Security Policy states that the agency shall develop a contingency plan to address maintaining essential missions and business functions despite an information system disruption, compromise, or failure. Further, IRS's Information System Contingency Plan for Systems, dated April 2021, includes systems that manage the agencies cloud computing, and described contingencies involving the sudden interruption or termination of cloud services.
Security	Perform continuous monitoring.	Agencies should perform continuous monitoring to detect malicious activity and dedicate effort to improving systems governance.	fully addressed	IRS's September 2021 Cloud Computing Security Policy states that IRS and cloud service providers shall develop a continuous monitoring strategy and implement a continuous monitoring program that includes among other things malicious activity detection and ongoing efforts to improve system governance. In addition, IRS's Cloud Strategy has identified continuous monitoring and cloud governance as key objectives for cloud adoption. Further, according to IRS officials from the Architecture and Implementation office, IRS recently deployed a security system that detects behavioral anomalies and sends out an action for review. IRS provided evidence of the system performing continuous monitoring and detecting malicious activity.
Procurement	Ensure the agency's chief information officer oversees modernization.	The agency Chief Information Officer should oversee the modernization processes.	fully addressed	IRS provided modernization documentation that states the Chief Information Officer oversees the modernization for the agency. In addition, in our interactions with IRS, we have observed the Chief Information Officer carry out this responsibility.



Letter

Category	OMB requirement	Requirement description	GAO evaluation	Summary of assessment
Procurement	Iteratively improve agency policies and guidance.	Agencies will need to iteratively improve policies, technical guidance, and business requirements.	fully addressed	IRS's March 2021 Cloud Strategy is an update to its initial Cloud Strategy which was issued in December 2017. The updated strategy states that IRS will continue to annually review and update, as appropriate, its Cloud Strategy to ensure continued alignment with federal and department guidelines.
Procurement	Have cloud service-level agreement in place.	If a vendor deploys a cloud solution, agencies should ensure that a service level agreement be in place that provides the agency with continuous awareness of the confidentiality, integrity, and availability of its information. With commercial cloud service providers, agencies should granularly articulate roles and responsibilities, establish clear performance metrics, and implement remediation plans for non-compliance.	fully addressed	IRS's September 2021 Cloud Computing Security Policy requires that service level agreements be in place to provide the agency with continuous awareness of the confidentiality, integrity, and availability of information. This includes notifying IRS promptly if a cybersecurity incident occurred or is to occur. In addition, the policy requires IRS to establish roles and responsibilities, and performance metrics. Further, IRS provided an example of a service level agreement which identified continuous awareness of the confidentiality, integrity, and availability of the information; roles and responsibilities, performance metrics, and remediation plans.
Procurement	Standardize cloud contract service level agreements.	Agencies should standardize cloud contract service level agreements that will provide more effective, efficient, and secure cloud procurement outcomes for agencies.	partially addressed	IRS's September 2021 Cloud Computing Security Policy requires the enforcement of using the security requirement identified in the Federal Risk and Authorization Management Program (FedRAMP) for cloud computing and service level agreements. The policy also requires the use of FedRAMP developed documents and templates that include standard contract clauses. However, according to IRS officials from the Office of Enterprise Services, the agency does not currently have cloud contracts with standardized contract language. According to these officials, this is in part due to the need to have service level agreements remain flexible depending on the type of cloud service, such as Infrastructure as a Service or Software as a Service and what contractors propose for a solution.

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Category	OMB requirement	Requirement description	GAO evaluation	Summary of assessment
Procurement	Ensure continuous visibility in high value asset contracts.	Agencies must ensure that contracts impacting their high value assets, including those managed and operated in the cloud, include requirements that provide agencies with continuous visibility of the asset.	not addressed	IRS's September 2018 Asset Management Policy does not specifically refer to high value asset contracts nor does it specify that high value asset contracts include requirements for continuous visibility of the asset. Further, according to officials from the Offices of Strategy and Planning and Enterprise Services, the policy does not discuss high value assets because IRS does not have high value assets in the cloud or cloud contracts with high value asset requirements. However, according to officials from Strategy and Planning, the agency has been partially funded to begin cloud software asset management. The scope of the work is expected to include working with the high value asset team to address high value assets in the cloud. Thus, developing and implementing policy on high value asset contracts is key for IRS future work.
Workforce	Provide cloud-related training.	Agency IT staff should become familiar with Lean product management <sup>b</sup> , Agile development, continuous delivery, and automated infrastructure. Additionally, non-IT staff supporting privacy, security, and procurement should receive training in the multiple core disciplines outlined above.	fully addressed	IRS's June 2021 Cloud Workforce and Operating Delivery plan establishes training for IT and non-IT staff to become familiar with developing, continuous delivery, automating, and monitoring cloud systems. The plan also identified previous training with staff attendance.

