Virginia Department of
Behavioral Health and
Developmental Services

# Data Strategy and Roadmap


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Virginia Department of
Behavioral Health and
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## Document History

| Name | Ver. | Date | Notes |
|---|---|---|---|
| CapTech | 1.0 | 1/15/2013 | Initial Version |
| CapTech | 2.0 | 1/30/2013 | Expanded Executive Summary, Added more detail, Added Business Benefits |
| DBHDS | 3.0 | 2/15/2013 | Added business language and new diagrams |
| CapTech | 3.1 | 4/1/2013 | Modified changes based on business owner feedback |

Virginia Department of
**Behavioral Health and Developmental Services**

# 1 Executive Summary

This Data Strategy and Roadmap (DSR) defines and documents a comprehensive view regarding the management and maintenance of data within the Department of Behavioral Health and Developmental Services (DBHDS). This DSR contains recommendations that support the DBHDS's evolution to a future state where data is managed to enable efficient data retention, exchange, analysis, and reporting. These business functions are critical priorities that require material improvement from the current state to support existing programmatic requirements related to provision of quality care to individuals with behavioral health needs.

The DBHDS contracted CapTech Consulting to perform a needs analysis and develop an improvement plan. CapTech has prior experience performing analyses of this type as well as strong familiarity with the DBHDS through multiple recent projects they have performed at the DBHDS. Within this DSR CapTech incorporates:

- Findings and recommendations from interviews with key stakeholders from the DBHDS and our information/data trading partners
- Best practice recommendations from the Healthcare and Data Warehouse / Business Intelligence industries
- Proposed action steps based on CapTech's practical experience helping organizations to mature data management policies and processes

CapTech used The Data Warehousing Institute (TDWI) Maturity Model[1] to benchmark the current state of the DBHDS's data management policies and processes and to define the proposed future state implementation of a Data Warehousing and Business Intelligence solution. Through extensive industry studies TDWI created a benchmark Maturity Model to compare organizations' data warehousing and business intelligence solutions across the world. The benchmark looks at scope, sponsorship, funding, value, architecture, data, development, and delivery to determine where an organization resides on the maturity model's curve.

Based on these values an organization resides in one of five stages: *Nonexistent*, *Preliminary*, *Repeatable*, *Managed*, or *Optimized*. The DBHDS resides solidly in Stage 1, i.e. *Nonexistent*, on the TDWI Maturity Model. While possibly disappointing, this current state is not surprising to stakeholders and is typical for organizations that have not explicitly defined and funded an initiative to manage organizational data.

The DBHDS is a diverse organization which has grown organically over time in its organizational structure, processes, and technologies. This history, coupled with the absence of

[1] *See TDWI's Business Intelligence Maturity Model for a detailed explanation of the stages in the model.*

a coordinated data management strategy, and further complicated by substantial new requirements brought forward by the Department of Justice Settlement Agreement (DOJ) and the Electronic Health Record System implementation project (EHRS), led the DBHDS to take action for development of this Data Strategy and Roadmap. Pending approval of the recommendations contained herein, the DBHDS will direct stakeholders to migrate from the current state of data management to a more effective future state that will continuously evolve in support of ever-changing business requirements.

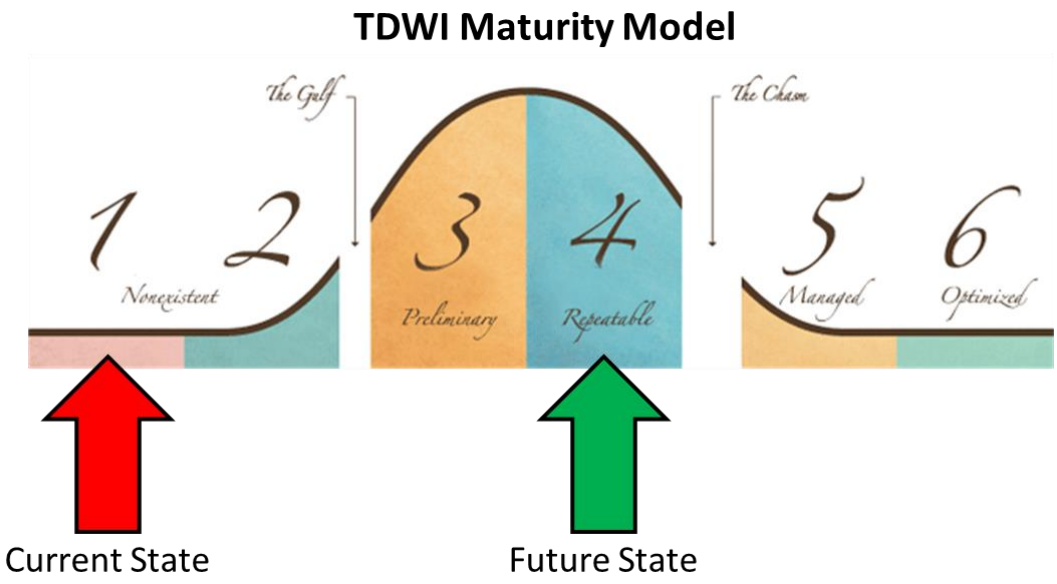



**Figure 1. TDWI Maturity Model: Current versus Proposed Future State**

The issues discovered in the current state data environment that pose the most significant challenges for the DBHDS in managing data are:

- Disparate data systems
- Data quality concerns
- Reporting inadequacies
- Reactive to information, rather than proactive
- Lack of process

These data and reporting challenges directly affect how the DBHDS runs its business. Not only does it take an inordinate amount of time and effort to develop accurate consistent analyses for executives to understand how the business is running, it also takes an excessive amount of time and effort to provide the regularly occurring reports needed to receive grant money, interact with external agencies, and provide quality management measures.

Because multiple offices within the Department are producing similar reports with different datasets and methods, the information being produced is often different, leading both analysts and executives to lack confidence in the accuracy of the information. Finally, because only a few reports are provided on a scheduled basis, excessive time is spent gathering, consolidating, and validating information rather than in using the information to assist in providing quality care and treatment to consumers.

Addressing these data challenges through a well-thought out action plan and roadmap will alleviate these business problems. The plan proposed here matures the DBHDS from its current state at *Stage 1: Nonexistent* to a future state at *Stage 4: Repeatable*, as shown in the figure above. At *Stage 4*, the DBHDS will have all of the pieces required to support an integrated data repository with processes that are consistently utilized and reports that can be accessed by the entire organization.

Data management and business intelligence industry best practices that are relevant to the DBHDS are specified in this DSR. Based on these best practices, interviews conducted at the DBHDS, and CapTech's prior experiences, CapTech has identified several strategic components needed to build a data solution to align the DBHDS future state data environment with its desired future state vision.

Key recommendations include:

- Development of a governance board to oversee evolution of the future data ecosystem
- Creation of an analytical data warehouse that encompasses all individual touch points
- Removal of local-office focused reporting databases to normalize data and business logic in one organization-wide easily accessible source
- Implement self-service business intelligence and reporting solutions for end-users

A functional, routinized data warehouse will provide information about all individuals, providers, and facilities, as shown in the figure below.


**Figure 2. Data Warehouse Subject Areas**

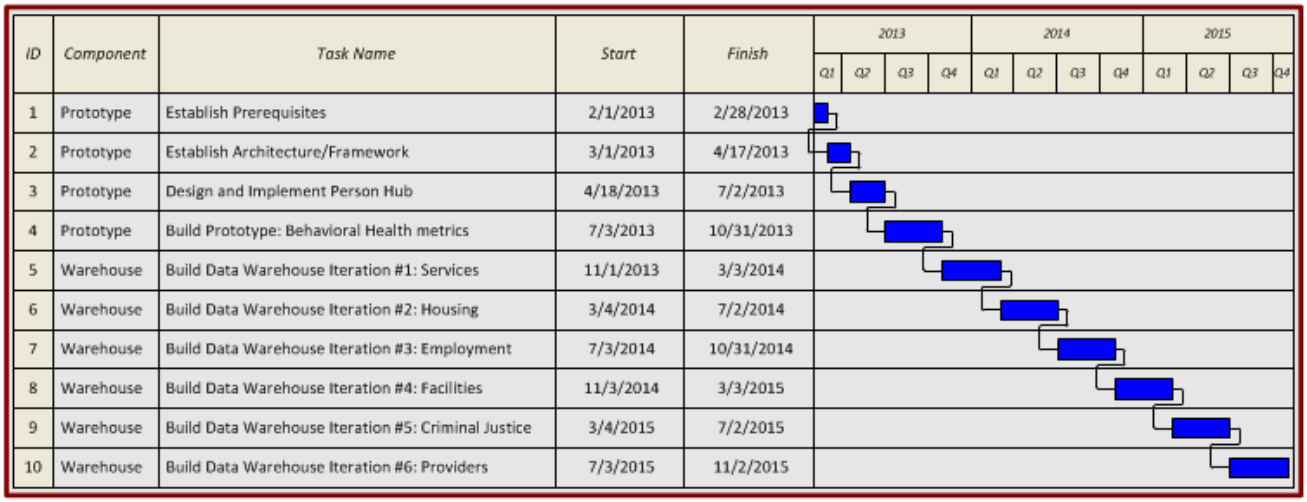
The recommendations contained in this Data Strategy and Roadmap will mature the DBHDS from its current state of *Stage 1: Nonexistent* through the stage of *Preliminary* and position the DBHDS solidly in *Stage 4: Repeatable*. Creation of a centralized data environment and requiring that it be used by the entire organization, coupled with coherent data import, export, and exchange processes, consistent computational business logic, and a system-wide commonly agreed data syntax will provide timely and accurate analysis and reports that improve the DBHDS's ability to conduct its business. Self-service Business Intelligence tools can then be deployed directly into business units thus empowering staff and managers who need information to access that information directly.

After reaching *Stage 4*, the DBHDS executives can expect to receive timely accurate answers to their queries. The self-service portal will benefit executives, directors, and analysts through direct access to data for information. All data consumers will be certain that the data they are using has been vetted and is accurate for distribution outside of the organization. Instead of waiting to hear when something goes wrong in a facility or to an individual, quality management teams will be able to proactively analyze the data, detect where a potential issue may occur, and effectively circumvent the problem before it even happens.

