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Breaking Down SILOS with Shared Data Systems

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Executive Summary

Public health programs have traditionally operated in data silos, with each program maintaining its own system. This fragmented approach leads to inefficiencies, duplicated efforts, and increased costs - hindering the ability of public health agencies to deliver coordinated, high-quality care.

This paper presents the case for a shared data system, demonstrating how jurisdictions can break down silos, enhance collaboration, and achieve cost-effective scalability through cloud-based technology. The SILAS (Share, Integrate, and Link American Samoa) model, originally designed for a smaller jurisdiction, has successfully integrated programs such as Vital Records, Early Hearing Detection & Intervention (EHDI), Early Intervention (EI), and Maternal and Child Health (MCH) into a single, shared database.

Key benefits of this approach include:

- Improved Data Access & Coordination – Programs seamlessly share critical patient data, reducing redundancies and ensuring timely interventions.
- Significant Cost Savings – A centralized system eliminates the need for separate infrastructure, reducing maintenance and compliance costs.
- Scalability for Larger Jurisdictions – Cloud computing enables expansion from smaller regions to multi-state implementations with minimal disruption.
- Enhanced Healthcare Outcomes – Real-time data access improves decision-making, supports early intervention, and strengthens public health initiatives.
- Future-Proofing Public Health Systems – The shared model integrates with national data standards (Fast Healthcare Interoperability Resources (FHIR), NVSS, STEVE), ensuring adaptability to evolving regulations and technologies.

The success of SILAS in American Samoa, coupled with its expansion to larger jurisdictions like The Federated States of Micronesia (FSM), demonstrates that this model is scalable, sustainable, and essential for modern public health data management.

To ensure cost-efficient, high-quality healthcare services, public health agencies must move beyond siloed data systems and embrace shared, cloud-based solutions that optimize collaboration, security, and scalability.

The following abstract provides an overview of how the SILAS model was developed, its implementation in American Samoa, and its potential for broader adoption.

Abstract

It is often the case that every public health program has its own data system, but that doesn't have to be the case. Public health agencies (PHAs) are rethinking the traditional siloed approach to data management, leveraging the scalability of cloud computing to create shared data systems that enhance collaboration. In 2008 the American Samoa Department of Health (AS-DOH) submitted a grant application to start their EHDI program. In a second grant, they proposed a shared data system that included Vital Records (Electronic Birth Certificate, eBC), EHDI (Newborn Hearing Screening), and Early Intervention (EI, Part C). They called this SILAS (Share Integrate and Link American Samoa). The idea was that the eBC would seed the newborn hearing screening, the hearing screening would be completed following the EHDI 1-3-6 protocols, and that when a child referred to EI, all the birth and screening information would be available to that program.

Today Maternal and Child Health (MCH) programs like prenatal have been added, so that all the prenatal visits and mother's information is available at birth. Vital Records/Statistics has expanded to include the Death and Fetal Death Certificates. Current additions to SILAS include Newborn Bloodspot screening, electronic Case Reporting (eCR), an epi dashboard, and syndromic surveillance.

When architecting the approach of a shared data system started, it was not clear if it would scale for larger stateside departments of health. However, with today's scalability of cloud computing, it has become clear that this absolutely does scale. The benefits of shared data are evident. Each program has access to the child and family demographics and case history. For example, when a child with hearing loss refers to Early Intervention, users in that program who have the appropriate permissions, have access to the prenatal visits, mother and father medical history, birth, and EHDI screenings and audiological evaluations.

This case study demonstrates that shared data systems significantly improve coordination, reduce costs, and enhance public health outcomes. The SILAS model serves as a replicable framework for jurisdictions seeking to modernize and integrate their health data infrastructure.

To fully understand how SILAS was developed, we need to examine the historical context that led to its creation.

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Program History

In 2008, the CDC's Early Hearing Detection & Intervention (EHDI) program was actively working to ensure that newborn hearing screening was implemented in all jurisdictions, including U.S. Territories. At the American Samoa Department of Health, the Early Intervention (EI) program - which serves as the Education Part C program for children ages 0 to 3 with disabilities - was already in place. In American Samoa, the EI program is known as Helping Hands. The leadership of Helping Hands took the initiative to explore the establishment of an EHDI program in the territory.

Helping Hands became aware of a CDC grant opportunity to start an EHDI program, as American Samoa did not screen newborn babies at birth for hearing loss. In their grant application, SILAS (Share Integrate and Link American Samoa), was proposed. The goal of SILAS was to support 3 public health programs with a single integrated data system. These programs were OVS (Office of Vital Records), EHDI (Helping Babies Hear), and Early Intervention (Helping Hands). An Electronic Birth Certificate (EBC) would be created at birth. This data would, by definition, be shared with Helping Babies Hear, as there is overlap between birth certificate data, and EHDI. If a baby referred to Helping Hands, this shared data would then become available to early intervention.