Category	OMB requirement	Requirement description	GAO evaluation	Summary of assessment
Workforce	Plan for workforce development and training.	Agencies' cloud strategies and policies should also include a workforce development and planning component that tailors a transformation and training approach to that agency. In the event that an impact to the existing workforce has been identified, this approach should include a crosswalk of new skills and occupational categories with legacy occupational categories to foster clarity and ease of transition. Agencies should plan for ongoing education in this rapidly evolving field.	fully addressed	IRS's March 2021 Cloud Workforce Development plans identify three goals (1) the scope of the impacted workforce to target for training based on defined cloud roles and responsibilities, (2) the process for Associate Chief Information Officer stakeholders to identify and procure necessary training for their team/staff, (3) recommended options for training, including role/certification paths, hands-on courses, and self-paced alternatives. In addition, the plan identifies ongoing education, such as a cross-walk of new skills and occupational categories with legacy occupational categories to foster clarity and ease of transition for employees.
Workforce	Conduct skills gap analysis for future skill and position requirements for cloud-based services, and where appropriate, equip existing staff with the additional skills and knowledge needed.	Agency chief information officers, chief human capital officers and senior agency officials for privacy should collaboratively conduct a skills gap analysis that maps current IT workforce resources to future skill and position requirements. Agencies should identify potential skills gaps that may emerge as a result of a transition to cloud-based services, and, where needed, equip their existing staff with additional skills and knowledge to keep up with the ever-expanding list of technology options available to procure and deploy.	fully addressed	IRS's March 2021 Cloud Strategy identifies goals for workforce impacts and training in support of cloud capabilities. In addition, IRS provided its June 2020 Cloud Functional Needs Assessment, which maps current IT workforce resources to future skill and position requirements. The assessment identified skill gaps, future cloud functional roles, and steps for IRS to take to equip its workforce for its future cloud environment.

Category	OMB requirement	Requirement description	GAO evaluation	Summary of assessment
Workforce	Execute communication plans regarding changes affecting employees.	Agencies should execute communication plans that help employees understand the changes that will occur.	fully addressed	IRS's March 2021 Cloud Strategy calls for the development of communication plans to promote cloud awareness. In addition, IRS provided its Cloud Management Office Communications Program Plan, dated May 2022, which identified the agency's plan to streamline, support and communicate its cloud program updates. The plan also identified how IRS plans to communicate to employees on any changes regarding cloud.
Workforce	Conduct regular evaluations of customer experience and user needs.	Agencies should conduct regular evaluations of customer experience and user needs to ensure that their solutions successfully foster efficiency, accessibility, and privacy.	not addressed	According to IRS's Cloud Management Office, IRS does not conduct evaluations of customer experience and user needs and there are no current or future plans to do so.

Legend:

- = Fully addressed: IRS provided evidence that it completely addressed all elements of the requirements in policy and implementation.
- ◐ = Partially addressed: IRS provided evidence that it partially addressed the elements of the requirements in policy or implementation.
- = Not addressed: IRS did not provide any evidence that it addressed the requirement in policy or implementation.

Source: GAO analysis of the Internal Revenue Service documentation and Office of Management and Budget's June 2019 Federal Cloud Computing Strategy. | GAO-23-104719

<sup>a</sup>Agile development is a type of incremental development, which calls for the rapid delivery of software in small, short increments.

<sup>b</sup>Lean and Agile are related philosophies. Lean can be characterized as related to Agile because the Lean practice and principles can be mapped to Agile methods.

Until IRS standardizes cloud contract service level agreements, ensures continuous visibility into high value asset contracts, and conducts evaluations of customer experience and user needs, it will have less assurance that it is adopting cloud solutions that efficiently and effectively help it meet its mission and customer needs, and protect sensitive taxpayer information. This will increase the likelihood that the agency will face challenges while developing, implementing, and operating its IT systems within the cloud environment.

## IRS Has Identified Some Costs and Benefits for its Cloud Computing Efforts

As of June 2022, IRS reported that it had 63 applications that were operating and using cloud services: 28 Infrastructure as a Service, 13 Platform as a Service, and 22 Software as a Service cloud services. Twenty-one of the applications are associated with the Integrated

Enterprise Portal's Public User Portal, the portal through which the public accesses the IRS's website and interacts with the agency ([www.irs.gov](http://www.irs.gov)). Further, IRS reported it plans to deploy 12 applications to cloud services in fiscal year 2022, and 20 in fiscal year 2023.

### IRS Tracks Some Costs of Cloud Computing Efforts

As previously stated, IRS reported it has begun to implement the TBM framework for tracking costs, including cloud-related spending. According to the TBM Council's Taxonomy (referenced in OMB's guidance),<sup>45</sup> IT services purchased from cloud service providers (including Infrastructure as a Service, Platform as a Service, and Software as a Service) should be categorized under the "outside services" IT cost pool.

IRS officials stated that the agency is not yet using the version of the TBM framework that would allow it to capture costs for outside services. They also acknowledged that the current categories of cloud services and cloud execution may not fully capture all cloud computing costs. In the meantime, officials are estimating actual costs. IRS officials expected, that they would better capture these costs as the agency continues to mature in the use of the TBM framework and make use of the Department of the Treasury's tool for reporting costs mentioned earlier in the report.

While IRS did not have actual costs for outside services that would capture cloud computing costs; it estimated spending the following for cloud services and cloud execution:<sup>46</sup>

- **Cloud services.** IRS estimated spending \$82 million for fiscal year 2021. Specifically, the agency estimated it spent \$41 million on Infrastructure as a Service, \$3 million on Platform as a Service, and \$38 million on Software as a Service. For fiscal year 2022, IRS reported that it planned to spend \$111 million on cloud services. Specifically, the agency planned to spend \$51 million on Infrastructure as a Service, \$17 million on Platform as a Service, and \$43 million on Software as a Service.

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<sup>45</sup>Technology Business Management Council, *TBM Taxonomy, Version 4.0*. Copyright © 2020 Technology Business Management Council.

<sup>46</sup>IRS's cloud execution program is intended to enable IRS to deliver secure, agile, and efficient cloud service offerings to the enterprise and the taxpayer.