A proposed roadmap and plan are included in this DSR to assist the DBHDS in working towards the future state data environment. The recommendations outlined in this DSR will require strong commitment from the DBHDS and consistent communication to all staff to promote the

acceptance and usage of the new data system and its supporting business practices. With this commitment, the DBHDS will realize the benefits of a data environment supported by standard processes which will result in timely, reliable, quality information.

A high level view of the roadmap is illustrated below:



| ID | Component | Task Name | Start | Finish |
|---|---|---|---|---|
| 1 | Prototype | Establish Prerequisites | 2/1/2013 | 2/28/2013 |
| 2 | Prototype | Establish Architecture/Framework | 3/1/2013 | 4/17/2013 |
| 3 | Prototype | Design and Implement Person Hub | 4/18/2013 | 7/2/2013 |
| 4 | Prototype | Build Prototype: Behavioral Health metrics | 7/3/2013 | 10/31/2013 |
| 5 | Warehouse | Build Data Warehouse Iteration #1: Services | 11/1/2013 | 3/3/2014 |
| 6 | Warehouse | Build Data Warehouse Iteration #2: Housing | 3/4/2014 | 7/2/2014 |
| 7 | Warehouse | Build Data Warehouse Iteration #3: Employment | 7/3/2014 | 10/31/2014 |
| 8 | Warehouse | Build Data Warehouse Iteration #4: Facilities | 11/3/2014 | 3/3/2015 |
| 9 | Warehouse | Build Data Warehouse Iteration #5: Criminal Justice | 3/4/2015 | 7/2/2015 |
| 10 | Warehouse | Build Data Warehouse Iteration #6: Providers | 7/3/2015 | 11/2/2015 |



**Figure 3. Sample Roadmap**

The roadmap organizes the process into two major components: Prototype and Warehouse.

In the first component, Prototype, the groundwork is laid for future development, which includes four key elements:

1) Creation of the governance board
2) Definition of a development framework and standards
3) Design of a master data management system to map individuals from different systems together
4) An initial foray into a data repository and self-service reporting solution.

At the end of the Prototype component, which will require approximately 5 resources for 8 months, the DBHDS will be at *Stage 2* in the Maturity Model. This Prototype component is expected to cost approximately one million dollars.

The next component, Data Warehouse, builds upon the Prototype component by iteratively adding subject areas to the data repository. Using 4-month iterations with an estimated team of 5, in approximately 6 iterations the data warehouse will include the currently known major subject areas needed to satisfy DOJ quality management requirements and EHRS data integration requirements.

As skill sets of the DBHDS employees increase, external consultant staff will be replaced with full-time DBHDS staff to create blended teams that reduce cost to the DBHDS and support knowledge transfer.

The recommendations contained in the balance of this report walks through each of the described steps detailing the DBHDS's current state, future state, business benefits, and the roadmap to achieve data management maturity Level 4. By investing in this initiative, the DBHDS will save organization time and resources dealing with complex reporting and data quality issues allowing resources to focus on our core mission to provide the best care for those individuals we serve.

## 2 The DBHDS Mission Statement and Strategic Goals

The Virginia Department of Behavioral Health and Development Services (DBHDS) is a state government agency that manages the care for individuals with behavioral health, substance abuse, or developmental disabilities. The DBHDS mission statement[2] describes this as:

> *"We provide leadership and service to improve Virginia's system of quality treatment, habilitation, and prevention services for individuals and their families whose lives are affected by behavioral health disorders or developmental disabilities.*
>
> *We seek to promote dignity, choice, recovery, and the highest possible level of participation in work, relationships, and all aspects of community life for these individuals."*

In addition, the DBHDS has highlighted twelve initiatives to drive the forward movement of the organization in their ***Creating Opportunities*** document:

1. Behavioral Health Emergency Response Services
2. Peer Services and Supports
3. Substance Abuse Treatment Services
4. Effectiveness/Efficiency of State Hospital Services
5. Child and Adolescent Mental Health Services
6. Developmental Services and Supports Community Capacity
7. Autism Spectrum Disorders/ Developmental Disabilities
8. Housing
9. Employment
10. Case Management
11. DBHDS Electronic Health Record (EHR) and Health Information Exchange (HIE)
12. Sexually Violent Predator (SVP) Service Capacity

The DBHDS contracted CapTech Consulting to perform this data management assessment and develop recommendations for improvement. CapTech has prior experience performing analyses of this type and strong familiarity with the DBHDS through multiple other recent projects performed at the DBHDS.

The objective of this Data Strategy and Roadmap (DSR) is to support more effective execution of the DBHDS mission statement and strategic goals. The recommendations described in this DSR will help to alleviate barriers to effective, timely, accurate, and useful analysis and reporting. This plan includes:

- Findings and recommendations from interviews with key stakeholders from the DBHDS and our information/data trading partners

[2] *http://www.dbhds.virginia.gov/CO-MissionValues.htm*

- Best practice recommendations from the Healthcare and Data Warehouse / Business Intelligence industries
- Proposed action steps based on CapTech's practical experience helping organizations to mature data management policies and processes

## 3 The CapTech Process

The CapTech methodology first emphasizes understanding of the business and technical challenges followed by definition of tailored approaches designed to resolve their clients' most pressing pain points.

For the DBHDS, CapTech undertook a twelve-week evaluation of the DBHDS's current data infrastructure. CapTech began by interviewing all key business and technical stakeholders and developing interview summaries. Appendix A provides a complete list of stakeholders interviewed.

Working from these interviews and additional documentation gathered in the interview process, CapTech created a current state view of the data infrastructure at the DBHDS. Utilizing the TDWI Maturity Model as a reference metric, CapTech identified the current state maturity of the DBHDS data process and infrastructure.

Using CapTech's data warehousing and subject matter experience coupled with an understanding of DBHDS organizational objectives for analysis and reporting quality, a target future state was crafted specifically for the DBHDS. Finally, CapTech outlined a roadmap to assist the DBHDS in achieving a target future state.

This data strategy will document each of the steps that CapTech took to develop this corrective action plan. In the next section, the needs assessment portion of this document outlines DBHDS's current state.

## 4 Current State

The DBHDS operates and/or provides support for a network of facilities, community services boards, and other resources to serve consumers who have mental health diagnoses, intellectual disabilities, and substance abuse disorders. The DBHDS's goal of enhancing community-based care for consumers is achieved by:

- **DBHDS Central Office:** An administrative agency providing services through multiple offices/departments to support the different consumers served. Central Office is an integral part of the DBHDS.
- **DBHDS Facilities:** The DBHDS operates sixteen (16) in-patient hospitals and treatment centers that provide services directly to consumers.
- **Community Services Boards (CSBs):** Forty (40) separately chartered and managed care delivery organizations (CSBs) provide out-patient services and supports for consumers in their regional area. CSBs participate directly in admission of consumers to DBHDS Facilities and help train and advise other resources in their region for providing consumer care. Although CSBs are separate and independent from the DBHDS, there are contractual agreements and obligations that define responsibilities of each partner and to ensure that an appropriate standard of care is provided.
- **Additional Resources:** A network of several thousand private provider organizations and individuals serve consumers through relationships with CSBs and/or the DBHDS.

As with any organization, change is constant. The DBHDS has and will continue to evolve in response to changes affecting its environment. Two highly visible multi-tens-of-million dollar drivers, i.e. the Department of Justice Settlement Agreement (DOJ) and the installation of a new Electronic Health Record System (EHRS), present new demands and opportunities that require the DBHDS to mature its data management ecosystem. Receipt of financial incentives and avoidance of financial penalties are dependent on quality of program execution, and quality of program execution is dependent on timely and accurate data and analysis.

This Data Strategy and Roadmap outlines the DBHDS journey to enhance its data and reporting infrastructure. The next section of the DSR will establish where the DBHDS must begin their journey by describing the current state of the organization.

## 4.1 Data Warehousing Maturity

Organizational evolution requires change in roles, requirements, and systems. New departments, sources of data, and reporting needs are poorly served by the current state model of individual staff using Access databases and Excel workbooks to consolidate data from across the organization.

As mentioned in the Executive Summary, CapTech used The Data Warehousing Institute (TDWI) Maturity Model to benchmark the state of the DBHDS's data warehousing and business intelligence solution. The DBHDS currently resides solidly in *Stage 1: Nonexistent* on the TDWI model.

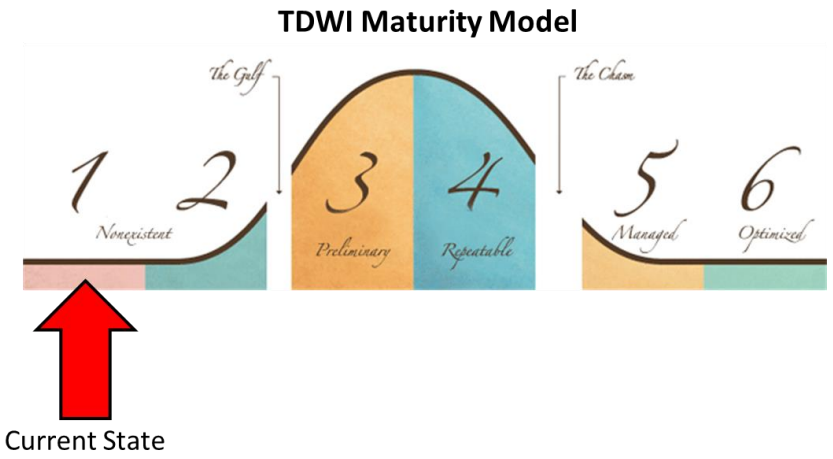



**Figure 4. Business Intelligence Maturity Model and Current State**

The maturity of the DBHDS data warehousing and business intelligence system was determined by the current technical architecture, organizational structure, processes, and technologies in service at the DBHDS. Without a centralized data repository, analysts are limited in their ability to get needed information in the required time frame. The DBHDS's evaluation of *Stage 1* is evidenced by a lack of automated management reports, information requests and reports being populated on an ad-hoc / manual basis, and application databases that are limited to a single data source. Based on the TDWI model's criteria, the DBHDS has not yet begun their data warehouse and business intelligence life cycle.