Over time the design team came to believe that American Samoa, with a population of under 60,000, was small enough that it didn't make sense for each Department of Health (AS-DoH) program to stand up its own data system. Furthermore, by sharing a common patient record, healthcare would benefit from programs having complete and up to date information.

At the time, it wasn’t clear whether this approach would scale for larger stateside departments of health. However, with the rapid advancement of cloud computing technologies, this model has proven to be adaptable and scalable, allowing jurisdictions of varying sizes to benefit from a shared data system.

Beyond the operational benefits of a shared system, one of the most significant advantages is the reduction in costs and resource duplication. The next section explores these financial efficiencies in more detail.

Cost Savings and Efficiency

The cost of maintaining separate data systems for each program is significant. A shared system eliminates redundant infrastructure, reduces maintenance expenses, and enables more efficient reporting and compliance.

Data exchange between siloed systems is not only costly but often inefficient. The absence of a shared system means that healthcare providers must duplicate efforts, re-enter data, and struggle to access complete patient histories. The cost of these inefficiencies, though harder to quantify, can result in delayed services and poor outcomes. To stand up interchange engines, like HIE's, APIs etc, can be costly, and is often reserved for the large providers like hospitals.

With a single DoH data system, sharing between programs is automatic, and budget resources can be focused on the primary data system that serves all. Of course resources must be allocated to interfaces with external systems such as hospitals, labs, public health clinics, and federal reporting systems such as AIMS, NVSS, STEVE, and NBS.

The financial benefits of a shared data system extend beyond infrastructure savings—improving efficiency, reducing redundancy, and streamlining compliance efforts. Table 1 below provides a comparative overview of the cost differences between maintaining standalone systems and adopting a shared data model:

Factor	Standalone Systems	Shared Data System
Infrastructure Cost	High – Each program requires its own servers, databases, and maintenance.	**Lower – A centralized system reduces hardware and operational costs.**
Data Redundancy	High – Duplicate records across multiple systems, leading to inefficiencies.	**Low – A single, unified data source eliminates duplication.**
Maintenance & IT Resources	Requires dedicated IT staff for each system, increasing overhead.	**A single system requires fewer resources, reducing administrative burden.**
Compliance & Security	Each system must be individually secured and audited for HIPAA, FERPA, etc.	**Centralized security controls streamline compliance and reduce risk.**
Data Exchange & Interoperability	Expensive and complex – Requires custom APIs and data bridges between systems.	**Built-in interoperability allows seamless data sharing across programs.**
Reporting & Analytics	Fragmented – Data is spread across multiple systems, making analysis difficult.	**Integrated – A shared system enables real-time insights and decision-making.**
Scalability	Challenging – Expanding requires additional infrastructure for each program.	**Effortless – Cloud-based solutions scale dynamically with demand.**
Total Cost of Ownership	High – Multiple software licenses, infrastructure, and IT costs add up over time.	**Lower – Cost-sharing across programs reduces long-term expenditures.**

Table 1: Cost Comparison: Standalone vs. Shared Data Systems

The SILAS model, originally envisioned for a few core programs, has since expanded to support a broader range of public health initiatives. The following section details its current scope and implementation.

SILAS Today

Today SILAS has grown to include 5 programs. Let's look briefly at what those are.

Vital Records and Vital Statistics

This includes vital records systems for all three certificate types: Birth, Death, and Fetal Death. Each certificate is seeded from the shared database, and then progresses through a strict workflow. Finally, a robust rules engine is used to validate the data against the NCHS standards. Today AS-DoH is participating in the NVSS initiative to report death certificates directly to STEVE and NCHS via a FHIR interface. This will be followed closely by the Birth and Fetal Death certificates.

Maternal and Child Health (MCH)

The Maternal and Child Health (MCH) program encompasses multiple services, including Rheumatic Heart Disease (RHD) care and prenatal women's health.

- RHD Workflow: Tracks initial RHD screenings, follow-up medical visits, and Bicillin medication distribution. Dashboard queues manage scheduling, visit tracking, and medication expiration monitoring to prevent expired administrations.
- Prenatal Workflow: Begins with the first prenatal visit and continues through postpartum care. An "unborn baby" record links to the mother, tracking prenatal visits, scheduling follow-ups, and managing postpartum care.
- Seamless Transition to EHDI: At birth, EHDI searches for the prenatal record, transfers the unborn baby into the program, and initiates newborn hearing screening protocols. This automated process schedules well-baby and postpartum visits, ensuring continuity of care.
- Lifelong Health Tracking: MCH monitors well-baby visits and ongoing pediatric, adolescent, and adult health services, integrating Infant/Perinatal, Child, and Adolescent Health.