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- **Cloud execution program costs.** IRS reported that it spent about \$9.4 million for fiscal year 2021 and, as of July 2022, estimated that it would spend \$28 million for fiscal year 2022.<sup>47</sup>

Continued maturation of the TBM process, consistent with OMB guidance, will assist IRS in developing complete and accurate cloud computing costs it needs to better understand its IT spending and inform decision making.

### IRS Has Identified Potential Benefits for its Cloud Computing Efforts

OMB's Federal Cloud Computing Strategy instructs federal agencies to consider how they are using their current resources to maximize value. Consistent with this, in December 2021, IRS conducted a business value analysis to identify the benefits for cloud migration. The analysis evaluated the 55 applications scheduled to be migrated to the cloud in fiscal year 2022. The analysis identified that 50, or 91 percent of the 55 applications would provide moderate to high value overall when benefits when migrated to the cloud. IRS determined that 23 of the 55 applications would be migrated to the cloud. IRS's analysis used three categories of criteria in the evaluation: financial benefits, business benefits, and enterprise risk to the agency. According to the assessment, these benefits included:

- immediate cost avoidance,
- reduction in future cost,
- advancement towards IRS's future cloud environment, and
- reductions in risk.

In addition, the benefits were ranked low, moderate, and high in providing business value for migrating to the cloud.

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## Conclusions

IRS depends extensively on IT to carry out its mission and responsibilities, and in doing so, utilizes a significant number of outdated or aging applications, software, and hardware assets. Reliance on these

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<sup>47</sup>The actual spending for fiscal year 2021 is from IRS's Fiscal Year 2023 Congressional Budget Justification.

legacy IT assets can contribute to security risks, unmet mission needs, staffing issues, and increased costs. The agency tracks various categories and sub-categories of IT costs consistent with OMB guidance. Further, it has efforts underway that should provide additional insights into legacy IT costs.

As part of its efforts to modernize its IT enterprise, IRS has developed modernization plans for 21 initiatives, including nine which are associated with legacy systems. However, the plans for six of the nine initiatives did not address a key element—the disposition of legacy systems. While officials stated they would address this element, they did not provide time frames for doing so. Establishing time frames for completing the disposition of legacy systems would increase IRS’s accountability for performing this activity, which in turn could lead to greater savings and efficiency. In addition, IRS’s recent suspension of six of the initiatives has now resulted in these having unknown expected completion dates. This is particularly concerning for two suspended initiatives associated with the replacement and retirement of the 60-year old IMF given that the agency will face mounting challenges in continuing to rely on a system that has software written in an archaic language requiring specialized skills that are increasingly difficult to find.

In increasingly turning to cloud computing, the agency has addressed most aspects of OMB’s cloud computing guidance. However, IRS has no plans to standardize cloud contract service level agreements or conduct evaluations of customer experience and user needs, which would help ensure that their solutions successfully foster efficiency, accessibility, and privacy. Further, the agency has not developed policy nor ensured contracts impacting high value assets in the cloud include continuous visibility. Fully addressing all of OMB’s cloud computing requirements and capturing complete cloud computing costs can provide IRS greater assurance that it is adopting cloud solutions that efficiently and effectively help to meet its mission needs and protect sensitive taxpayer information.

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## Recommendations for Executive Action

We are making the following nine recommendations to IRS:

The Commissioner of the IRS should ensure that IRS establishes time frames for addressing the disposition of legacy systems for the Enterprise

Case Management modernization initiative and follow through to document a complete modernization plan. (Recommendation 1)

The Commissioner of the IRS should ensure that IRS establishes time frames for addressing the disposition of legacy systems for the Enterprise Data Platform modernization initiative and follow through to document a complete modernization plan. (Recommendation 2)

The Commissioner of the IRS should ensure that IRS establishes time frames for addressing the disposition of legacy systems for the Information Returns Modernization initiative and follow through to document a complete modernization plan. (Recommendation 3)

The Commissioner of the IRS should ensure that IRS establishes time frames for addressing the disposition of legacy systems for the Information Technology Service Management modernization initiative and follow through to document a complete modernization plan. (Recommendation 4)

The Commissioner of the IRS should ensure that IRS establishes time frames for addressing the disposition of legacy systems for the Enterprise Anomaly Detection / Enterprise Case Selection modernization initiative and follow through to document a complete modernization plan when it resumes. (Recommendation 5)

The Commissioner of the IRS should ensure that IRS establishes time frames for addressing the disposition of legacy systems for the Workforce Infrastructure modernization initiative and follow through to document a complete modernization plan when it resumes. (Recommendation 6)

The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with standardizing cloud contract service level agreements that will provide more effective, efficient, and secure cloud procurement outcomes for agencies. (Recommendation 7)

The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with developing and implementing policy to contracts impacting high value assets that are managed and operated in the cloud, including requirements that provide continuous visibility of the asset. (Recommendation 8)



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The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with conducting regular evaluations of customer experiences and user needs to ensure that cloud solutions foster efficiency, accessibility, and privacy. (Recommendation 9)

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## Agency Comments and Our Evaluation

We received written comments on a draft of this report from IRS. In its comments, which are reproduced in appendix II, IRS agreed with all 9 of our recommendations.

In its comments, IRS also described efforts underway and plans to develop complete IT modernization plans and fully address OMB's cloud computing requirements. The agency also stated that it planned to accelerate the replacement of the remainder of the IMF with funding provided by the Inflation Reduction Act. This planned acceleration, if implemented effectively, represents progress in ending IRS's reliance on this legacy system and its associated challenges.