Next, the data strategy describes the current architecture for moving and reporting data.

## 4.2 Current Architecture

The DBHDS technical architecture supporting data maintenance, analysis, and reporting has evolved over time and largely without intention. This is to say that data collection systems, databases, reports, and maintenance processes have been created in response to specific needs and without consideration of impact to other components of the ecosystem.

Some data systems are tailored to fit a specific office's precise need, such as SVPTracker. Others systems are long overdue for material expansion and addition of new functionality, such as the Licensure system. Essentially every CSB and DBHDS Facility has many independent home-grown applications and reports, and both CSBs and Facilities enter a wide range of requested information into siloed applications developed by Central Office.

There are a few reporting databases, specifically the CCS data system and the AVATAR complex of databases, but no consolidated data repository. The AVATAR database complex alone consists of approximately twenty (20) databases across the DBHDS to satisfy the local needs of reporting from this single data source.

A small number of power users merge data from various systems for reporting purposes through the ad-hoc use of Access and Excel files.

The figure below shows the movement of data from the top to the bottom of the diagram. The top layer shows the sources of data, moving to the next layer of consolidation, and finally ending in reports that are created.

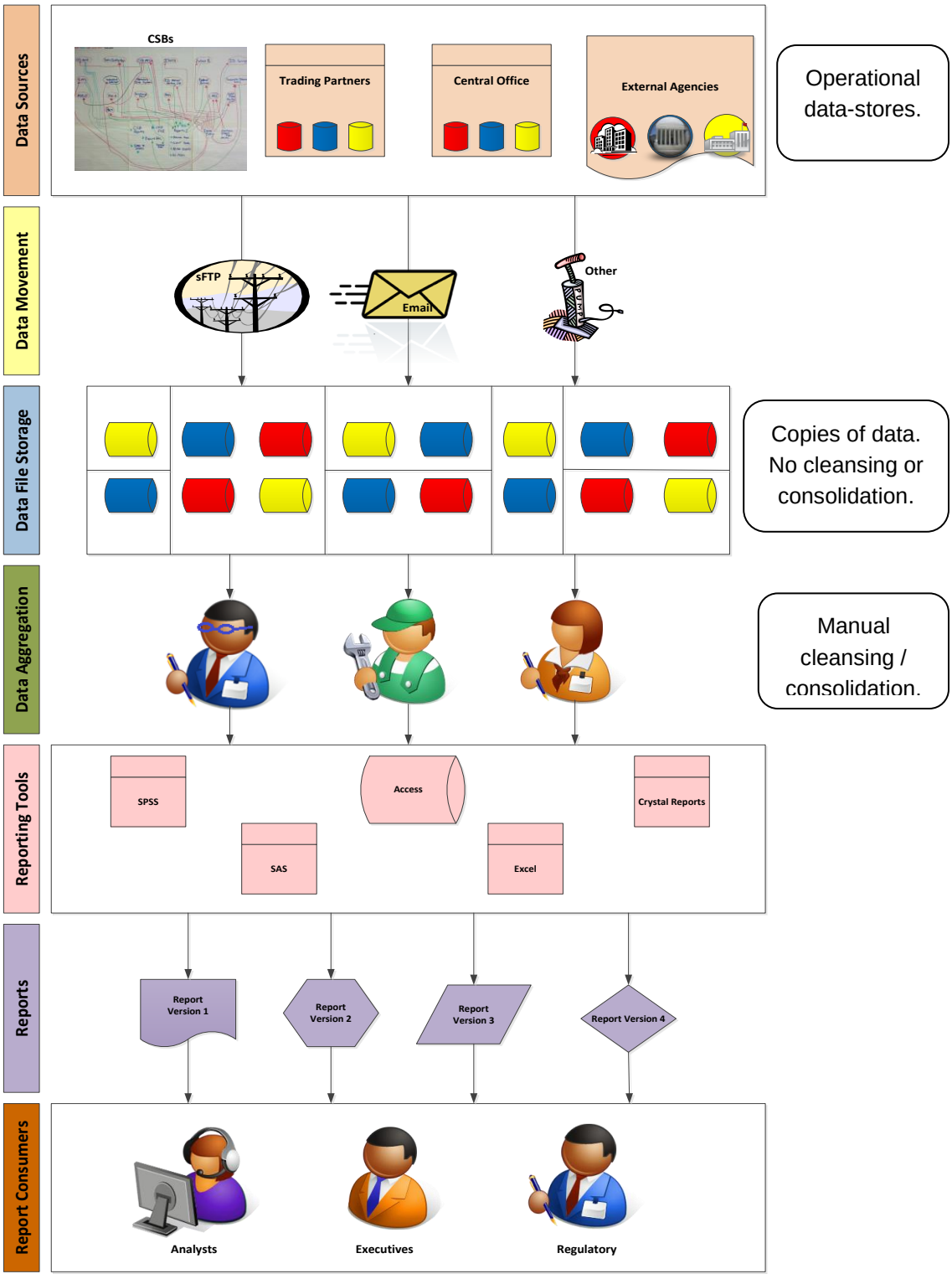



**Figure 5. Current State Data System Architecture Diagram**

## 4.3 Organization

The DBHDS contains multiple offices/departments that perform different functions. Data sources and consumers are numerous with some need for sharing of data between offices and a substantial need for aggregation of data for external reporting. We organize our information trading/sharing partners into two areas: Internal and External Stakeholders.

### 4.3.1 Internal Stakeholders

The DBHDS is operational functions are organized into four broad categories: Behavioral Health Services, Developmental Services, Quality Management, and Finance and Administration.

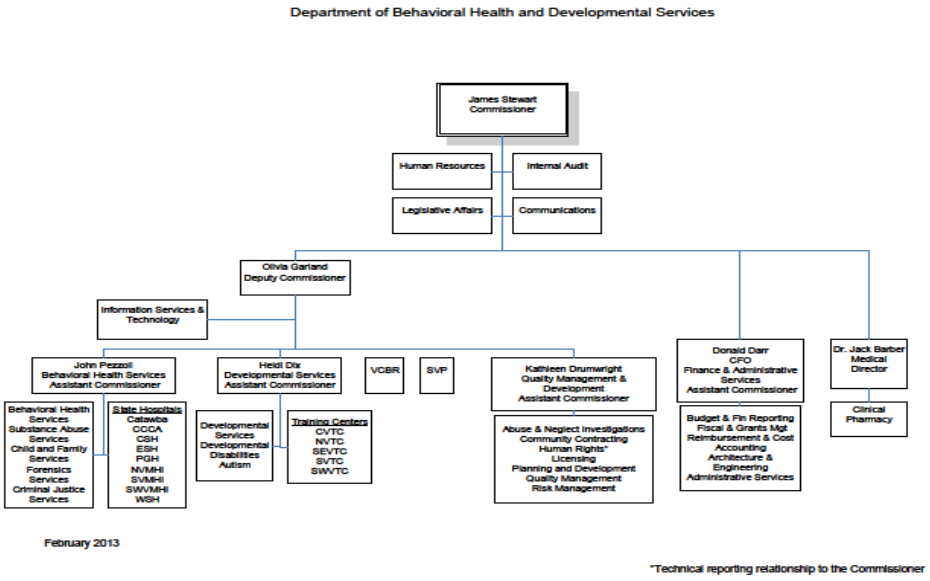



**Figure 6. The DBHDS Organizational Chart**

Each of these offices supports/uses distinct systems that support specific objectives. These systems maintain parochial data as well as shared data. There is little visibility across offices and consolidated reporting across the organization is essentially manual. Data producers and consumers within each office are described below:

- ***Executives***: The Executive role includes the Commissioner, Deputy Commissioner, and the Assistant Commissioners. Executives are interested in data at an outcome level. Executives are interested in aggregated data and receiving quick answers regarding program performance and special conditions. Their desire is to receive automated reports and dashboards that show how the Department is doing at a strategic level.

- ***Director***: The Director role includes the next level of staff such as Jae Benz, Paul Gilding, Marion Greenfield, Jim Martinez, and Lee Price. This role straddles the desire to see outcomes and the need to resolve day-to-day operational issues. Directors tend

to be focused on the program office business and would prefer reports to be delivered to them automatically.

- ***Program Office Subject Matter Experts (SMEs)***: Program SMEs are in many of the offices, but not all. Staff in this role include David Mills and Joel Rothenberg. Program SMEs are information consumers that analyze and report their data. The Program SME acts as the go-between for the program office and the Information Services & Technology department. Some SMEs can write queries and are intimately familiar with the data in their closest systems.

- ***Report Development Staff***: Report Development staff include individuals directly embedded in Program Offices and in the Information Services & Technology (IS&T) department. A few staff in this role include Adrienne Ferriss, George Banks, Rupinder Kaur, Diane Marsiglia, Beth Locke, and many others. For the most part, staff familiarity is limited to a few related systems and there are no staff conversant in the full spectrum of DBHDS systems and/or data/reporting requests. Within all roles, the Report Development staff are most familiar with mapping data from systems across the DBHDS data inventory. Report Developers often create their own local databases and spreadsheets to accommodate frequently requested reports and requests.

- ***Database Administrators***: A few staff members in the IS&T office support applications and databases from a technical system perspective. These members include those such as Bob Bean and Herv Sherd. These staff monitor system functions such as capacity utilization, backup, and other aspects of system operation that are related to total data volume without regard to any specific data item values. These staff would handle the software and hardware of a future DBHDS data repository.

- ***Data Consumers***: Data Consumers include any employee who will act based on the content of either a single data value or an aggregation/summary of data values. Organizational roles that encompass this role range from the Commissioner to a clerk. If you receive a report or look at data on a screen and perform work based on that data, you are a Data Consumer.

### 4.3.2 External Stakeholders

External stakeholders are people who trade information back and forth with the DBHDS. These include but are not limited to the state and federal agencies that provide or consume program information and in some cases consumer level information regarding how individuals are doing when they are no longer receiving the DBHDS's Facility services or once they have been released from a facility, or for any other purpose.