As with all programs, MCH utilizes dashboard queues and tracking tools for appointments, caseloads, referrals, authorizations, consents, evaluations, progress notes, and client contacts.

Early Intervention

Early Intervention or Education Part C, which is known as Helping Hands in American Samoa. This program serves children with disabilities, ages birth to 3 years old. In American Samoa this is a uni-system, meaning that the State and local programs are combined. Everything from referral, to intake, evaluation, plan, and service delivery comes out of the Helping Hands program. At the heart of this program is the rather complex IFSP and its related workflow rules. Modeling a robust IFSP was one of the greatest challenges of the early SILAS development.

EHDI

Of course, the Newborn Hearing Screening program that is known in American Samoa as Helping Babies Hear. It's a little humorous to think back to the start of SILAS when the thinking was, how hard could this be. Right ear, left ear, pass refer. Of course now the EHDI program in SILAS includes inpatient, outpatient, follow ups, audiological evaluations (DAE), lost to follow up, outreach, etc.

I’m happy to report that today AS-DoH is in the process of adding newborn metabolic screening or Bloodspot. This testing has been ubiquitous in the US for decades but has evaded American Samoa due to the challenges of getting the bloodspot sample to the lab in a timely fashion. The current approach is to send these samples to a lab in New Zealand.

Epidemiology and Laboratory Capacity (ELC)

There is lots of activity in the Epidemiology and Laboratory Capacity program today. This includes electronic Case Reporting (eCR), an epi dashboard, electronic Lab Reporting (eLR), syndromic surveillance, and integration with the National Electronic Disease Surveillance System Base System (NBS).

To fully grasp how these programs interact within a shared data system, the following section walks through a typical workflow, illustrating how patient data moves seamlessly from prenatal care to early childhood interventions.

A Typical Workflow

An expectant mother starts prenatal care. SILAS holds the mother's family, health, and demographic information. When the pregnancy is confirmed, an "unborn child" is created. All prenatal visits are associated with this child. At birth, the EHDI program can search for the mother and convert the child, as they now have the MRN as well as all of the birth and screening data. Much of the required EHDI data pertaining to the mother and family is already in place, not to mention the prenatal data. Similarly, vital records can seed their birth certificate with the child and family data.

Vital records have their own workflow where a certificate transitions from state to state, is validated against complex rules, and finally issued. Along the way certificates can be synchronized with the health record.

Of course SILAS fully implements all of the requirements of an EHDI program like 1-3-6, Follow Up, DAE, Outreach, and Referral.

To support these seamless workflows, SILAS has undergone significant infrastructure evolution, transitioning from local hosting to a scalable, cloud-based model. The next section explores this transformation.

Infrastructure History

When SILAS began, cloud computing was in its infancy. Due to limitations in local infrastructure, the system was initially hosted in the U.S. mainland. As cloud computing evolved, it transitioned to Cloud Service Providers (CSPs) such as AWS, Google Cloud, and Microsoft Azure, improving scalability and performance. CSPs offer a wide range of cloud-based infrastructure services, including scalable storage, security compliance, and on-demand computing resources, making them an ideal solution for hosting public health data systems. Over time, better local network bandwidth in American Samoa and other Pacific islands further optimized SILAS' performance, making cloud-based solutions the ideal choice.

Other cloud based infrastructure in Hawaii and Japan was also tried. But in the end the challenges to the user experience came down to the application's performance and local network bandwidth. As bandwidth on-island has improved over the years, so has SILAS' performance. It turns out that latency due to distance is insignificant relative to local bandwidth and response time of the application delivering web pages.

It has also proved to be true in The Federated States of Micronesia (FSM), where SILAS supports the MCH Prenatal and EHDI programs across the four FSM States: Pohnpei, Chuuk, Kosrae, and Yap. As in American Samoa, access to submarine fiberoptic cables as well as upgrades to on-island networks have shown continued improvements over time. In general, cloud computing has seen increased adoption in the Pacific Islands, just as it has elsewhere.

With the right infrastructure in place, SILAS is designed to function as an integrated system that connects multiple public health programs. The next section details how the shared database and family model work together to create a unified public health record.