The agency also requested that we refer to the number of software products instead of number of instances to "more accurately portray the currency" of the software in our description of the legacy IT environment. Specifically, IRS stated that, as of September 2022, 40 out of 3,505 software products in use at the IRS (about one percent of the most frequently used Commercial Off-the-Shelf products at the IRS) were considered legacy products and that 13 products were four or more versions behind the current version. While IRS did not provide us the number of products during our review, we agree that it provides additional context and have added this information to the report. However, the 40 legacy software products represent 1,111,419 of IRS's total 4,821,033, or 23 percent of software instances. Consequently, we continue to believe that the number of instances reflects the prevalence of the legacy software and therefore did not remove that information from the report.

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As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 26 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees, Commissioner of IRS, and other interested parties. In addition, this report will be available at no charge on the GAO website at <https://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (214) 777-5719 or [hinchmand@gao.gov](mailto:hinchmand@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix III.

Sincerely yours,

A handwritten signature in black ink that reads "David B Hinchman". The signature is written in a cursive style with a long, sweeping underline.

David B. Hinchman  
Acting Director, Information Technology and Cybersecurity

## Appendix I: Objectives, Scope and Methodology

Our objectives were to (1) describe the Internal Revenue Service’s (IRS) legacy IT systems environment and its efforts to identify associated costs; (2) determine to what extent IRS has defined its plans, including cost, schedule, and benefits for modernizing or replacing and retiring its legacy IT systems; and (3) determine to what extent IRS’s current efforts and plans to move to cloud services are consistent with Office of Management and Budget guidance.

For our first objective, we obtained and reviewed IRS’s definition of a legacy system for consistency with the definition in the provisions commonly referred to as the Modernizing Government Technology Act and prior GAO work.<sup>1</sup> We then identified what IRS considered to be legacy for its IT systems (applications, software, and hardware), the three categories of assets officials told us make up the agency’s IT environment. First, we obtained the list of applications maintained in IRS’s as-built architecture, and analyzed for the age and programming language.<sup>2</sup> Second, we requested, analyzed, and summarized a list of the 20 most frequently used “aged software.” We requested the information for the software running on IRS’s servers and workstations, referred to by IRS as tier 2 and tier 3 software, respectively.<sup>3</sup> We selected these categories of software because they represent the software running on the majority of IRS’s hardware and are the focus of IRS’s IT footprint reduction strategy. Finally, we obtained a detailed list of IRS’s aged hardware assets. We analyzed the list to identify the number and

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<sup>1</sup>National Defense Authorization Act for Fiscal Year 2018, Pub. L. No. 115-91, Div. A, Title X, Subtitle G, § 1076(8), 131 Stat. 1283, 1587 (2017); GAO, *Information Technology: Agencies Need to Develop Modernization Plans for Critical Legacy Systems*, [GAO-19-471](#) (Washington, D.C.: June 11, 2019).

<sup>2</sup>An architecture is a blueprint that describes the current and desired states of an organization or functional area in both logical and technical terms, as well as a plan for transitioning between the two states. The as-built architecture represents IRS’s current state.

<sup>3</sup>IRS provided tier 2 aged software data in August 2022 and tier 3 aged software data in September 2022.

percentage of legacy assets for each of the 45 hardware categories that IRS uses to track these assets.

We assessed the reliability of the application, software, and hardware data, by (1) corroborating it with related agency documentation, (2) reviewing the data for anomalies, and (3) interviewing knowledgeable officials on the data and the processes used to generate and maintain the data. We also followed up with these officials to discuss any anomalies we found in the data. We determined the data to be sufficiently reliable for our purposes.

To determine the extent to which IRS has identified how much it spends to operate and maintain its legacy IT systems, we reviewed the agency's expenditure plans for fiscal years 2020 and 2021. We also interviewed IRS officials from IRS's Financial Management Services group to determine whether and how the agency specifically tracks the costs for its legacy systems.

For the second objective, we obtained and reviewed IRS's list of business capabilities and applications to be modernized and retired through fiscal year 2026 from IRS's Enterprise Architecture Roadmap. The Roadmap establishes a timeline for the IT activities IRS intends to perform in support of the agency's long-term goals. We identified 24 initiatives with which the capabilities and applications were associated and added two more initiatives we identified in the list of initiatives for which IRS provides quarterly reports to Congress. This resulted in a total of 26 initiatives for which IRS should have detailed modernization plans. We corroborated the list of 26 initiatives with knowledgeable officials who confirmed that 21 were underway and five had not yet started.

We requested the modernization plans for the 21 initiatives underway. For initiatives that did not have a plan, we asked IRS to provide estimated timeframes for completing a plan. We analyzed the modernization plans that IRS provided to determine whether they included the key elements of a modernization plan identified in a prior report: (1) milestones to complete the modernization, (2) a description of the work necessary to modernize the system, and (3) details regarding the disposition of the legacy system.<sup>4</sup> Finally, we reviewed the modernization plans, the IRS's quarterly reports to Congress on the status of its modernization efforts,

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<sup>4</sup>GAO, *Information Technology: Agencies Need to Develop Modernization Plans for Critical Legacy Systems*, [GAO-19-471](#). (Washington, D.C.: June 11, 2019).

and other project documentation to identify IRS's estimated modernization and replacement costs, schedule, and benefits.