**Provider stakeholders that deliver information to DBHDS include:**

1. VHI (Private Hospitals)
2. MEDIS (State Pharmacies)
3. DMAS (Medicaid Dataset)

4. VEC (Employment data)
5. DOC (Arrests and detentions)
6. DOE (Department of Education)
7. DARS (Department for Aging and Rehabilitative Services)
8. DOA (Department of Accounts)
9. CMS (Centers for Medicare & Medicaid Services)

**Consumer/Reporting stakeholders that request information from DBHDS include, but are not limited to:**

1. SAMHSA CSAT: SA NOMS/TEDS
2. SAMHSA CMHS: Mental Health NOMS
3. State Reporting
4. URS – Uniform Reporting System
5. Comprehensive State Plan
6. CMHS and SAPT Block grants
7. DOJ
8. Independent Reviewer
9. Joint Commission
10. Accreditation reviewers for hospitals

**External stakeholders that both provide and consume data include the following:**

**Community Services Boards:** While the CSBs are not technically an internal organization, the relationship with the VACSB (Virginia Association of Community Services Boards) is close and the data relationship is almost as close as if they were an internal organization.

CSBs have a range of technical skill levels. Staff at the CSBs are interested to see data for individuals at an aggregate level for comparisons as well as to see through that aggregation by drilling down through the summary to an individual level detail for investigations. They prefer a seamless connection to their reporting with a limited amount of technical interaction.

## 4.4 Process

The DBHDS has many documented and word-of-mouth workflows in place to handle business processes. These include processes that address definition of data content, alignment of data used for aggregation, and consistency of business logic used for data transformations. However, absent a unifying architecture for data management, coupled with the existing office-centric perspective of data, these processes are inconsistent in their application across the DBHDS. The result is flawed analysis and inconsistent reports.

### 4.4.1 Data Management Committee (DMC)

Community services board data is critical to the DBHDS. Fortunately, a large portion of our CSB information trading partners participate in the Virginia Community Services Board (VACSB) Data Management Committee (DMC), a governing body of business and technical staff who work to achieve consistency in definition of data elements, their intended content, and the quality of that data computation. The DMC has materially improved the quality of data provided by VACSB members to the DBHDS. The DMC meets monthly with regular participation by about 25-30 CSBs and 6 - 10 DBHDS staff. The topics of the meetings include: DBHDS requests for data from the CSBs, data content definition, computation of data, data quality checks, and other data consistency issues. The DMC also serves as a conduit for exchange of general Information Technology news, how best to minimize the impact on DBHDS data requests to the CSBs, technical issues with applications, survey requests, feedback on processes, and other technical matters between organizational information trading partners .

This group is a great example of how disparate agencies can work together to ensure proper data movement and quality for the Department. Note that this group only covers the data interaction between Central Office and the VACSB members. Previous committees, including the Data Policy Task Force, have tried to fill the need for an overall data governance board, but those efforts have not been upheld.

### 4.4.2 Master Patient Index (MPI)

The DBHDS currently uses components of its vendor-provided Billing and Reimbursement system (Avatar) as a Master Patient Index (MPI). This tool is adequate for billing and reimbursement functions and consumer demographic data maintained within the MPI is reused widely throughout the DBHDS where information is needed concerning individuals receiving services in our hospitals and training centers.

A few years ago the DBHDS commissioned a consulting firm to develop a needs analysis and strategic plan[3] for creation of a comprehensive MPI to meet organizational needs for combination of individual information from all of the disparate data sources used within the DBHDS. While this project was not funded, SOMMS VA Unique Client Identifier report remains

[3] State Outcomes Measurement and Management System (SOMMS) V3.2; prepared by FEI.com; February 10, 2009

relatively accurate as a Requirements Definition for the DBHDS's consumer matching needs of DBHDS application systems.

### 4.4.3 Consolidated Data

Consolidation of data from different sources for reporting is currently performed on an individual basis. Each of the data managers and staff who produce reports create their own Access database, Excel workbook, or other tools to merge data from the many sources available into a common workspace from which a report can be generated. Sample data sources include: Avatar and as many as twenty Avatar derivative databases, the CCS3 database derived from data submissions from all CSBs, IDOLS, PAIRS, ITOTS, twenty-plus other Central Office maintained applications, and multiple-hundred application data sources currently in operation at the DBHDS's sixteen Facilities.

While these "workspace" databases are frequently reused by the person that created them, they tend to be limited to the creator and are created by manual manipulations, rather than repeatable processes. This means that any two individuals, starting with the same objective and sources of data, have potential to create differently organized workspaces and are likely to produce different analyses. Moreover, as these workspaces are manually created they tend to be static. Thus, any updates to the source data usually require that the manual data extraction, consolidation, and reporting process begin anew.

### 4.4.4 Automated Reporting

Many automated (programmed) reports have been developed by Information Technology staff. However, budget pressures over the course of the past decade led to staff attrition, loss of business knowledge, and inadequate maintenance of these automated reports.

While there are a few areas, most notably in the financial reporting arena(s), where required report maintenance has occurred as data sources have changed, many of these automated reports have either stopped functioning, or worse – continued to operate and produce inaccurate results. This has eroded DBHDS confidence in its reporting infrastructure and damaged DBHDS credibility with oversight bodies to which the DBHDS provides analyses and reports.

### 4.4.5 CSB CCS3 Submissions

Through the DMC, the DBHDS and the CSBs reached agreement for an interface application, known as CCS (Community Consumer Submission) to provide information from the CSBs to the DBHDS about the services provided by CSBs. The CCS is currently on its third generation (CCS3) of this interface definition and application.

CCS data is received as a monthly snapshot throughout the fiscal year (July through June). A major shortfall of this critical service data is that the data is provided in cumulative form throughout the fiscal year and it resets at the beginning of the next fiscal year. When information changes from month to month, staff cannot tell if it was a correction or a status change.

### 4.4.6 Impacts from the Electronic Health Record System (EHRS) and the Department of Justice (DOJ) projects

The new Electronic Health Record System (EHRS) being deployed within the DBHDS hospital system will dramatically change the data ecosystem within the DBHDS. Enormous volumes of new data will come online, many existing disparate data collection application and downstream process data sources will be replaced by functions and data provided through the EHRS, and data analyses and reporting results must normalize as both federal government and healthcare industry standards are imposed on the DBHDS hospital system.

The EHRS project, coupled with the DOJ project, present a dramatically changed suite of demands on the DBHDS data environment. The current dissonant analysis and reporting processes and systems serving the DBHDS do so poorly and must be replaced. A productive upgrade of our reporting infrastructure will affect the business and data processes within Central Office and all Facilities. Modern data systems and management processes need to be developed and implemented system-wide.

While the full implication of these changes is not yet known, the DBHDS is a very late adopter of a cohesive data management program and strong resources are readily available to navigate and execute this transformation. Very little, if anything, needs to be invented here. We simply need to execute well using proven best practices and tools.

## 4.5 Technology

The DBHDS uses several tools for data movement, storage, analysis, reporting, and display activities. This is ordinary as no single tool fits all jobs and the DBHDS acquired its data environment over the course of decades with evolving strategies and variable support from its administrations during this time.

However, different versions of the same tool are in service, data is frequently duplicated and thus often out-of-date, and staff resources are and will likely remain inadequate to operate, maintain and use our discordant data ecosystem.

### 4.5.1 Developer Tools

The DBHDS uses multiple tools to move, store, and manipulate incoming data and create outgoing data. These include Microsoft SQL Server versions 2000, 2005, and 2008 and each of their respective data transformation tools. Extracts and Uploads are coded in a variety of programming languages including Secure File Transfer Protocol (SFTP), E-Mail, and several other data exchange tools. Some of these tools, such as Microsoft SQL Server 2000, have outlived their vendor-provided support life and pose material risk to ongoing use within the environment.

Microsoft Visual SourceSafe 2005 is the program source-code control system currently in service. SourceSafe is another example of a critical tool that is too old to qualify for vendor

support. A separate project is currently underway to replace this tool with Microsoft Team Foundation Server (TFS), a next generation source-code control development tool.

### 4.5.2 End-User Tools

Microsoft Excel, Microsoft Access, and Microsoft Visual FoxPro 9 are tools used to capture data from a source. Housed as a simple data repository, this enables manual scrubbing and sorting of data for specific reporting purposes. Some examples of these include: PACT Access database, forensic information, and URS data.

Reporting is performed using Crystal Reports, Microsoft SQL Reporting Services, SPSS, SAS, FMS, tools provided in conjunction with our Avatar system, Excel, FoxPro, and others. While it is common to support multiple tools in a reporting environment so as to satisfy personal preferences and variability in staff expertise levels, the DBHDS reporting tool suite is simultaneously over-complicated and inadequate to meet current and future demands. Some normalization is appropriate to minimize technical support needs, improve consistency, and ensure quality.

## 4.6 Challenges

The DBHDS has grown organically over time in its organizational structure, processes, and technologies. This growth has resulted in a series of challenges that do not support new requirements deriving from the recent Department of Justice Settlement Agreement (DOJ) and the new Electronic Health Record System (EHRS). The issues discovered in the current data environment that pose the most significant challenges for the DBHDS are:

- Disparate data systems
- Data quality concerns
- Reporting inadequacies
- Reactive to information, rather than proactive
- Lack of process

These data and reporting challenges directly affect how the DBHDS runs its business. Not only does it take an inordinate amount of time and effort for executives to provide answers to requests on how the business is running, it also takes an excessive amount of time and effort to provide the regularly occurring reports needed to receive grant money, interact with external agencies, and provide quality management measures. Because multiple offices within the Department are producing similar reports with different datasets and methods, the information being produced is often different, and both executives and analysts lack confidence in the accuracy of the information. Finally, because only a few reports are provided on a scheduled basis, time is spent gathering, consolidating, and validating information rather than using the information to assist in the quality care and treatment of the individuals. The challenges identified here can be described in more detail through the following descriptors, provided by the business through their interviews.