Basics on How it Works

Shared Database and Family Model

SILAS is based on a shared database model. Here, all programs sit on top of a common database. A powerful family model is implemented, where each person is grouped into one or more families and has relationships with other family members. A typical family might include parents and other caregivers, and children, who of course have sibling relationships. As children become parents themselves, the multigenerational family is constructed. These are the components that make up the person view in SILAS:

Child Details

When viewing a family member, say a newborn child, various programs would see a common header where they see name, date of birth, MRN, and gender. Then there are multiple pages of more specific child details. These pages are mapped by program, so that child details can be shared or private to a specific program. Similarly, SILAS users are granted access on a per program basis.

Family Details

Information that is specific to the family, that spans the family members can be found in FamilyDetails. A common example might be the "Primary language in the home".

Assignments

Many programs include case assignments, where SILAS users are assigned to individual children, and there is a tab for these. Here you can view and make case assignments based on a child by child basis.

Program

At the heart of a case management system is the program data. Here is where all the things, or "Activities" that happen with the child are managed. Activities are grouped into "Phases". Here is a brief list of activities by phase in the EHDI program

- Inpatient Phase
    - Initial Screening
    - Rescreening
    - Progress Note
    - Reminder
    - EI Referral

- Outpatient Phase
    - 6 Month Screen
    - EI Referral
    - ENT Appointment
    - Global ENT
    - Initial Screening
    - Reminder
    - Progress Note
    - Rescreening
    - Six Month Zika Rescreen
    - Twelve Month Zika Rescreen

- Evaluation Phase
    - EI Referral
    - ENT Appointment
    - Global ENT
    - Initial Audiological Evaluation (DAE)
    - Reminder
    - Progress Note
    - Special Ed Referral

- Treatment and Follow Up Phase
    - Audiological Evaluation (DAE)
    - EI Referral
    - ENT Appointment
    - Global ENT
    - Reminder
    - Progress Note
    - Special Ed Referral
    - Amplification and AT Adjustment
    - Amplification and AT Consult
    - Amplification and AT Fitting

- Tracing Phase
    - Child Find
    - Lost to Follow-up Approval
    - Reminder

- Family Activities Phase
    - Family Event
    - Progress Note

Each program defines its own phases and activities.

Files

Many activities are configured to allow files to be uploaded and attached to the activity. Common examples might include referral document(s) and audiograms. On the child details page there is a files tab where all uploaded files for a child can be viewed, and downloaded, in one place.

Reports

There are 7 ways that reports can be accessed in SILAS, and each is described below:

(1) Program Level Reports

Program reports, or custom reports are program specific reports that are custom built for each program.

(2) Child Level Reports

Each child may have a suite of reports that are specific to the individual child. This includes, at a minimum, the case history report. You can think of this as essentially the child's chart.

(3) Activity Print Form Report

Each activity has a corresponding report. Most of these are based on a generic format that serves all activities. However complex activities may require a custom report.

(4) Ad Hoc Reports

Ad hoc reports are custom reports that do not have to be formatted in a precise format, and can be created quickly. These are easily exported into spreadsheet form, and are the preferred type of custom report.

(5) Report Builder by Activity

The report builder suite of reports are self-serve reports, where the user enters their own report criteria to generate the desired results. Report builder by activity provides all program activities filtered by parameters phase, activity, activity date, and child date of birth.

(6) Report Builder by Child and Family Details

Report builder by Child and Family Details is a “Group By” report where results can be filtered based on any child details data element that is a single or multiple selection list. There are over 100 such data elements in the HBH program, but examples include: Race, Birth Country, and Plurality. Results can be further limited based on activity type and activity date range.

(7) Report Builder by Overall Status

Report builder by Overall Status provides a report based on the selected overall status of a child. In HBH, the status’ are: Active, Tracking, and Exited. Since status is historical, the status date range can be specified.

While the shared database model offers significant advantages, it also introduces challenges related to data access, program autonomy, and privacy considerations. The following section addresses these complexities and how SILAS mitigates them.

Challenges

What are some of the challenges faced by a single department of health data system that hosts multiple programs on a shared data system? One rather obvious challenge is that programs share some portion of their data with others on the platform. This is mostly beneficial, especially in tracking, as updated contact information is available to all programs in real-time. However, programs also have confidential data that should not be shared outside of their specific scope.

SILAS enforces strict access controls, ensuring that users only access the programs they serve. Data separation is built into the system, including reporting access—some users have read-only privileges, while others have restricted viewing permissions. Additionally, case assignments can be made per user, further limiting access where necessary.

There is also a cultural mindset challenge, where programs can become possessive of their data. This reluctance is not rooted in compliance requirements, but rather in an institutional resistance to data sharing. However, a shared data view strengthens all programs. For example, MCH prenatal, EHDI, and Vital Records all track birth counts—but through SILAS, they can collaborate and cross-validate their numbers, ensuring higher data accuracy. It is not uncommon for the hospital nursery to compare its birth count against SILAS, further improving data quality.