For our third objective, we obtained and reviewed cloud computing documents from IRS, including the cloud inventory report, cloud execution plan, and cloud roadmap. We reviewed these documents to understand the agency's overall strategy for moving to cloud services, ongoing and planned cloud adoption efforts and the associated costs and benefits. Further, we assessed IRS's cloud strategy and efforts against 14 requirements we identified in OMB's Federal Cloud Computing Strategy in prior work.<sup>5</sup> We assessed the requirement as fully addressed if IRS provided evidence that it completely addressed all elements of the requirements in policy and implementation. We assessed the requirement as partially addressed if IRS provided evidence that it partially addressed the elements of the requirements in policy or implementation.

Lastly, we assessed the requirement as not addressed if IRS did not provide any evidence that it addressed the requirement in policy or implementation. For any requirements that IRS did not fully address, we interviewed relevant officials to determine the causes as well as IRS's actions or plans to address them. In addition, we asked IRS to provide us how much it spent and plans to spend on cloud services for fiscal years 2021 and 2022. We also identified how much IRS spent on cloud execution for fiscal year 2021 and 2022 by reviewing IRS expenditure plans and other relevant cost documentation. We interviewed IRS officials to verify these costs.

We conducted this performance audit from May 2021 to January 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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<sup>5</sup>GAO, *Cloud Computing: DOD Needs to Improve Workforce Planning and Application Rationalization Efforts*, [GAO-22-104070](#) (Washington, D.C.: June 29, 2022).

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# Appendix II: Comments from the Department of the Treasury Internal Revenue Service

**Appendix II: Comments from the Department  
of the Treasury Internal Revenue Service**



DEPUTY COMMISSIONER

**DEPARTMENT OF THE TREASURY**  
INTERNAL REVENUE SERVICE  
WASHINGTON, DC 20224

Mr. David B. Hinchman  
Director, Information Technology and Cybersecurity  
U.S. Government Accountability Office  
441 G Street, N.W.  
Washington, DC 20548

Dear Mr. Hinchman:

We reviewed the U. S. Government Accountability Office (GAO) draft report entitled Information Technology: IRS Needs to Complete Modernization Plans and Fully Address Cloud Computing Requirements (GAO-23-104719).

**GAO's Draft Report is Mostly Correct**

The draft report is a generally accurate description of the agency's operating environment, and we appreciate the opportunity to provide further clarification and comments. The IRS is committed to delivering complete modernization plans, fully addressing cloud computing requirements established by the Office of Management and Budget (OMB) and continuing to address prior year recommendations associated with legacy technology.<sup>1</sup>

On November 18, 2022, we requested GAO update the final report to more accurately portray the currency of the agency's most frequently used Commercial Off-The-Shelf (COTS) software products. We recommended GAO refer to the count of software products, not software instances. As of September 2022, 40 out of 3,505 software products in use at the IRS (about one percent of the most frequently used COTS products at the IRS) are considered legacy products. 13 products are four or more versions behind the current version. We provided GAO updated information for Table 1 and appreciate the opportunity to offer a correction.

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<sup>1</sup> For example, in a June 2018 report on IRS IT operations (GAO-18-298), which included a summary of risks associated with selected legacy systems, GAO recommended 21 actions to address significant risks to tax processing. As of November 2022, the IRS has completed corrective actions for 20 of the 21 recommendations and we remain on track to address the final recommendation by January 2023. In 2020, TIGTA also assessed the IRS's efforts to identify and replace its legacy systems; we have completed actions to address the recommendations to which the IRS agreed.

### **Modernizing the Individual Master File**

The IRS fully recognizes the importance of replacing the Individual Master File (IMF), and we have taken a series of steps to address the challenges associated with the system. In 2021, we delivered a comprehensive IMF Retirement Plan that underwent an independent validation and verification to assess the plan's feasibility and assumptions, and despite funding challenges over the last decade, we have progressed incrementally. The IRS used available resources in fiscal year (FY) 2022 to continue funding the Customer Account Data Engine (CADE) 2 Transition State 2 program – a key step on the way to replacing the IMF. As of September 2022, we have re-engineered and converted to a modern programming language the most complex aspects of processing individual tax returns, and we plan to accelerate the replacement of the remainder of the IMF with funding provided by the Inflation Reduction Act (IRA).

### **Developing Complete Modernization Plans**

The IRS Integrated Modernization Business Plan released in FY 2019 has guided our technology modernization work since that time, and we have largely delivered those modernization capabilities our funding supported on schedule and within budget. The plan provides a six-year strategy to modernize IRS information technology systems and build critical infrastructure needed for a fully digital tax system that provides on-demand customer service options. Although limited funding has forced us to rescope, replan, and delay certain modernization projects, from FY 2019 through FY 2022, we delivered 147 modernization capabilities across all four components of the plan: improving the taxpayer experience, core services and enforcement, IRS operations and cybersecurity.

For added perspective, over the last decade the IRS has delivered significant technology improvements. Today, the IRS has in place:

- The ability to electronically file individual returns, including amended returns, and most related schedules;
- Daily processing to ensure that most refunds are paid in 21 days or less;
- Innovative digital services like the Documentation Upload Tool;
- A new feature that allows taxpayers to check the status of their refund for the current tax year and for two previous tax years through the Where's My Refund? online tool;
- Two world-class data centers with dual power for seamless disaster recovery;
- Cloud-based technology for storage, data analytics and case management functions; and
- A highly effective cybersecurity program to defend and protect high value assets.