#### Disparate data systems

1. Having to combine individual information from multiple sources is time consuming
2. Master individual data has many disparate identifiers
3. It takes too long to create reports/ad-hoc queries because information is everywhere
4. Importing external data extracts is a manual process
5. Data does not automatically interface between community, facilities, and central office
6. Data exists in disparate systems
7. Limited ability to compare across localities
8. Current interfaces are too rigid

### Data quality concerns

1. There are no routinized data quality checks
2. Source systems may not contain all data needed for reporting
3. Unexamined data is incorrect
4. There is an increasing risk of incorrect reports produced by non-technical staff not fully familiar with programming and complex data structures

### Reporting inadequacies

1. Facilities are all different, so success criteria are different
2. Distribution of reports at facilities are manually communicated via email
3. Reports and access to reports are not user-friendly
4. There is limited technical ability at facilities; Need easier way to use tools
5. Limited standard automated reports

### Reactive to information, rather than proactive

1. Reporting is solely on outputs, not outcomes and value
2. Reporting is driven by external requests; we do not drive our use of data
3. No monitoring/notification system for individual metrics

### Lack of process

1. There are limited processes in place to utilize the information received
2. There are multiple, incomplete, and incompatible data dictionaries/standard definitions in use
3. The data must be manually cleansed due to no standard cleansing processes
4. No confidence in data or having a data warehouse due to trying many times before

From this understanding of the current state architecture and challenges that the DBHDS faces, we address a target future state view of the organizational data ecosystem.

# 5 Future State

The current administration of the DBHDS has brought forward substantial changes to the department's operational characteristics for which data and reporting will play an essential role for the foreseeable future. These needs are customarily serviced by well-proven data warehouse and business intelligence capabilities that support all touch points of the individuals that the department serves.

A data warehouse coupled with self-service business intelligence tools provides a one-stop shop for reporting on any metrics that may be requested by internal or external stakeholders. The data warehouse incorporates internally generated information and supports its combination with external information trading partner information.

Through this holistic view, analysis and reporting is possible that will support both strategic and operational decision making for service quality management, regulatory oversight, and fiscal responsibility.

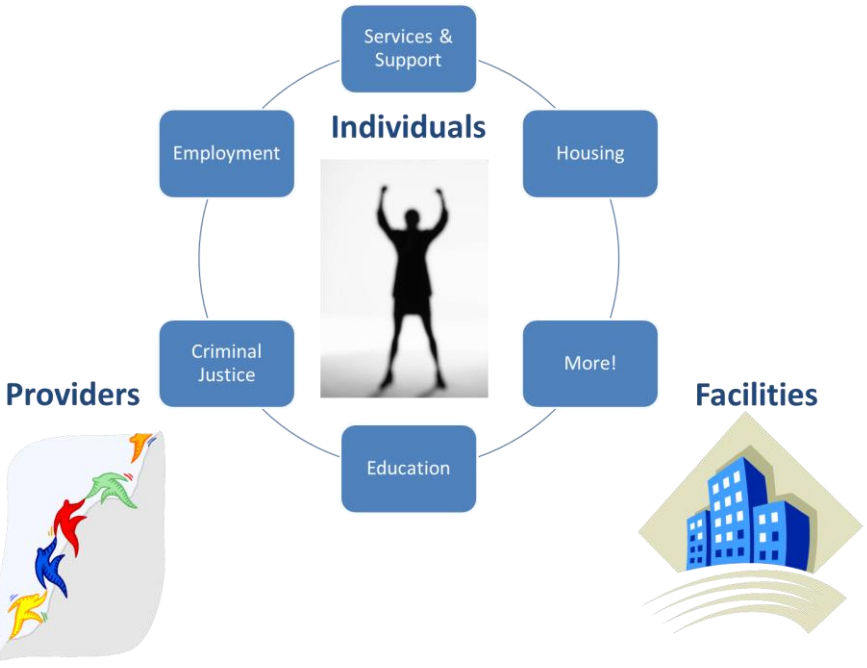



**Figure 7. The DBHDS Services**

The following sections describe a proposed future architectural state of data and reporting for the DBHDS. This strategy is based on best practice models endorsed by the Data Warehouse Institute and supported by policies, processes, and skills developed and implemented by CapTech in multiple client engagements for architectural design and implementation of data warehouses.

## 5.1 Data Warehouse Maturity

Through years of data warehouse experience, the Data Warehouse Institute (TDWI) has created a maturity model to define how advanced an organization is with regards to their data warehouse and business intelligence lifecycle. These well-defined levels have been used by many organizations to assess their data infrastructures and begin upgrade programs.

This plan proposes to mature the DBHDS from its current level of *Stage 1 maturity: Nonexistent* to a future state of *Stage 4: Repeatab*le.

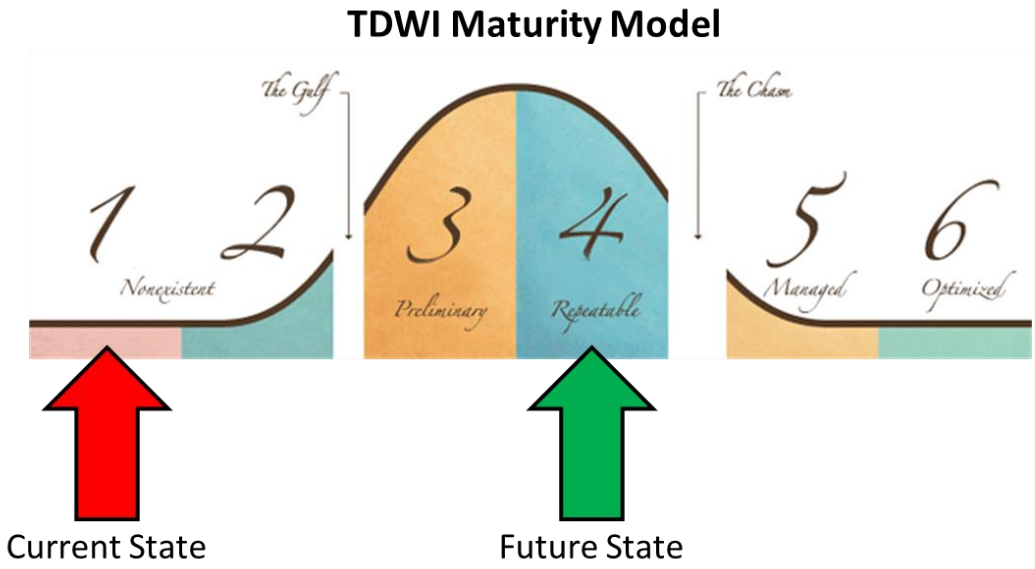



**Figure 8. Business Intelligence Maturity Model and Current versus Future State**

At *Stage 4*, the DBHDS will have all of the components required to provide:

- An integrated data repository accessible by all stakeholders
- Efficient and secure data exchange mechanisms for acquiring data from and distributing data to information trading partners
- Compatible tools and technologies that support use of any data anywhere at any time
- Tested business logic that ensures accuracy for data computation and combination
- Consistent processes and controls that ensure the right data is used for the target business purpose
- Self-service tools for immediate ad-hoc data review and analyses
- Infrastructure support for repeating scheduled report production and distribution
- Business Unit led governance processes for data ecosystem change

Once the DBHDS has operated successfully at Stage 4, additional process analysis can be performed to determine if the organization should move to a higher stage.

## 5.2. Recommended Architecture

The DBHDS will need to use a new architecture for moving, consolidating, cleansing, and accessing data to achieve *Stage 4* in the TDWI Maturity Model. The following textual description accompanies Figure 9 below, Proposed Future State Architectural Diagram.

### 5.2.1 Source Data

Data sources are any application program, database, or other origin of data to be considered in the DBHDS data universe. This will often be an Operational Datastore comprised of data recorded in day-to-day commerce of the DBHDS and its information trading partners.

### 5.2.2 Data Interface Engine

Data must first be moved from their source systems to the Staging layer of the Data Warehouse. In the recommended architecture, a Commercial-Off-the-Shelf (COTS) Data Interface Engine capable of handling any type of input source and output requirement is proposed for use. Data is manually loaded for many of the DBHDS systems, including CCS3. These processes will be automated, resulting in fewer errors, more timely and secure data, and reduced staff effort.

### 5.2.3 Staging Layer

The *Staging layer* of the Data Warehouse ecosystem is an abstraction layer to protect the integrity of the operational application systems and databases that are the data source. Each dataset will be loaded into the staging database before any data cleansing or preprocessing occurs.

The staging data will contain all data that should be retained. Each set of data has different retention policies and will be stored in this area for its lifetime.

### 5.2.4 Data Warehouse

From the *Staging layer*, data is cleansed, integrated, and moved into the *Data Warehouse* layer of the ecosystem. The data warehouse will be in a dimensional, de-normalized format for analytical reporting. It will serve as both a permanent integrated data repository and a data source for outputs to other downstream uses such as reports, aggregated data feeds to other systems and external trading partners, and optional *domain-specific* data cubes. Several of the existing databases contain a large amount of data which does not change frequently and is difficult to access. New data structures may be created to provide faster and more simplified reporting than is currently possible from Avatar, CCS3, and other agency databases, while reducing storage requirements.

### 5.2.5 Business Layer

The Business Layer bridges the Data Cubes and the Reporting Tools reflected in Figure 9. *Data Cubes* are domain specific subsets of warehouse data that have been combined in a manner to support easy access to related data. Data is often duplicated, combined, and restructured to serve frequent views/perspectives that are meaningful to a segment of data consumers. For example, a given data cube might contain all financial data, or all quality measure data, or all patient demographic data, but limited other data outside one of those specific focus areas.

Data cubes are refreshed regularly and are designed to work well with self-service ad-hoc reporting tools designed for business users as opposed to programmatic reporting tools usually designed for technical report development staff.

Data movement from Staging to Warehouse and from Warehouse to Cubes will most likely transit using the Data Interface Engine.

### 5.2.5 Reporting Tools /Business Layer

*Business Intelligence tools* encompass any software product capable to read data resident in either the Warehouse or a Cube. Microsoft Excel, programming languages, and graphical drag-and-drop products targeted at executives, administrative staff, and other non-technical data-consumers all qualify as Business Intelligence (BI) tools.

