



Technical Design Document PPM Version 2.0

<Project or System Name>

U.S. Department of Housing and Urban Development

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Document History

<Provide information on how the development and distribution of the Technical Design Document is controlled and tracked. Use the table below to provide the version number, date, author, and a brief description of the reason for creating the revised version.>

Version No.	Date	Author	Revision Description

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1. Architecture Design and Provision for Updates

<This section outlines the system and hardware architecture design of the system. In the sub-sections below, describe the system architecture and how Enterprise Architecture related information with reference to any changes of the EA layers would be updated.

Briefly introduce here the system context and the basic design approach or organization. Provide a brief overview of the system and software architectures and the design goals. Include the high-level context diagram(s) for the system and subsystems previously provided in the High-Level Technical Design Concept/Alternatives and/or Requirements Document, updated as necessary to reflect any changes that have been made based on more current information or understanding. If the high-level context diagram has been updated, identify the changes that were made and why. >

1.1 Logical View

<Insert any related logical views or provide a reference to where they are stored.> The purpose of the logical view is to specify the functional requirements of the system visually. The logical view is your “big picture” and allows you to present the structure of the system through its components and their interactions.

1.2 Hardware Architecture

<Describe the overall system hardware and organization. Include a list of hardware components with a brief description of each item and diagrams showing the connectivity between the components. If appropriate, use subsections to address each subsystem.>

1.3 Software Architecture

<Describe the overall system software and organization. Include a list of software modules (this could include functions, subroutines, or classes), database platform, computer languages, and programming computer-aided software engineering tools, commercial off-shelf (COTS) software, open source frameworks (with a brief description of the function of each item and identifying information such as manufacturer, version number, number and types of licenses needed as appropriate.

Note: *The diagrams must map to the Requirements Definition document, data flow diagrams, providing the physical process and data flow (describing how each input is processed/transformed into the resulting output). Insert any software architecture documents or provide a reference to where they are stored.>*

1.4 Security Architecture

<Insert any related security documents, including PPM Security Plan, integrity controls, or provide a reference to where they are stored.>

1.5 Communication Architecture

<Describe the overall communications within the system (e.g. LANs, buses). Include the communications architecture(s) being implemented and how the system components are linked (e.g. X.25, Token Ring). Provide a diagram depicting the communication flow between the system and subsystem components. If

appropriate, use subsections to address each architecture being employed. Insert any related communication architecture documents or provide a reference to where they are stored.>

1.6 Performance

<Insert any performance documents or provide a reference to where they are stored.>

2. Detailed Design

<In the sub-sections below, provide the information needed for the development team to actually build and integrate the hardware components, code and integrate the software modules, and interconnect the hardware and software segments into a functional product. Additionally and if applicable, address the detailed procedures for combining separate commercial-off-the-shelf (COTS) packages into a single system. Map every detailed requirement to the Requirements Definition document and include the Requirements Traceability Matrix (RTM) as an appendix to this design document.>

2.1 Hardware Detailed Design

<A hardware component is the lowest level of design granularity in the system. Depending on the design requirements, there may be one or more components per system. Provide enough detailed information about individual component requirements to correctly build and/or procure all the hardware for the system (or integrate COTS items).

If there are many components or if the component documentation is extensive, place it in an appendix or reference a separate document. Add additional diagrams and information, if necessary, to describe each component and its functions, adequately. Follow industry standard component specification practices. For COTS procurements, if a specific vendor has been identified, include appropriate item names. Include the following information in the detailed component designs (as applicable):

- *Power input requirements for each component*
- *Signal impedances and logic states*
- *Connector specifications (serial/parallel, 11-pin, male/female, etc.)*
- *Memory and/or storage space requirements*
- *Processor requirements (speed and functionality)*
- *Graphical representation depicting the number of hardware items (for example, monitors, printers, servers, I/O devices), and the relative positioning of the components to each other*
- *Cable type(s) and length(s)*
- *User interfaces (buttons, toggle switches, etc.)*
- *Hard drive/floppy drive/CD-ROM requirements*
- *Monitor resolution>*

2.2 Software Detailed Design

<A software module is the lowest level of design granularity in the system. Depending on the software development approach, there may be one or more modules per system. Provide enough detailed information about logic and data necessary to completely write source code for all modules in the system (and/or integrate COTS software programs).

