NOAA NESDIS
CENTER for SATELLITE APPLICATIONS and RESEARCH (STAR)

TASK GUIDELINE

TG-8
DETAILED DESIGN (STEP 8)
TASK GUIDELINES

Version 3.0

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VERSION HISTORY SUMMARY

Version	Description	Revised Sections	Date
1.0	No version 1		
2.0	No version 2		
3.0	New Task Guideline adapted from CMMI guidelines by Ken Jensen (Raytheon Information Solutions)	New Document	10/01/2009

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LIST OF ACRONYMS

ATBD	Algorithm Theoretical Basis Document
BB	Baseline Build
CDD	Critical Design Document
CDR	Critical Design Review
CDRR	Critical Design Review Report
CI	Cooperative Institute
CICS	Cooperative Institute for Climate Studies
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CIOSS	Cooperative Institute for Oceanographic Satellite Studies
CIRA	Cooperative Institute for Research in the Atmosphere
CL	Check List
CLI	Check List Item
CoRP	Cooperative Research Program
CM	Configuration Management
CMMI	Capability Maturity Model Integration
CREST	Cooperative Remote Sensing and Technology Center
DDD	Detailed Design Document
DG	Document Guidelines
DM	Data Management
DPP	Development Project Plan
DPR	Development Project Report
EPG	Enterprise Process Group
EPL	Enterprise Product Lifecycle
G4D	Gate 4 Document
G4RR	Gate 4 Review Report
IPT	Integrated Product Team
NESDIS	National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
OCD	Operations Concept Document

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PAR	Process Asset Repository
PBR	Project Baseline Report
PDD	Preliminary Design Document
PDR	Preliminary Design Review
PDRR	Preliminary Design Review Report
PG	Process Guidelines
PP	Project Proposal
PRD	Project Requirements Document
PRG	Peer Review Guidelines
PRR	Project Requirements Review
PRRR	Project Requirements Review Report
PSR	Project Status Report
QA	Quality Assurance
R&D	Research & Development
RAD	Requirements Allocation Document
RAS	Requirements Allocation Sheet
RNM	Requirements/Needs Matrix
SG	Stakeholder Guideline
STAR	Center for Satellite Applications and Research
SWA	Software Architecture Document
TD	Training Document
TG	Task Guideline
TRR	Test Readiness Review
VVP	Verification and Validation Plan

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1. INTRODUCTION

The NOAA/NESDIS Center for Satellite Applications and Research (STAR) develops a diverse spectrum of complex, often interrelated, environmental algorithms and software systems. These systems are developed through extensive research programs, and transitioned from research to operations when a sufficient level of maturity and end-user acceptance is achieved. Progress is often iterative, with subsequent deliveries providing additional robustness and functionality. Development and deployment is distributed, involving STAR, the Cooperative Institutes (CICS[1], CIMSS[2], CIOSS[3], CIRA[4], CREST[5]) distributed throughout the US, multiple support contractors, and NESDIS Operations.

NESDIS/STAR is implementing an increased level of process maturity to support the development of these software systems from research to operations. This document is a Task Guideline (TG) for users of this process, which has been designated as the STAR Enterprise Product Lifecycle (EPL).

1.1. Objective

The STAR EPL is designed as a sequence of 11 process steps that take a product from initial conception through delivery to operations. These steps are:

- Step 1 - Basic Research (TG-1)
- Step 2 - Focused R & D (TG-2)
- Step 3 - Project Proposal (TG-3)
- Step 4 - Resource Identification (TG-4)
- Step 5 - Development Project Plan (TG-5)
- Step 6 - Project Requirements (TG-6)
- Step 7 - Preliminary Design (TG-7)
- **Step 8 - Detailed Design (TG-8)**

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[1] Cooperative Institute for Climate Studies

[2] Cooperative Institute for Meteorological Satellite Studies

[3] Cooperative Institute for Oceanographic Satellite Studies

[4] Cooperative Institute for Research in the Atmosphere

[5] Cooperative Remote Sensing and Technology Center

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- Step 9 - Code & Test Data Development (TG-9)

- Step 10 - Code Test And Refinement (TG-10)

- Step 11 - System Integration and Test (TG-11)

The objective of this Task Guideline (TG-8) is to describe how to perform the standard tasks of STAR EPL process step 8, "Detailed Design".

The intended users of this TG are all participants in the STAR EPL process who are involved in performing the standard tasks of step 8. Participants are referred to as STAR EPL stakeholders.