Outputs from BI tools include any form of display desired. Traditional paper reports, desktop/notebook screen displays, reader-boards, and even a single value transmitted and displayed on a handheld device such as a smart-phone or delivered to another application program and consumed into an executing application with no human review can be classified as a Business Intelligence tool.

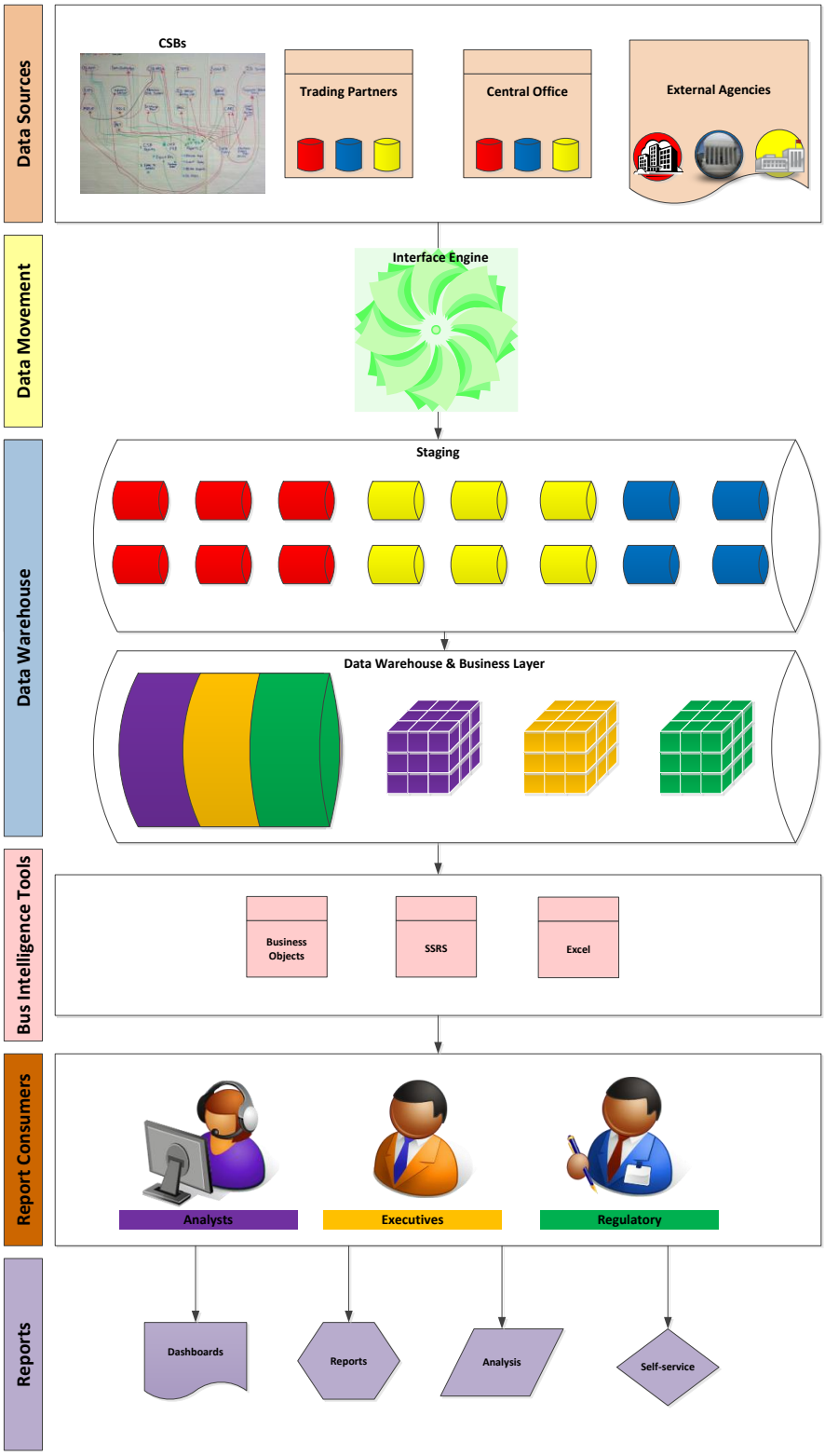



**Figure 9. Proposed Future State System Architecture Diagram**

The Data Movement and Data Warehouse sections in the proposed future state system architecture diagram highlight the most significant technology components that are different from the DBHDS current state architecture. While these components are complex Information Technology products, they are mature systems that can be easily acquired and deployed without material effort.

The following diagram shows these components in more detail.

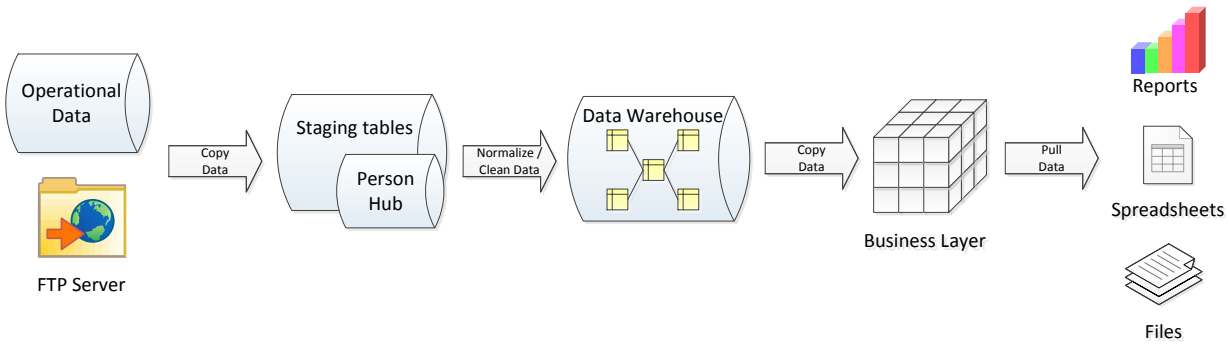



**Figure 10. Detailed Future State Diagram: New Development**

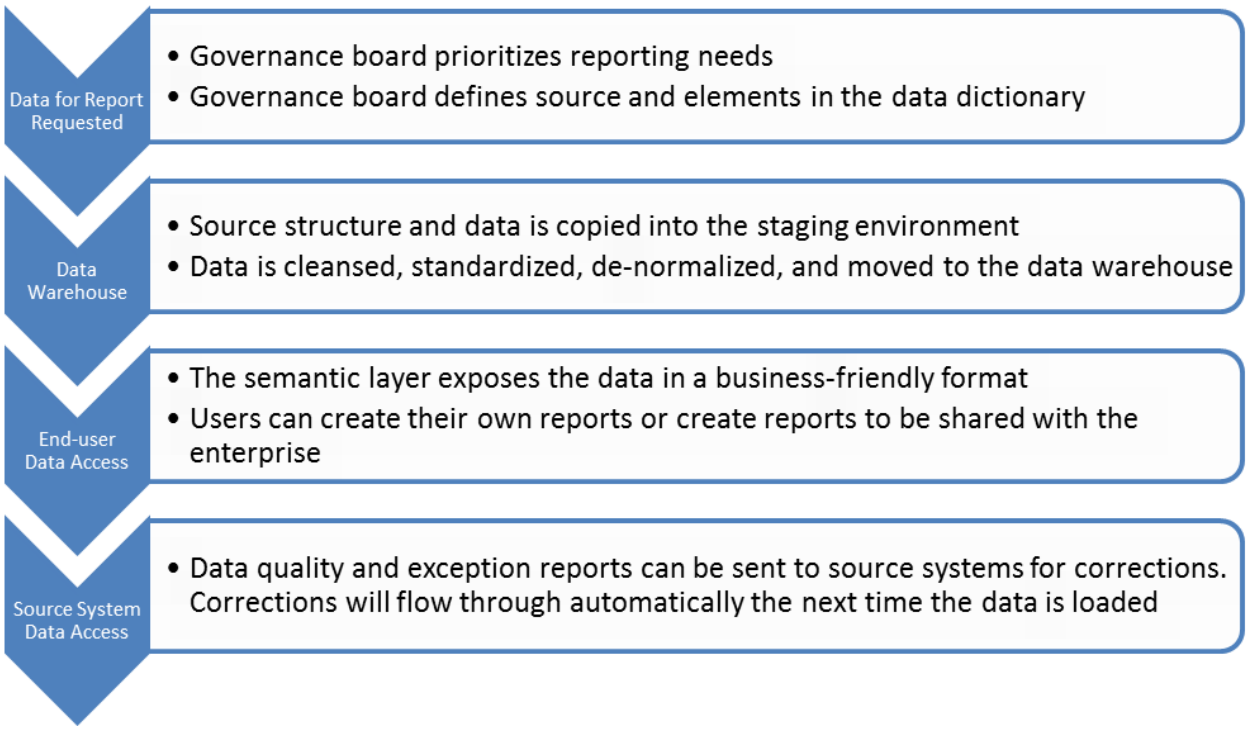
Process and Governance, discussed in the next section, are then required for the heavy lifting of morphing a Commercial-Off-The-Shelf (COTS) product into the DBHDS Warehouse. The goal of the physical technologies is to support logical work performed to create a consolidated environment of accurate useful data that is managed through a well understood suite of policies and guidelines, accurate and repeatable processes, organization-wide consistency, and business-led governance.

This work represents significant transformation of existing workflows, staff collaboration, buy-in, and behavior, and a shared understanding of business strategy and needs between business units and technical teams.

## 5.3 Data Process

The DBHDS uses many processes to carry out its data and reporting needs. Like the current architecture, they are not generally standard, coordinated, or often shared. The future state will introduce new processes that are aligned with a future state vision of business-led governance, shared data, standardization, and consistent outputs.

An overview of the process is reflected in the following diagram with more detailed descriptions of each contributor below.




## 5.4 Data Governance

The lifecycle of DBHDS data should be managed through a repeatable governance process. CapTech recommends the creation of a data governance board specifically focused on the data warehouse project. The board should include members from all major stakeholder groups including multiple Central Office business units, a CSB representative, Facilities, Information Services & Technology, and potentially others. The responsibilities of the board will include prioritizing what data elements should be included in the data warehouse, the definitions of each element, and the distribution scope of the data element.