If there are many modules or if the module documentation is extensive, place it in an appendix or reference a separate document. Add additional diagrams and information, if necessary, to describe each

module, its functionality, and its hierarchy. Follow industry standard module specification practices. Include the following information in the detailed module designs:

- *A narrative description of each module, its function(s), the conditions under which it is used (called or scheduled for execution), its overall processing, logic, interfaces to other modules, interfaces to external systems, security requirements, etc. Explain any algorithms used by the module in detail*
- *For COTS packages, specify any call routines or bridging programs to integrate the package with the system and/or other COTS packages (e.g. dynamic link libraries)*
- *Data elements, record structures, and file structures associated with module input and output and a CRUD matrix of modules to data entities.*
- *Graphical representation of the module processing, logic, flow of control, and algorithms, using an industry standard notation and diagramming approach (e.g. structure charts action diagrams, flowcharts)*
- *Data entry and data output graphics; define or reference associated data elements; if the project is large and complex or if the detailed module designs will be incorporated into a separate document, then it may be appropriate to repeat the screen information in this section*
- *Report layout (e.g. type of report and report design >*

2.3 Internal Communications Detailed Design

<If the system includes more than one component there may be a requirement for internal communications to exchange information, provide commands, or support input/output functions. Provide enough detailed information about the communication requirements to correctly build and/or procure the communications components for the system. Include the following information in the detailed designs (as appropriate):

- *The number of servers and clients to be included on each area network*
- *Specifications for bus timing requirements and bus control*
- *Format(s) for data being exchanged between components*
- *Graphical representation of the connectivity between components, showing the direction of data flow (if applicable), and approximate distances between components; information should provide enough detail to support the procurement of hardware to complete the installation at a given location*
- *Local Area Network (LAN) topology>*

3. Interfaces

3.1 External Interfaces

<Describe the electronic interface(s) between this system and each of the other systems and/or subsystem(s), emphasizing the point of view of the system being developed. External systems are any systems that are not within the scope of the system under development, regardless of whether the other systems are managed by HUD or another agency.

If the interface information is too detailed or complex, reference the Interface Control document in this section.>

3.2 Interface Detailed Design

<For each system that provides information exchange with the system under development, there is a requirement for rules governing the interface. Provide enough detailed information about the interface requirements to correctly format, transmit, and/or receive data across the interface. Remember to utilize relevant information from previous artifacts. Include the following information in the detailed design for each interface (as appropriate):

- The data format requirements; if there is a need to reformat data before they are transmitted or after incoming data is received, tools and/or methods for the reformat process should be defined*
- Specifications for hand shaking protocols between the two systems; include the content and format of the information to be included in the hand-shake messages, the timing for exchanging these messages, and the steps to be taken when errors are identified*
- Format(s) for error reports exchanged between the systems; address the disposition of error reports (e.g. retained in a file, sent to a printer, flag/alarm sent to the operator)*
- Graphical representation of the connectivity between systems, showing the direction of data flow*
- Query and response descriptions*

If the interface information is too detailed or complex, reference the Interface Control document in this section.>

4. User Interface

<In the subsections below, describe the detailed design of the system and subsystem inputs and outputs relative to the user/operator. Depending on the particular nature of the project, it may be appropriate to repeat these sections at both the subsystem and design module levels. Provide additional information in the subsections if the suggested lists are inadequate to describe the system's inputs and outputs.>

4.1 Inputs

<Describe the input media used by the operator for providing information to the system (e.g. data entry screens, optical character readers, bar scanners). If appropriate, reference the input record types, file structures, and database structures provided in Section 6 - Data Design. Include reference to the data dictionary.

Provide the layout of all input data screens or graphical user interfaces (GUIs) (e.g. Microsoft Windows). Provide a graphic representation of each interface. Define all data elements associated with each screen or GUI, or reference the data dictionary.