Addressing Resistance to Change

Beyond technical and compliance challenges, one of the biggest obstacles to adopting a shared data system is the natural resistance to change. Programs that have operated independently for years may be hesitant to share data due to concerns over control, confidentiality, and differing workflows. However, SILAS addresses these concerns through structured access controls, security protocols, and collaboration strategies:

- **Concern: Programs fear losing control of their data**
  SILAS maintains strict role-based access controls, ensuring that each program retains authority over its data. Users can only access records relevant to their program, preventing unauthorized data modifications while still allowing cross-program insights where needed.

- **Concern: Confidentiality risks may increase in a shared system**
  SILAS complies with industry standards such as HIPAA and FERPA, incorporating encrypted data storage and audit trails to monitor access and ensure compliance. Program managers can define data-sharing parameters to maintain confidentiality while enabling necessary interagency collaboration.

- **Concern: The transition process will be too disruptive**
  To ease the transition, SILAS employs phased implementation strategies, allowing programs to integrate gradually. Training sessions, sandbox environments, and real-time support ensure that staff can adapt to the system with minimal disruption to daily operations.

- **Concern: Our workflows are unique—how will a shared system accommodate them?**
  SILAS is designed with configurable workflows that align with the operational needs of different programs. Customizable data fields, reporting structures, and automation features allow departments to maintain their unique processes while benefiting from shared infrastructure.

By addressing these common concerns, SILAS has successfully gained buy-in from multiple public health programs. The result is a system that balances security, flexibility, and efficiency—empowering jurisdictions to transition away from siloed systems without compromising program autonomy.

A challenge that is specific to incorporating vital records, birth, death, and fetal death certificates into SILAS is that of locking down a certificate after it is issued. Once a certificate is issued by the registrar, it cannot be modified without going through an amendment workflow. So, SILAS has a workflow engine in its framework that allows a certificate to move from state to state until it is finally issued by the registrar. Each state is controlled by security roles that restrict access to the appropriate users.

Again the robust data sharing here in vitals records contributes to certificate accuracy. In birth certificates, the collaboration of the hospital (birthing center), MCH prenatal, newborn hearing screening, and the family model in SILAS, go a long way to having the most accurate and up to date information available to vital records when creating the birth certificate.

Despite these challenges, the shared data model has successfully expanded beyond American Samoa, proving its adaptability for larger jurisdictions. The next section explores how SILAS has scaled to new environments and what makes this model suitable for broader implementation.

Scalability to Larger Jurisdictions

While initially designed for smaller jurisdictions like American Samoa, the shared data system model has proven its ability to scale effectively for larger regions. A strong example is the Federated States of Micronesia (FSM), which spans 1.2 million square miles across the Pacific Ocean. Despite its vast and dispersed geography, FSM successfully utilizes this model to support multiple healthcare programs across its widely scattered locations.

The Role of Cloud Computing in Scalability

The advent of cloud computing has been a game-changer for public health data systems. With scalable storage, processing power, and security features, cloud platforms allow jurisdictions of any size to implement a shared data model efficiently. Key technologies such as AWS, Google Cloud, and Azure provide auto-scaling, secure data environments, and cost-effective solutions for expanding public health programs.

What are some of the features that cloud computing offers? We'll discuss several important ones, but this is by no means a comprehensive list. These are just cloud resources and services that are commonly used today.

Infrastructure as a Service (Iaas)

Cloud computing offers scalable computing resources that allow jurisdictions to adjust their infrastructure needs in real-time. Whether a jurisdiction serves 60,000 people or several million, CSPs like AWS, Google Cloud, and Azure offer resources on-demand. These cloud resources can be rapidly scaled up or down based on population size, data volume, and program requirements, enabling seamless expansion as needs grow without the burden of physical infrastructure.

Virtual Networks and Security Compliance

Cloud-based virtual networks enable secure and private data flows across multiple facilities, ensuring compliance with stringent security standards like HIPAA, NIST, and FedRAMP. Instead of managing local networks, CSPs offer scalable solutions such as AWS Virtual Private Cloud (VPC), which functions like a traditional network but leverages the flexibility of cloud infrastructure.

Achieving security compliance can be costly, but CSPs have already implemented and validated security standards, including FedRAMP High and Moderate compliance through services like AWS GovCloud. These providers continually update and audit security measures, reducing the burden on individual organizations.

For protected health information (PHI), cloud service providers typically offer a Business Associate Addendum (BAA) to ensure HIPAA compliance. This allows healthcare programs to focus on securing applications and access protocols rather than managing data center security, leading to significant cost savings and improved compliance efficiency.