The Data Management Committee (DMC) serving the CSBs has expressed interest in aligning DMC needs and vision re: data with the DBHDS. This body is the logical choice to represent the interests of the CSBs and has been incorporated into planning discussions for the DBHDS Data Warehouse project.

Composition of the Governance Board will evolve in parallel with changing business needs.

### 5.4.1 Data Policies

A key part of the Data Warehouse Governance Committee's job will be to define guidelines and policies for each data element that enters the data warehouse ecosystem. While most of this work will generally be performed by technical staff, this work process must have business-led oversight. The time-value of data illustrated below is an example of one such key policy.

The value of all data changes over time. The value of *most* data rises rapidly during its very early stages of life and declines as time progresses. Again, ***most*** data will eventually cross the line of having zero value and will become negative.

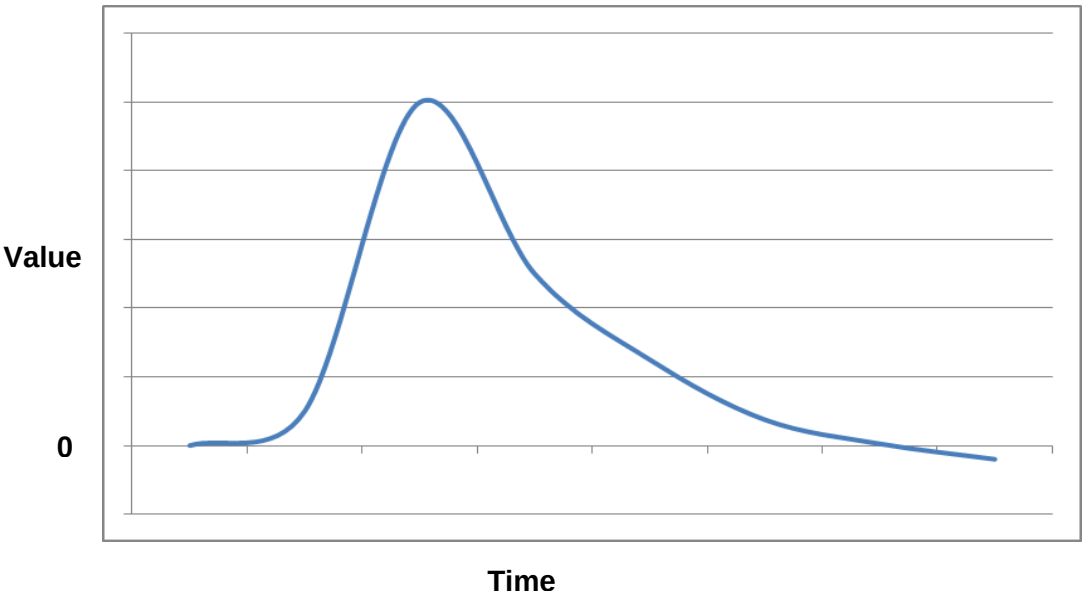



**Figure 11. Data Value over Time**

This concept becomes clear when considering your own email. Upon creation, the information contained therein tends to spike to its maximum value very quickly. Often within a day, the information has subsided in value, perhaps entirely. Within a week, a month, or a year it has likely lost all value.

When we begin to consider the costs of keeping data and its ongoing backup and long-term management costs, the value that data provides will eventually drop below the expense required to maintain access to the data.

When we factor in other potential costs, such as an error in data selection and use of out-of-date data in a current report, it becomes sensible to define data retention policies that govern what data should be kept, for how long, and how data will be ultimately be archived and/or destroyed.

Every data element goes through a process of discovery, definition, cleansing, storage, retention, and archival. Policies governing these processes are a Governance role.

## 5.5 Technology

A standard suite of Commercial-Off-The-Shelf (COTS) technologies and applications will be used in the DBHDS data warehouse development and deployment. Coordination and compatibility are planned with existing and future technologies used within VITA, EHRS, and the eHHR initiative.

### 5.5.1 Microsoft SQL Server Consolidated Toolset

The DBHDS intends to deploy its data warehouse using currently supported versions of the Microsoft SQL Server Database and Business Intelligence suite.

This suite is capable to support all required databases, a substantial portion of the data movement requirements, all cube creation, and a substantial portion of Analytic and Report Development tool needs.

Other data movement, transformation and reporting tools may be engaged to support:

- Data movement from/to very large or sophisticated data sources
- Analyses and report creation where other tools better serve business requirements and/or staff skills

### 5.5.2 Office Database Elimination

Functionality that is currently housed within departmental Microsoft Access databases and Excel spreadsheets will migrate into the data warehouse. This is required to ensure data integrity, data transparency, standardization of data usage, and to recapture the manual labor currently spent to maintain these data silos.

This requirement embodies a need for cultural change within the DBHDS. Business units currently view data as being locally owned and managed within a department. *Absent an organizational commitment to treat all data as owned and managed at the organizational level, implementation of a data warehouse will not succeed and should not be attempted.*

### 5.5.3 Master Data Management

A Master Patient Index (Person Hub) will be required to resolve differences in spelling of names and other demographic data that cause the computer to see “Jim Jones” and “Jimmy Jones” as different people. Multiple person matching criteria capabilities are available in COTS products designed expressly for this purpose. The data warehouse will leverage technologies used in the EHRS project and planned to be provided by the eHHR initiative for this critical function.

### 5.5.4 Data Dictionary

A unique comprehensive data dictionary must be established to support a full list of data elements, document where data is currently used, and to define the business logic used to create that element and to calculate values derived from data in analyses. The data dictionary

will normalize the disparate definitions in use today and support an environment where there is a single version of the truth for data used in reports derived from the data warehouse.

## 5.6 Organization

The DBHDS does not currently have sufficient staff to build or support a data warehouse. Development, deployment, and maintenance of a data warehouse will require multiple highly-specific technical skillsets at varying capacity levels during different stages of the project.

CapTech recommends using a blended staffing model for the DBHDS Data Warehouse project. Consultant staff who are already well-versed in data warehouse technologies and development processes should lead infrastructure design and deployment work, governance and process creation, and early-adopter deployments.

Business domain Subject Matter Experts (SME) from the DBHDS business units will interact directly with Data Warehouse architects, data stewards, and ETL/Report developers to build the logical structure of the warehouse and incorporate data from data sources into the warehouse.

IS&T staff will work alongside both Consultant staff and business unit SMEs to ensure proper integration of the warehouse into the DBHDS Strategic Information Technology Plan and to develop the requisite skills required for long-term evolution, support, and maintenance of the Data Warehouse ecosystem.

| Role | Definition | Min | Exists |
|---|---|---|---|
| Manager | Handles the data warehouse and reporting project schedules and interfaces with the executive team. | 1 | |
| Data Steward | Maintains the data dictionary and upholds the standard enterprise definitions. Manages the Person Hub information. | 1 | 1 |
| Business Analyst | Works with the business to discover new data definitions and works with the rest of the data warehouse team to share data and reporting requirements. | 1 | 1 |
| Architect/Data Modeler | Oversees the technical direction of the warehouse and reporting solution and creates and maintains the model for the staging layer and data warehouse. | 1 | |
| ETL Developer | Creates all inbound and outbound feeds to/from the application database and data warehouse. | 2 | 2 |
| Report Developer | Creates all reports from the application database and data warehouse. Performs ad-hoc report development. | 1 | 1 |
| Database Administrator | Ensures the accessibility and usability of the database server through backups, maintenance, and query tuning. | 1 | 1 |
| Tester | Creates test cases for all data feeds and reports. Validates all reports before being sent externally. | 2 | |

**Table 1. Staffing Requirement**

Long-term support for the Data Warehouse will require a team of 1-2 FTE Warehouse-focused staff (Data Steward, Architect / Data Modeler) with ready access to shared technical staff for most of the other roles reflected in Table 1.

# 6 Benefits

By establishing a data warehouse and self-service business intelligence solution the DBHDS gains reliable and sustainable processes to create, manage, and leverage information across its entire scope of strategic and operational domains. The business process transformation required to achieve *Stage 4* of the TDWI Maturity Model will yield a holistic perspective and understanding throughout all staff levels and across all program domains.

Efficiencies will be uncovered through quality analyses of program operations and also in the data management and reporting work required to develop analyses. Organizational credibility will rise as consistency in operational reporting and outcome measures begin to drive organizational decision making.

Self-service capabilities for reporting and analysis will reinforce staff ownership for initiation and follow-through of needed corrective actions. Data producers will invest effort to improve the quality of their data knowing that the data has potential to modify courses of action. Data consumers will have confidence that the data they are using has been properly vetted, is accurate, and appropriate for use in their domain.

Empowerment of employees is the single greatest factor in improving organizational performance and retention of experienced staff. A well-functioning data management and analysis capability is a critical prerequisite for that empowerment.

# 7 Implementation Roadmap

Based on our prior experience and our conversations with the DBHDS stakeholders, CapTech recommends that the DBHDS build a centralized, enterprise data warehouse. This approach has the major advantage of allowing the DBHDS to build out its new data environment incrementally, focusing initially on those subject areas and business intelligence capabilities most critical to the business. It will position the DBHDS to demonstrate value from the new data environment quickly, add additional value over time, and adjust to changing requirements as they evolve.

As is in any significant business transformation initiative, technical activities are just one component of successful execution. DBHDS staff will need to provide ongoing input to program governance, requirements, and user acceptance testing. Existing IT staff responsible for infrastructure maintenance and production support will invest time establishing new infrastructure, administering new systems, receiving knowledge transfer, and supporting new production platforms. Technical and non-technical data consumers will need to participate in formal and informal training to ramp-up on new data stewardship and reporting mechanisms. To the extent the DBHDS wants to do business differently in order to either support higher quality data collection or take action on newly available information, DBHDS managers will need to define and implement these policies and procedures and training programs.