This section should reference the HUD Standard Data Dictionary for the data elements, including specific values, range of values, mandatory/optional, alphanumeric values, and length. Also address data entry controls to prevent edit bypassing.

Discuss the miscellaneous messages associated with operator inputs, including the following:

- *Copies of form(s) if the input data are keyed or scanned for data entry from printed forms*
- *Description of any access restrictions or security considerations*
- *Each transaction name, code, and definition, if the system is a transaction-based processing system>*

4.2 Outputs

<Describe the system output design relative to the user/operator; show a mapping to the high level data flows described in Section 2.2. - Software Detailed Design. System outputs include reports, data display screens and GUIs, query results, etc. The following should be provided, if appropriate:

- *Identification of codes and names for reports and data display screens*
- *Description of report and screen contents (provide a graphic representation of each layout and reference the data dictionary)*
- *Description of the purpose of the output, including identification of the primary users*
- *Report distribution requirements, if any (include frequency for periodic reports)*
- *Description of any access restrictions or security consideration>*

5. Section 508 Compliance

Discuss how the system and hardware architecture design will address and integrate accessibility features that align with best practices for section 508 compliance. Section 508 compliance Best Practices information is available on the HUD web site as follows:

The HUD Section 508 Policy website <http://hudatwork.hud.gov/po/i/508/overview.cfm> provides a link to the HUD level policy. The Section 508 Coordinators, Officials, and Other Public Contacts web site <http://hudatwork.hud.gov/po/i/508/roles.cfm> lists functional area coordinators and other officials who are directly responsible for Section 508 activities across HUD. The HUD Section 508 Voluntary Template Product Accessibility Template (VPAT) web site <http://hudatwork.hud.gov/po/i/508/forms.cfm> provides information on the requirements for vendors involved in Section 508-related products and services and provides information on completing the product assessment templates and links in consideration of Section 508 of the Rehabilitation Act of 1973. The HUD Tools web site <http://hudatwork.hud.gov/po/i/it/sd/guide/section508.cfm> includes contact information that identifies the functional requirements of a project including the intended users and how the application will be accessed. The GSA-sponsored Section 508 web site (<http://section508.gov>)

provides information at the Federal level on Section 508 laws and applicable EIT standards developed by the U.S. Access Board.

For HUD IT projects, the following Section 508 compliance practice activities are appropriate:

Ensure projects include high level compliance requirements in the design and use of the IT solution and how provisions for Section 508 compliance will be made in:

- I. **Testing** – Develop and execute a testing plan utilizing available tools.
- II. **Implementation** – Implement any required changes.
- III. **Review** – Re-evaluate compliance whenever changes or updates are made.

6. Data Design

*<Interact with the database administrator (DBA) when preparing this section. In the sub sections below, provide the final design of all database management system (DBMS) files and the non-DBMS files associated with the system under development. Provide a **data model** and comprehensive **data dictionary** showing data element name, type, length, source, validation rules, maintenance (create, read, update, delete (CRUD) capability), data stores, outputs, aliases, and description. The data dictionary can be included as an appendix. Use the standards provided by the Data Steward Advisory Group (DSAG).>*

6.1 Database Management System Files

<Provide the final design of the DBMS files and include the following information, as appropriate (refer to the data dictionary):

- *Refined logical model; provide normalized table layouts, entity relationship diagrams, and other logical design information (reference or update information from the Solutions Architecture document).*
- *Separate from the logical model, provide a physical description of the DBMS schemas, sub-schemas, records, sets, tables, storage page sizes, etc.*
- *Access methods (e.g. indexed, via set, sequential, random access, sorted pointer array)*
- *Estimate of the DBMS file size or volume of data within the file, and data pages, including overhead resulting from access methods and free space*
- *Definition of the update frequency of the database tables, views, files, areas, records, sets, and data pages; estimate the number of transactions if the database is an online transaction-based system>*

6.2 Non-Database Management System Files

<Provide the detailed description of all non-DBMS files and include a narrative description of the usage of each file—including if the file is used for input, output, or both; if this file is a temporary file; an indication of which modules read and write the file; and file structures (refer to the data dictionary). As appropriate, the file structure information should:

- *Identify record structures, record keys or indexes, and reference data elements within the records*

- Define record length (fixed or maximum variable length) and blocking factors
- Define file access method, e.g. index sequential, virtual sequential, random access
- Estimate the file size or volume of data within the file, including overhead resulting from file access methods
- Define the update frequency of the file; if the file is part of an online transaction-based system, provide the estimated number of transactions per unit time, and the statistical mean, mode, and distribution of those transactions>

7. Integrity Controls

<Sensitive systems use information for which the loss, misuse, modification of, or unauthorized access to that information could affect the conduct of Federal and HUD programs, or the privacy to which individuals are entitled.

If this is a sensitive system, provide specifications for the following minimum levels of control:

- Internal security to restrict access of critical data items to only those access types required by users
- Audit procedures to meet control, reporting, and retention period requirements for operational and management reports
- Application audit trails to dynamically audit retrieval access to designated critical data
- Standard tables to be used or requested for validating data fields
- Verification processes for additions, deletions, or updates of critical data
- Ability to identify all audit information by user identification, network terminal identification, date, time, and data accessed or changed>

8. Analysis of Capacity

<Define the capacity requirements by considering what work will be performed by the system. Consider the following: system performance requirements, expected volume of information to be processed and stored, the quantity of work, and the agreed upon measurement of system performance, testing considerations, and agreed upon service level requirements.

Conduct an analysis of the current capacity and validate the capabilities of the existing resources (CPU, memory, hard drives, etc.). Describe plans for growth and/or upgrades and how they will be addressed and managed. Consider not only the requirements for additional hardware, software, building materials, and space but also where funding for these things will come from, additional resource allocation requirements, staffing, training, other expenditures, etc.

Remember to consider future requirements. Expand upon this section by adding/removing additional scenarios if necessary.>

Capacity Type	Current Capacity Analysis	Planned/Expected Growth and Recommendations
<i><Describe the capacity requirement analyzed. Enter details on current & future capacity requirements.></i>	<i><Describe currently available capacity.></i>	<i><Describe how future growth expectations have been identified and analyzed. Outline recommendations for managing and addressing this expected growth.></i>

Table 1 - Analysis of Capacity

9. Findings Summary

<If applicable, describe historical capacity growth patterns. Explain how future expected capacity requirements have been identified and analyzed. Outline recommendations for managing and addressing expected growth.

Insert a table/illustration, or provide a reference to where it is stored, that shows the different recommendations to address each of the capacity scenarios illustrated above.

Describe how expected growth will be monitored and managed. Below is a basic example of a table that may be used to illustrate one approach for monitoring and managing future capacity. The approach used to illustrate these requirements may differ from project to project.>

Area/Item Monitored	Capacity Requirements	% Increase Needed Per <time period>	Capacity Threshold(s)	Threshold Response Strategy (Action to Be Take Upon Reaching Threshold)
<i><Hard Drive Storage></i>	<i><Enter capacity requirements and measures.></i>	<i><Enter projected increases over intervals of time.></i>	<i><Enter acceptable capacity threshold(s).></i>	<i><Enter response strategies to varying threshold limits. Threshold is defined as the level at which an event or change occurs.></i>
<i><Number of Project Staff></i>				
<i><Ratio of Quality Assurance Staff to Development Staff></i>				

Table 2 - Findings Summary

Appendix A: References

<Insert the name, version number, description, and physical location of any documents referenced in this document. Add rows to the table as necessary.>

Table 3 below summarizes the documents referenced in this document.

Document Name	Description	Location
<i><Document name and version number></i>	<i><Document description></i>	<i><URL to where document is located></i>

Table 3 - Appendix A: References

Appendix B: Key Terms

Table 4 below provides definitions and explanations for terms and acronyms relevant to the content presented within this document.

Term	Definition
<i>[Insert Term]</i>	<i><Provide definition of term and acronyms used in this document></i>

Table 4 - Appendix B: Key Terms