These accomplishments have propelled the IRS forward, and we are on track to do more. With passage of IRA in August 2022, we plan to restart and, in some cases, accelerate the programs that we paused in FY 2022 due to funding reallocations. As directed by the Treasury Secretary, the IRS anticipates completing a detailed plan by February 2023 on the long-term goal of transforming taxpayer service, enforcement and technology with the IRA funding congress made available through the end of FY 2031.

We do not anticipate this detailed plan will include time frames for addressing the disposition of legacy systems for all modernization programs; however, we have processes in place to ensure that all modernization plans address the disposition of the associated legacy systems. For example, in January 2022, the IRS Chief Information Officer implemented the IT decommissioning policy and provided relevant guidance to require the identification and oversight of the decommissioning of associated legacy products, systems and services. This policy applies to the programs included in this report. In effect, all programs have developed or are developing a complete modernization plan that includes the identification of the products, systems and/or services that will be decommissioned with the deployment of any modernized solution.

We agree with GAO's recommendation to establish time frames for addressing the disposition of legacy systems for the modernization initiatives included in this report and will follow through to document a complete modernization plan.

#### **Fully Addressing Cloud Computing Requirements**

As GAO noted in September 2022, federal agencies must overcome challenges to fully realize the benefits of transitioning to cloud services, including ensuring cybersecurity, procuring cloud services, maintaining a skilled workforce, and tracking costs and savings.<sup>2</sup> The 2019 Federal Cloud Computing Strategy (Cloud Smart) continues to guide our efforts. Although none of the agency's high value assets are currently hosted in the cloud, we continue to adhere to OMB guidance for all applications and systems that move to the cloud. We agree to fully address cloud computing requirements as they apply to the IRS IT operating environment.

- **Ensuring cybersecurity:** In 2011, OMB established the Federal Risk and Authorization Management Program (FedRAMP) to provide a standardized approach for selecting and authorizing the use of cloud services that meet federal security requirements. All cloud services used at the IRS are following the FedRAMP approach, which is an important safeguard for ensuring compliance with OMB requirements on security, privacy and accessibility.

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<sup>2</sup> GAO-22-106195

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**Appendix II: Comments from the Department  
of the Treasury Internal Revenue Service**

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- **Tracking costs and savings:** The IRS tracks and accounts for all IT costs and spending; however, like many federal agencies, systematically tracking and reporting on spending and savings specific to cloud technology has been challenging due to several factors. Although OMB guidance does not currently require federal agencies to explicitly report savings and/or cost avoidance from cloud implementations, we are continuing to explore methods for establishing a repeatable mechanism to better track cloud savings and avoidances. We are continuing to explore methods for establishing a repeatable mechanism to better track cloud savings and avoidances. We anticipate that we can gain additional insight through implementation of the Technology Business Management discipline, which will enable the IRS to better connect business value with technology investments.
- **Evaluating the customer experience:** In compliance with OMB Circular A-11, Capital Programming Guide, the IRS carefully reviews and manages major IT investments that have been in operations and maintenance for at least 12 months as part of the Operational Analysis evaluation process. As part of this annual evaluation, we demonstrate that the existing investment is meeting the needs of the agency, continuing to support the organization's strategic goals and delivering expected value, and we collect customer feedback. As the IRS uses cloud services for various technology deployments that meet the criteria for undergoing an Operational Analysis, we will continue to collect customer feedback and adjust accordingly. This feedback helps the IRS ensure we are meeting stated objectives, in combination with the agency's external-facing customer satisfaction surveys and ongoing analysis of the user experience for major digital services like the IRS.gov website.

We continue to prioritize and focus on the mission critical infrastructure and services the public needs to comply with tax laws. Over time, the IRS has delivered a variety of modernized services to the public while maintaining legacy systems that contribute to the rising cost of operations and maintenance; this trajectory remains a significant risk that the IRS is carefully managing and addressing in collaboration with GAO and other oversight entities.

We also recognize that to achieve the agency's strategic goals, we must complete significant and highly complex technology transformations that reduce the number of legacy assets. As this response illustrates, we have taken a series of actions to address these important issues. The systems we use for mission critical functions like return processing operate on current, state-of-the-art hardware. This means that IRS systems,

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**Appendix II: Comments from the Department  
of the Treasury Internal Revenue Service**


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even those that use older programming languages, remain secure and stable. We will continue to reduce and remove legacy technologies in use at the IRS today.

Enclosed is a response to your recommendations. If you have any questions, please contact me, or your staff may contact Nancy A. Sieger, chief information officer, at 202-317-5000.

Sincerely,

**Jeffrey J.  
Tribiano**

 Digitally signed by Jeffrey J.  
Tribiano  
Date: 2022.12.07 19:08:28 -05'00'

Jeffrey J. Tribiano  
Deputy Commissioner for Operations Support

Enclosure

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**Appendix II: Comments from the Department  
of the Treasury Internal Revenue Service**

Enclosure

**Recommendations for Executive Action (GAO 23-104719)**

**Recommendation 1**

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Enterprise Case Management modernization initiative and follow through to document a complete modernization plan.

**Comment**

We agree with this recommendation.

**Recommendation 2**

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Enterprise Data Platform modernization initiative and follow through to document a complete modernization plan.

**Comment**

We agree with this recommendation.

**Recommendation 3**

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Information Returns Modernization initiative and follow through to document a complete modernization plan.

**Comment**

We agree with this recommendation.

**Recommendation 4**

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Information Technology Service Management modernization initiative and follow through to document a complete modernization plan.