Elastic Scalability

Cloud services such as Elastic Compute Cloud (EC2) instances and load balancers allow for scaling of application resources dynamically as demand increases. As a larger jurisdiction serves a growing number of patients or health screenings, the system can automatically allocate additional resources, ensuring uninterrupted access and fast performance. Additionally, as new states or regions adopt the shared system, cloud tools like auto-scaling and load balancing ensure consistent performance.

Cost Efficiency with Pay-as-You-Go

As public health programs expand across jurisdictions, the shared database model on the cloud becomes even more cost-effective. Unlike traditional physical systems where hardware and storage costs grow linearly with the size of the program, cloud computing enables a pay-as-you-go model. As programs grow and require additional storage or processing power, costs are incrementally adjusted based on actual usage, thus avoiding the overhead associated with maintaining physical infrastructure.

Data Warehousing and Integration

With growing datasets from various programs like EHDI, MCH, Early Intervention, and others, cloud-based data warehouses and data lakes provide scalable solutions for handling large volumes of both structured and unstructured data. This capability ensures that the system can handle everything from child records to epidemiological data, making it easier to track outcomes, perform analytics, and generate necessary reports. The integration with other systems—whether local, national, or international (like NVSS or AIMS)—becomes more streamlined, as cloud tools can handle large-scale data transfers and transformations seamlessly.

Scalable Resources

Now that we have a virtual network, in a secure data center, that meets strict security compliance levels. What services are available that support the ability to scale our application? This section is based on cloud services that are available at AWS, but typically have a counterpart within the other CSPs. Also, this is by no means a comprehensive list of available cloud services.

eC2 instances

Elastic Compute Cloud, or EC2, is a web service that provides virtual servers. These can be configured by processor, storage, networking and operating system (Windows Server, many Linux distributions) . EC2 allows applications to be scaled up quickly based on their computing needs.

Load balancer

A load balancer is a networking device that distributes incoming traffic across multiple servers to ensure no single server is overwhelmed. It helps improve performance, reliability, and availability by directing requests to the most appropriate server in the system, or farm.

In terms of scalability, a load balancer enables applications to handle increased traffic by adding more servers to the system. As demand grows, the load balancer efficiently distributes requests among all available servers, ensuring smooth performance and preventing downtime.

Object Storage

Amazon S3 (Simple Storage Service) is a cloud-based object storage service provided by AWS. It allows applications to store and retrieve any amount of data securely, with high availability and durability. S3 is commonly used for storing files, backups, static website content, and large datasets.

S3 supports scalability by automatically handling increasing storage needs without requiring manual intervention. As data grows, S3 scales to accommodate any volume while maintaining performance. Additionally, it offers features like lifecycle policies, automatic replication, and tiered storage options to optimize cost and efficiency. This makes it ideal for applications with unpredictable or rapidly growing storage demands.

Infrastructure as Code

Infrastructure as Code (IaC) is the practice of managing and provisioning infrastructure using machine-readable configuration files rather than manual processes. Tools like Terraform enable us to define infrastructure (servers, networks, databases) in code, making deployments more consistent and automated.

IaC supports scalability by allowing us to rapidly and reliably provision or modify resources as demand changes. Instead of manually setting up infrastructure, IaC enables automated scaling, replication, and updates, ensuring efficient resource management and reducing downtime.

RDS and NoSQL databases

AWS RDS (Relational Database Service) is a managed database service that simplifies the setup, operation, and scaling of relational databases.It handles routine database tasks such as backups, patching, and monitoring, reducing administrative overhead.

RDS supports scalability through features like read replicas (for distributing read traffic), vertical scaling (resizing instance types), and horizontal scaling. Additionally, it offers multi availability zone deployments for high availability and failover support, ensuring that applications can handle increased loads efficiently while maintaining reliability.

Data Warehouses and Data Lakes

A data warehouse is a structured, centralized repository designed for storing and analyzing large volumes of organized data. It is optimized for business intelligence (BI) and reporting, using predefined schemas to enable fast queries.

A data lake, on the other hand, is a storage system that holds raw, unstructured, and structured data in its native format. It is more flexible than a data warehouse, allowing for big data processing, machine learning, and advanced analytics.

Both support scalability by leveraging cloud-based, distributed architectures that automatically scale storage and compute resources as data volume grows. Data warehouses scale through massively parallel processing (MPP), while data lakes handle large datasets using distributed computing frameworks. This ensures efficient performance, even as data demands increase.

ETL Tools

ETL (Extract, Transform, Load) cloud service tools are platforms that automate the process of extracting data from various sources, transforming it into a usable format, and loading it into a target system (e.g., a data warehouse or data lake).