To determine whether or not they should be involved with this step, the readers of this TG should first determine what stakeholder roles apply to their participation in a STAR research-to-operations development project. Generic stakeholder roles are listed in Section 3 of this TG and discussed in Section 3.2 of the EPL Process Guideline (PG-1)[6]. PG-1 and this TG will direct stakeholders to Stakeholder Guidelines (SG) that are pertinent to their roles.

1.2. Version History

This is the first version of TG-8. It is identified as version 3.0 to align it with the release of the version 3.0 STAR EPL process assets.

1.3. Overview

This TG contains the following sections:

Section 1.0 - Introduction
Section 2.0 - References
Section 3.0 - Stakeholders
Section 4.0 - Reviews
Section 5.0 - Project Artifacts
Section 6.0 - Task Descriptions

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[6] It is recommended that potential STAR EPL stakeholders either review PG-1 prior to using this TG or use it as a reference while using this TG.

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2. REFERENCE DOCUMENTS

All of the reference documents for the STAR EPL process are STAR EPL process assets that are accessible in a Process Asset Repository (PAR) on the STAR website. http://www.star.nesdis.noaa.gov/star/EPL_index.php.

Process assets include:

- Process Guidelines
- Stakeholder Guidelines
- Task Guidelines
- Peer Review Guidelines
- Review Check Lists
- Document Guidelines
- Training Documents

2.1. Process Guidelines

Process Guideline (PG) documents describe STAR's standard set of practices and guidelines for tailoring them to specific projects.

- STAR EPL Process Guidelines (PG-1)
- STAR EPL Process Guidelines Appendix (PG-1.A)
- STAR EPL Tailoring Guidelines (PG-2)

PG-1 and PG-1.A apply generally to each EPL step. Each stakeholder performing tasks during each step can benefit from a familiarity with these documents.

PG-2 is primarily useful for project planners and project plan reviewers during steps 4 and 5. It is also useful during steps 6-11 for project plan revision tasks.

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2.2. Stakeholder Guidelines

A Stakeholder Guideline (SG) is a description of how to perform all STAR EPL standard tasks assigned to a given type of stakeholder. It should itemize the actions to be taken. It should contain appropriate standards, conventions, and (where appropriate) examples. It should point to the appropriate references and the required artifacts.

Stakeholder roles are identified in Section 3 of this TG. For each type of stakeholder, the appropriate SG provides that stakeholder with a complete description of the standard tasks for that stakeholder role, along with references to all appropriate process assets and project artifacts (c.f. Section 5 of this TG). This functions as a complement to the TGs (c.f. Section 2.3 of this TG), which provide a completion description of all stakeholder tasks for a specific process step.

Table 2.2.1 lists the Stakeholder Guidelines that are relevant to this step.

TABLE 2.2.1 – Stakeholder Guidelines for Step 8

ID	Stakeholder
SG-4	STAR CM/DM
SG-5	STAR Web Developers
SG-6	STAR Quality Assurance
SG-7	STAR Managers
SG-13	Development Leads
SG-14	Development Scientists
SG-15	Development Testers
SG-16	Development Programmers
SG-17	Technical Review Leads
SG-18	Technical Reviewers

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2.3. Task Guidelines

A Task Guideline (TG) is a description of how to perform the tasks of a STAR EPL process step. It should itemize the actions to be taken. It should contain appropriate standards, conventions, and (where appropriate) examples. It should point to the appropriate references and the required artifacts. There is one Task Guideline for each step in the STAR EPL. The relevant TG for this step is TG-8 (this document).

2.4. Peer Review Guidelines

For each review (c.f. Section 4), there is a Peer Review Guideline (PRG) that describes the objectives of the review, the required artifacts, standards for reviewers, requirements for approval, and options other than approval. For step 8, the relevant PRGs include:

- Critical Design Review Guidelines (PRG-8.1)
- Gate 4 Review Guidelines (PRG-8.2)

2.5. Review Check Lists

For each review (c.f. Section 4), there is a Review Check List (CL) that captures all the objectives for a review as a set of check list items. Each item in the check list should have a "Disposition" column that contains "Pass", "Conditional Pass", "Defer", "Waive", or "N/A" (Not Applicable). Each item will also have columns for Risk Assessment and for Actions generated. For step 8, the relevant CLs include:

- Critical Design Review Check List (CL-8.1)
- Gate 4 Review Check List (CL-8.2)

2.6. Document Guidelines

There is a Document Guideline (DG) for each standard STAR EPL document. Each DG includes a description of the purpose for the document, a standard document outline (table of contents), a brief description of each subsection in the outline, and an Appendix containing an example document.