**Comment**

We agree with this recommendation.

**Recommendation 5**

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Enterprise Anomaly Detection / Enterprise Case Selection modernization initiative and follow through to document a complete modernization plan when it resumes.

**Comment**

We agree with this recommendation.

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**Appendix II: Comments from the Department  
of the Treasury Internal Revenue Service**

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**Recommendation 6**

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Workforce Infrastructure modernization initiative and follow through to document a complete modernization plan when it resumes.

**Comment**

We agree with this recommendation.

**Recommendation 7**

The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with standardizing cloud contract service level agreements that will provide more effective, efficient, and secure cloud procurement outcomes for agencies.

**Comment**

We agree with this recommendation.

**Recommendation 8**

The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with developing and implementing policy to contracts impacting high value assets that are managed and operated in the cloud, including requirements that provide continuous visibility of the asset.

**Comment**

We agree with this recommendation.

**Recommendation 9**

The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with conducting regular evaluations of customer experiences and user needs to ensure that cloud solutions foster efficiency, accessibility, and privacy.

**Comment**

We agree with this recommendation.

# Accessible Text for Appendix II: Comments from the Department of the Treasury Internal Revenue Service

Mr. David B. Hinchman  
Director, Information Technology and Cybersecurity  
U.S. Government Accountability Office  
441 G Street, N.W.  
Washington, DC 20548

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On November 18, 2022, we requested GAO update the final report to more accurately portray the currency of the agency's most frequently used Commercial Off-The-Shelf (COTS) software products. We recommended GAO refer to the count of software products, not software instances. As of September 2022, 40 out of 3,505 software products in use at the IRS (about one percent of the most frequently used COTS products at the IRS) are considered legacy products. 13 products are four or

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<sup>1</sup> For example, in a June 2018 report on IRS IT operations (GAO-18-298), which included a summary of risks associated with selected legacy systems, GAO recommended 21 actions to address significant risks to tax processing. As of November 2022, the IRS has completed corrective actions for 20 of the 21 recommendations and we remain on track to address the final recommendation by January 2023. In 2020, TIGTA also assessed the IRS's efforts to identify and replace its legacy systems; we have completed actions to address the recommendations to which the IRS agreed.

more versions behind the current version. We provided GAO updated information for Table 1 and appreciate the opportunity to offer a correction.

### **Modernizing the Individual Master File**

The IRS fully recognizes the importance of replacing the Individual Master File (IMF), and we have taken a series of steps to address the challenges associated with the system. In 2021, we delivered a comprehensive IMF Retirement Plan that underwent an independent validation and verification to assess the plan's feasibility and assumptions, and despite funding challenges over the last decade, we have progressed incrementally. The IRS used available resources in fiscal year (FY) 2022 to continue funding the Customer Account Data Engine (CADE) 2 Transition State 2 program – a key step on the way to replacing the IMF. As of September 2022, we have re-engineered and converted to a modern programming language the most complex aspects of processing individual tax returns, and we plan to accelerate the replacement of the remainder of the IMF with funding provided by the Inflation Reduction Act (IRA).

### **Developing Complete Modernization Plans**

The IRS Integrated Modernization Business Plan released in FY 2019 has guided our technology modernization work since that time, and we have largely delivered those modernization capabilities our funding supported on schedule and within budget. The plan provides a six-year strategy to modernize IRS information technology systems and build critical infrastructure needed for a fully digital tax system that provides on-demand customer service options. Although limited funding has forced us to rescope, replan, and delay certain modernization projects, from FY 2019 through FY 2022, we delivered 147 modernization capabilities across all four components of the plan: improving the taxpayer experience, core services and enforcement, IRS operations and cybersecurity.

For added perspective, over the last decade the IRS has delivered significant technology improvements. Today, the IRS has in place:

- The ability to electronically file individual returns, including amended returns, and most related schedules;
- Daily processing to ensure that most refunds are paid in 21 days or less;
- Innovative digital services like the Documentation Upload Tool;
- A new feature that allows taxpayers to check the status of their refund for the current tax year and for two previous tax years through the Where's My Refund? online tool;

- Two world-class data centers with dual power for seamless disaster recovery;
- Cloud-based technology for storage, data analytics and case management functions; and
- A highly effective cybersecurity program to defend and protect high value assets.

These accomplishments have propelled the IRS forward, and we are on track to do more. With passage of IRA in August 2022, we plan to restart and, in some cases, accelerate the programs that we paused in FY 2022 due to funding reallocations. As directed by the Treasury Secretary, the IRS anticipates completing a detailed plan by February 2023 on the long-term goal of transforming taxpayer service, enforcement and technology with the IRA funding congress made available through the end of FY 2031.

We do not anticipate this detailed plan will include time frames for addressing the disposition of legacy systems for all modernization programs; however, we have processes in place to ensure that all modernization plans address the disposition of the associated legacy systems. For example, in January 2022, the IRS Chief Information Officer implemented the IT decommissioning policy and provided relevant guidance to require the identification and oversight of the decommissioning of associated legacy products, systems and services. This policy applies to the programs included in this report. In effect, all programs have developed or are developing a complete modernization plan that includes the identification of the products, systems and/or services that will be decommissioned with the deployment of any modernized solution.

We agree with GAO's recommendation to establish time frames for addressing the disposition of legacy systems for the modernization initiatives included in this report and will follow through to document a complete modernization plan.