These tools support scalability by leveraging cloud infrastructure to handle increasing data volumes efficiently. They use serverless architectures, parallel processing, and auto-scaling to manage large datasets dynamically. This ensures reliable, high-performance data integration even as business data needs grow.

Analytics

Cloud analytics services are platforms that provide tools and infrastructure for analyzing large datasets in the cloud. They offer capabilities such as data visualization, machine learning, and real-time analytics.

These services support scalability by leveraging cloud-based, distributed computing to process vast amounts of data efficiently. They can automatically scale computing resources based on demand, ensuring fast query performance without manual intervention. This makes them ideal for businesses dealing with growing data volumes and complex analytics needs.

The ability of SILAS to scale across multiple regions reinforces the case for a unified public health data system. The following summary recaps the key benefits and future opportunities for broader adoption.

Summary

The Shared Database Advantage

A shared data system provides real-time access to accurate patient records across multiple public health programs, ensuring that healthcare providers have the most comprehensive and up-to-date information. This improves decision-making, reduces duplicate data entry, and streamlines inter-program collaboration.

Improved Data Access and Coordination

One of the primary benefits of a shared database is the seamless flow of information across programs. With the shared system, departments like Vital Records, Early Intervention, EHDI, Maternal and Child Health, and Epidemiology are not working in silos. Instead, the same set of data is accessible to all relevant programs, ensuring that critical health information, such as birth records, hearing screenings, and maternal health data, is readily available across the board. This cross-program access reduces redundancies and the possibility of errors due to outdated or incomplete data.

For example, when an EHDI program (Helping Babies Hear) receives information from the Vital Records program about a newborn, the shared database allows for automatic updates to the child's health records. These updates can include necessary follow-up care, scheduling of hearing screenings, or referrals to early intervention services. By ensuring that no program has to manually input or duplicate data, a shared system significantly reduces the likelihood of data inconsistencies and promotes more timely and accurate healthcare interventions.

Efficiency and Cost-Effectiveness

Maintaining multiple, separate databases for each program is not only inefficient but also costly. The costs involved in developing, maintaining, and reporting from individual data systems can be overwhelming, especially when federally funded programs must adhere to the same complex standards and regulations. SILAS, by centralizing data for multiple public health programs into one system, dramatically reduces the need for each department to create and maintain its own data infrastructure. This pooled approach leads to significant cost savings.

Moreover, the long-term benefits of cost reduction are realized when sharing data is automated. For instance, by linking the Vital Records, EHDI, and Early Intervention programs, the necessity for manual data exchange is minimized, which saves both time and resources. As these programs share a common data structure, the cost of data exchange—such as building and maintaining complex interfaces or using expensive interchange engines is also reduced. This leads to a more sustainable and scalable model for data sharing in jurisdictions with limited resources.

Enhanced Healthcare Outcomes

A major advantage of the shared database model is its positive impact on healthcare outcomes. When healthcare programs can access and share the most up-to-date and complete information about individuals, they are better positioned to deliver timely and appropriate care. For instance, in Early Intervention, a child's prenatal record from the Maternal and Child Health program is seamlessly available to the Early Intervention program once the baby is born. This ensures that the child's developmental needs are tracked from birth, allowing for early identification of potential issues and interventions. Similarly, the ability to share data between the EHDI and Helping Hands (Early Intervention) programs ensures that children who may be referred due to hearing loss have their records available, improving the chances for early diagnosis and treatment.

The model also supports longitudinal care. As children age and move through different healthcare programs, their records follow them seamlessly across the system. This continuity ensures that healthcare providers have a full picture of the child's health history, making it easier to identify trends and intervene proactively.

Scalability and Adaptability

The scalability of the shared database model is one of its strongest features. While it was initially tested and developed for a smaller jurisdiction, like American Samoa, the success of this model has proven that it can be adapted to larger and more complex jurisdictions. The ability to integrate multiple programs into a single database system means that the model is not just confined to small populations. For instance, SILAS now supports programs across The Federated States of Micronesia (FSM), where it operates effectively in four states with varying infrastructure. As cloud computing has evolved and bandwidth has improved, particularly in remote regions like the Pacific Islands, this system's performance and scalability have been proven in real-world settings.

With cloud-based infrastructure, scaling up to accommodate larger populations or expanding services across more jurisdictions is increasingly feasible. As the demand for data storage and processing increases, the shared database can expand, leveraging cloud resources to manage larger datasets without sacrificing speed or reliability.