The overall project delivery will take approximately 33 months. A sample roadmap can be seen here, depending on the priorities that are defined throughout the lifecycle of the project. The times associated with these phases are strictly estimates based on number of staff, availability of resources, and complexity of scope.

| ID | Component | Task Name | Start | Finish |
|---|---|---|---|---|
| 1 | Prototype | Establish Prerequisites | 2/1/2013 | 2/28/2013 |
| 2 | Prototype | Establish Architecture/Framework | 3/1/2013 | 4/17/2013 |
| 3 | Prototype | Design and Implement Person Hub | 4/18/2013 | 7/2/2013 |
| 4 | Prototype | Build Prototype: Behavioral Health metrics | 7/3/2013 | 10/31/2013 |
| 5 | Warehouse | Build Data Warehouse Iteration #1: Services | 11/1/2013 | 3/3/2014 |
| 6 | Warehouse | Build Data Warehouse Iteration #2: Housing | 3/4/2014 | 7/2/2014 |
| 7 | Warehouse | Build Data Warehouse Iteration #3: Employment | 7/3/2014 | 10/31/2014 |
| 8 | Warehouse | Build Data Warehouse Iteration #4: Facilities | 11/3/2014 | 3/3/2015 |
| 9 | Warehouse | Build Data Warehouse Iteration #5: Criminal Justice | 3/4/2015 | 7/2/2015 |
| 10 | Warehouse | Build Data Warehouse Iteration #6: Providers | 7/3/2015 | 11/2/2015 |

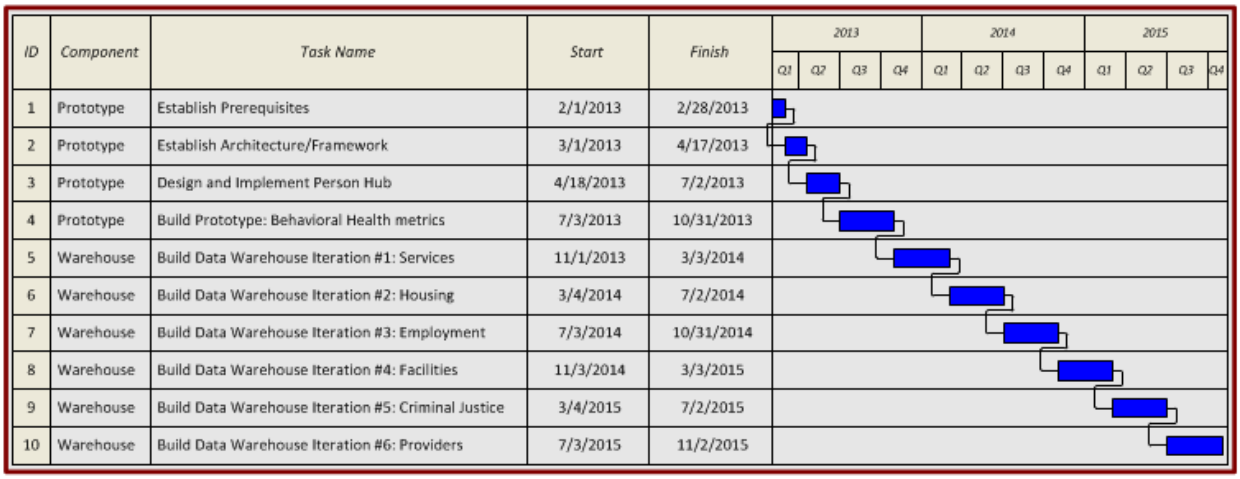



**Figure 12. Sample Data Warehouse Implementation Plan**

CapTech recommends that the work be divided into two components: Prototype and Warehouse. The following sections describe each component.

## 7.1 Prototype Component

This section provides a high-level plan using a phased approach for addressing the challenges and opportunities to implement the target environment based on the business's priorities. In the first component, Prototype, the groundwork is laid for future development, which includes creation of the governance board, definition of a development framework and standards, design of a master data management system to map individuals from different systems together, and an initial foray into a data repository and self-service reporting solution. At the end of the Prototype component, which will include approximately 5 resources for 8 months, the DBHDS will be at *Stage 2* in the Maturity Model. This component is expected to cost approximately one million dollars. The Prototype component contains four phases: Establish Prerequisites, Establish Architecture/Framework, Design and Implement Person Hub, and Build Prototype. Each phase is described below.

### Establish Prerequisites (1 month, team of 2)

The *Establish Prerequisites* phase prepares the DBHDS and the development team for a data warehouse project. Preparation materials created include a marketing plan, project charter, detailed project plan, and a governance board mission statement. In addition, all people to be involved in the project will be identified and read in. Finally, this phase will ensure the technical environments are available for development at the beginning of the project. By the end of the first month, the team should be able to start developing. High level tasks include:

- Plan data warehouse marketing
- Acquire hardware and software for all environments
- Identify and acquire personnel, business sponsor

### Establish Architecture/Framework (1.5 month, team of 5)

The *Establish Architecture/Framework* phase prepares the technical environment for development of a data warehouse. A standard architecture for all development will decrease development and maintenance times and provide a consistent standard for all future development. A data integration framework is used to manage and standardize configurations, logging, and reporting of data movement across the organization. Similarly, a reporting architecture will provide a standard approach for the development, deployment, and accessibility of all reports in the DBHDS. High level tasks include:

- Define standards
- Define Data Management Framework
- Define Reporting Structure and Layout

### Design and Implement Person Hub (2.5 months, team of 5)

The *Design and Implement Person Hub* phase creates the master data management system to link individuals from different systems together. This phase builds the underlying technology to handle this mapping and will import and map three different sources together with the help of the DBHDS. After this phase is completed, business users will be able to identify the same individual from the three different systems without having to do their own matching. High-level tasks include:

- Create mapping structures
- Create front-end for mapping
- Import and map 3 sources
- Train data steward on governance

### Build Prototype (4 months, team of 5)

The *Build Prototype* phase populates the staging and data warehouse structures, the self-service business intelligence area, and provides initial reports. This phase will use an initial set of data, to be determined by the Data Warehouse Governance committee, which will provide instant business value. Once this phase has been completed, business users will be able to consume data for the initial set of data and receive reports that are published on a regular basis. High level tasks for this phase include:

- Initiate Data Discovery
- Model Database Structures
- Create Data Loads
- Design Business Layer
- Design Reports

Once the Prototype Component has been completed, the Warehouse component can be built.

## 7.2 Warehouse Component

The Warehouse component builds upon the Prototype component by iteratively adding subject areas to the data repository and implementing a self-service business intelligence solution. Using 4-month iterations with a team of 5, in approximately 6 iterations, the data warehouse will include the subject areas needed to satisfy the DOJ settlement and quality management requirements. As the skillsets of the DBHDS employees increase, CapTech consultants can be replaced with full-time employees to create a blended team that will reduce the cost to the DBHDS while ensuring thorough knowledge transfer. The interaction is described below, and will be repeated for each area of the business.

### Build Data Warehouse Section (4 month iterations, team of 5)

The *Build Data Warehouse Section* populates the staging and data warehouse structures, the self-service business intelligence area, and provides initial reports. This phase will use an ever growing amount of data, to be determined by the Data Warehouse Governance committee, which will provide instant business value. Once this phase has been completed, business users will be able to consume data for the next set of data and receive reports that are published on a regular basis. High level tasks include:

- Initiate Data Discovery
- Model Database Structures
- Create Data Loads
- Design Business Layer
- Design Reports

## Conclusion

By implementing the strategy outlined in this document, the DBHDS will have an enterprise warehouse and reporting capabilities able to meet the present needs of the organization and capable to evolve as future requirements change. The DBHDS can save their organization time and resources dealing with complex reporting and data quality issues allowing staff to focus on the mission statement of providing the best care for those individuals they serve.

## Appendix A. Stakeholders Interviewed

1. George Banks, Evaluation Associate (Behavioral Health - Resource Management)
2. Jack Barber, Acting Medical Director (Commissioner Office)
3. Bob Bean, DBA (IS&T)
4. Jae Benz, Training Center Operations Manager (Developmental Services)
5. Victoria Cochran, State Coordinator, Mental Health & Criminal Justice Services (Behavioral Health)
6. Charline Davidson, Director (Planning & Development)
7. Sterling Deal, Manager, Research & Evaluation (Substance Abuse Services)
8. Heidi Dix, Assistant Commissioner, Developmental Services (Developmental Services)
9. Kathy Drumwright, Assistant Commissioner, Quality Management & Development (Clinical Quality & Risk Management)
10. Adrienne Ferriss, Behavioral Health - Resource Management (IS&T)
11. Wanda Fitzgerald & David Mawyer, IT, Western State Hospital
12. Olivia Garland, Deputy Commissioner
13. Paul Gilding, Director (Community Contracting)
14. Marion Greenfield, Director (Clinical Quality & Risk Management)
15. Phyllis Harden-West, Change Management (IS&T)
16. Steve Herrick, Director, Piedmont Geriatric Facility
17. Beth Lock, Systems Analyst (IS&T)
18. Scott Logue, IT, Piedmont Geriatric Facility
19. Janet Lung, Director (Child and Family Services)
20. Jim Martinez, Director (Behavioral Health)
21. Diane Marsiglia, Programmer/Analyst (IS&T)
22. David Mills, Technical Assistance Consultant (Child and Family Services)
23. John Pezzoli, Assistant Commissioner, Behavioral Health Services (Behavioral Health)
24. Lee Price, Director (Developmental Services)
25. Mellie Randall, Manager, Planning & Grants Management (Behavioral Health)
26. Les Saltzburg, Director (Licensing)
27. Russ Sarbora, CIO (Information Services &Technology)
28. Michael Schaefer, Forensic Director (Forensic Services)
29. Michael Shank, Director, Community Support Services (Behavioral Health)
30. Herv Sherd, IT Specialist, Substance Abuse Services (IS&T)
31. Jim Stewart, Commissioner
32. Beverly Thomas, Project Manager (IS&T)
33. VACSB, Cathy Pumphrey, Jo Powell, David Schullery, Mary Ann Bergeron
34. James Wiers, CIO, Eastern State Hospital
35. Steven Wolf, Director of Sex Offender Services (Sexually Violent Predator Services)
36. Jack Wood, now former Director, Eastern State Hospital
37. Joy Yeh, Assistant Commissioner (Finance and Administration)