### **Fully Addressing Cloud Computing Requirements**

As GAO noted in September 2022, federal agencies must overcome challenges to fully realize the benefits of transitioning to cloud services, including ensuring cybersecurity, procuring cloud services, maintaining a skilled workforce, and tracking costs and savings.<sup>2</sup> The 2019 Federal Cloud Computing Strategy (Cloud Smart) continues to guide our efforts. Although none of the agency's high value assets are currently hosted in the cloud, we continue to adhere to OMB guidance for all applications and systems that move to the cloud. We agree to fully address cloud computing requirements as they apply to the IRS IT operating environment.

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<sup>2</sup> GAO-22-106195



- **Ensuring cybersecurity:** In 2011, OMB established the Federal Risk and Authorization Management Program (FedRAMP) to provide a standardized approach for selecting and authorizing the use of cloud services that meet federal security requirements. All cloud services used at the IRS are following the FedRAMP approach, which is an important safeguard for ensuring compliance with OMB requirements on security, privacy and accessibility.
- **Tracking costs and savings:** The IRS tracks and accounts for all IT costs and spending; however, like many federal agencies, systematically tracking and reporting on spending and savings specific to cloud technology has been challenging due to several factors. Although OMB guidance does not currently require federal agencies to explicitly report savings and/or cost avoidance from cloud implementations, we are continuing to explore methods for establishing a repeatable mechanism to better track cloud savings and avoidances. We are continuing to explore methods for establishing a repeatable mechanism to better track cloud savings and avoidances. We anticipate that we can gain additional insight through implementation of the Technology Business Management discipline, which will enable the IRS to better connect business value with technology investments.
- **Evaluating the customer experience:** In compliance with OMB Circular A-11, Capital Programming Guide, the IRS carefully reviews and manages major IT investments that have been in operations and maintenance for at least 12 months as part of the Operational Analysis evaluation process. As part of this annual evaluation, we demonstrate that the existing investment is meeting the needs of the agency, continuing to support the organization's strategic goals and delivering expected value, and we collect customer feedback. As the IRS uses cloud services for various technology deployments that meet the criteria for undergoing an Operational Analysis, we will continue to collect customer feedback and adjust accordingly. This feedback helps the IRS ensure we are meeting stated objectives, in combination with the agency's external-facing customer satisfaction surveys and ongoing analysis of the user experience for major digital services like the IRS.gov website.

We continue to prioritize and focus on the mission critical infrastructure and services the public needs to comply with tax laws. Over time, the IRS has delivered a variety of modernized services to the public while maintaining legacy systems that contribute to the rising cost of operations and maintenance; this trajectory remains a significant risk that the IRS is carefully managing and addressing in collaboration with GAO and other oversight entities.

We also recognize that to achieve the agency's strategic goals, we must complete significant and highly complex technology transformations that reduce the number of legacy assets. As this response illustrates, we have taken a series of actions to address these important issues. The systems we use for mission critical functions

like return processing operate on current, state-of-the-art hardware. This means that IRS systems, even those that use older programming languages, remain secure and stable. We will continue to reduce and remove legacy technologies in use at the IRS today.

Enclosed is a response to your recommendations. If you have any questions, please contact me, or your staff may contact Nancy A. Sieger, chief information officer, at 202-317-5000.

Sincerely,

Jeffrey J. Tribiano  
Deputy Commissioner for Operations Support

Enclosure

### **Recommendations for Executive Action (GAO 23-104719)**

#### Recommendation 1

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Enterprise Case Management modernization initiative and follow through to document a complete modernization plan.

#### Comment

We agree with this recommendation.

#### Recommendation 2

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Enterprise Data Platform modernization initiative and follow through to document a complete modernization plan.

#### Comment

We agree with this recommendation.

#### Recommendation 3

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Information Returns Modernization initiative and follow through to document a complete modernization plan.

Comment

We agree with this recommendation.

Recommendation 4

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Information Technology Service Management modernization initiative and follow through to document a complete modernization plan.

Comment

We agree with this recommendation.

Recommendation 5

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Enterprise Anomaly Detection / Enterprise Case Selection modernization initiative and follow through to document a complete modernization plan when it resumes.

Comment

We agree with this recommendation.

Recommendation 6

The Commissioner of the IRS should ensure that IRS establish time frames for addressing the disposition of legacy systems for the Workforce Infrastructure modernization initiative and follow through to document a complete modernization plan when it resumes.

Comment

We agree with this recommendation.

Recommendation 7

The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with standardizing cloud contract service level agreements that will provide more effective, efficient, and secure cloud procurement outcomes for agencies.

Comment

We agree with this recommendation.

Recommendation 8

The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with developing and implementing

policy to contracts impacting high value assets that are managed and operated in the cloud, including requirements that provide continuous visibility of the asset.

Comment

We agree with this recommendation.

Recommendation 9

The Commissioner of the IRS should ensure that IRS's cloud computing efforts fully address the key OMB requirement associated with conducting regular evaluations of customer experiences and user needs to ensure that cloud solutions foster efficiency, accessibility, and privacy.

Comment

We agree with this recommendation.

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## Appendix III: GAO Contact and Staff Acknowledgments

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### GAO Contact

David B. Hinchman, (214) 777-5719, or [hinchmand@gao.gov](mailto:hinchmand@gao.gov)

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### Staff Acknowledgments

In addition to the individual named above, the following staff made key contributions to this report: Sabine Paul (Assistant Director), Lori Martinez (Analyst in Charge), Leland Buggie, Donna Epler, Taylor Parker, and Christy Tyson.

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