Family-Centered Healthcare

A unique feature of the SILAS model is its family-centered approach to health data. By organizing health records around a family unit, rather than just individual patients, the model provides a more holistic view of a family's health history. This structure allows for better coordination of care, particularly in communities where family dynamics play a significant role in healthcare delivery. When a child's record is linked with that of their mother, father, siblings, and other caregivers, it creates a comprehensive profile of health information that is more relevant and actionable for healthcare providers.

For instance, when a child is diagnosed with hearing loss, the family's historical health data—such as prenatal care records or a sibling's medical history—can help providers understand possible genetic or environmental factors influencing the condition. This data model allows for multigenerational tracking of health, which enhances the program's ability to detect patterns and improve preventive care strategies.

Future-Proofing Public Health Systems

As data sharing becomes increasingly important across public health systems globally, the shared database and family model position SILAS as a future-proof solution for health data management. The use of FHIR (Fast Healthcare Interoperability Resources) interfaces, particularly with initiatives like NVSS and STEVE, shows that SILAS is well-positioned to integrate with national and international health data standards. This level of integration ensures that SILAS will be compatible with evolving technologies and data-sharing requirements as public health priorities shift and new challenges emerge, making it adaptable to future needs.

In conclusion, the Shared Database and Family Model adopted by SILAS represents a cost-effective, scalable, and efficient solution for managing public health data. By consolidating data from various programs into a single system, it not only reduces administrative overhead but also enhances healthcare delivery by ensuring that information is accessible, accurate, and up-to-date. Public health agencies must act now to move beyond siloed systems and embrace shared, cloud-based solutions. SILAS demonstrates that interoperability is not just possible but essential for modernizing public health infrastructure. By proactively transitioning to a shared data model, jurisdictions can optimize resources, enhance security, and ensure seamless data exchange. The time for change is now. Public health agencies must prioritize shared, cloud-based solutions to optimize data integration, reduce costs, and improve health outcomes. Agencies that transition today will lead the way in shaping a more efficient, data-driven, and connected public health system..

The following steps outline a structured approach for agencies looking to transition from siloed data systems to a unified, cloud-based model.

Next Steps

To fully leverage the benefits of a shared data system, public health agencies should take a strategic approach to implementation. The first step is conducting an ***assessment of existing data silos*** to identify redundancies and inefficiencies. Agencies should then engage ***key stakeholders across departments*** to build consensus and ensure alignment on data-sharing policies. A ***pilot implementation*** with a subset of programs can provide valuable insights before full-scale adoption. Additionally, developing a ***clear interoperability strategy*** for integrating external systems—such as hospitals, laboratories, and national databases—will ensure seamless data exchange. By proactively addressing these steps, jurisdictions can move toward a ***scalable, cost-effective, and future-ready*** public health data infrastructure.

Glossary of Terms

- **AIMS:** APHL Informatics Messaging Services
- **APHL:** Association of Public Health Laboratories
- **AS-DoH:** American Samod - Department of Health
- **API:** Application Programming Interface
- **BI:** Business Intelligence
- **CDC:** U.S. Centers for Disease Control and Prevention
- **CSP:** Cloud Service Provider
- **DAE:** Diagnostic Audiological Evaluation
- **DoH:** Department of Health
- **eBC:** Electronic Birth Certificate
- **EC2:** Elastic Compute Cloud
- **EHDI:** Early Hearing Detection & Intervention
- **EI:** Early Intervention
- **ELC:** Epidemiology and Laboratory Capacity
- **ENT:** Ear Nose and Throat
- **ETL:** Extract, Transform, Load
- **FedRAMP:** Federal Risk and Authorization Management Program
- **FERPA**: Family Educational Rights and Privacy Act
- **FHIR:** Fast Healthcare Interoperability Resources
- **HBH:** Helping Babies Hear
- **HH:** Helping Hands
- **HIE:** Health Information Exchange
- **HIPAA**: Health Insurance Portability and Accountability Act
- **IFSP:** Individualized Family Service Plan
- **IaaS:** Infrastructure as a Service
- **MCH:** Maternal and Child Health
- **MPP:** Massively Parallel Processing
- **NAPHSIS:** National Association of Public Health Statistics and Information Systems
- **NBS:** National Electronic Disease Surveillance System Base System
- **NCHS:** National Center for Health Statistics
- **NIST:** National Institute of Standards and Technology
- **NVSS:** National Vital Statistics System
- **OVS:** Office of Vital Records
- **PHA:** Public Health Agencies
- **PHI:** Protected Health Information
- **RDS:** Relational Database Service
- **RHD:** Rheumatic Heart Disease
- **S3:** Simple Storage Service
- **SILAS:** Share Integrate and Link American Samoa
- **SOC2:** Service Organization Control Type 2
- **STEVE:** State and Territorial Exchange of Vital Events
- **VPC:** Virtual Private Cloud