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Table 2.6.1 lists the Document Guidelines that are relevant to this step.

TABLE 2.6.1 – Document Guidelines for Step 8

ID	Document
DG-1.1	Algorithm Theoretical Basis Document (ATBD)
DG-1.2	Software Architecture Document (SWA)
DG-5.1	Development Project Plan (DPP)
DG-5.2	Project Status Report (PSR)
DG-5.2.A	PSR Appendix
DG-5.4	Project Baseline Report (PBR)
DG-6.1	Operations Concept Document (OCD)
DG-6.2	Requirements Allocation Document (RAD)
DG-6.3	Verification and Validation Plan (VVP)
DG-8.1	Detailed Design Document (DDD)
DG-8.2	Critical Design Document (CDD)
DG-8.2.A	CDD Appendix
DG-8.3	Critical Design Review Report (CDRR)
DG-8.4	Gate 4 Document (G4D)
DG-8.4.A	G4D Appendix
DG-8.5	Gate 4 Review Report (G4RR)

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2.7. Training Documents

Training Documents (TD) assist the stakeholders (c.f. Section 3) in performing the process tasks. By using the TDs, the stakeholders should be able to perform the tasks more effectively.

Table 2.7.1 lists the Training Documents that are relevant to this step.

TABLE 2.7.1 – Training Documents for Step 8

ID	Training Document
TD-9	Project Requirements

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3. STAKEHOLDERS

The STAR Enterprise is comprised of a large number of organizations that participate and cooperate in the development and production of environmental satellite data products and services. Individual project teams are customarily composed of personnel from these organizations, supplemented by contractor personnel. These organizations and project teams are referred to as the STAR Enterprise stakeholders.

An overview of the stakeholder roles is provided in the STAR EPL Process Guidelines (PG-1, c.f. Section 2). A more detailed description can be found in the Stakeholder Guidelines (SGs, c.f. Section 2).

Stakeholders who have a role during step 8 include:

- STAR CM/DM (SG-4)
- STAR Web Developer (SG-5)
- STAR QA (SG-6)
- STAR Manager (SG-7)
- Development Lead (SG-13)
- Development Scientist (SG-14)
- Development Tester (SG-15)
- Development Programmer (SG-16)
- Technical Review Lead (SG-17)
- Technical Reviewer (SG-18)

STAR CM/DM is the Configuration Management (CM) and Data Management (DM) group for the STAR organization. CM/DM is responsible for establishing and maintaining project baselines for code, test data, documentation, and reports. CM/DM works with each Development Lead to ensure that project artifacts are maintained in accordance with STAR standards. CM/DM works with Operations CM/DM on the transition of the project baseline from pre-operational development to operations.

STAR Web Developer is responsible for maintenance of the STAR web pages. The Web Developer works with STAR CM/DM to ensure that all project baseline items are posted to the appropriate project artifact repository in a timely fashion. The Web Developer works with the STAR EPG and STAR CM/DM to ensure that all STAR EPL process assets are

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posted to the PAR, and to ensure that all process measures are posted to the STAR Measurement Repository.

STAR QA is the quality assurance (QA) group for the STAR organization. QA is responsible for ensuring that each project's tailored process meets STAR EPL process standards and ensuring that each project meets its process requirements during its pre-operational development phases. QA works with the STAR EPG to ensure effective implementation of the process throughout the organization.

STAR Management includes the STAR Division Chiefs and Branch Chiefs. Management is responsible for management oversight of all STAR projects.

Development Lead is nominally a STAR scientist who leads a project's development efforts after a Project Proposal (PP) has been approved. The Development Lead is typically identified in the PP and is often the same person who was the Research Lead. The Development Lead works with STAR Management to tailor the STAR EPL process to the project and leads the project's development efforts during the Design and Build phases as the lead of the Integrated Product Team (IPT).

Development Scientist is nominally a STAR scientist who has been assigned by the Development Lead to one or more of the tasks of reviewing the technical content of project proposals, maturing a research algorithm into an operational algorithm, developing project requirements, supporting product design, coding and testing, and providing product validation and science maintenance.

Development Tester is any person located at a research organization who has been assigned by the Development Lead to one or more of the tasks of identifying pre-operational test data, acquiring and integrating the test data into the pre-operational product processing system, creating pre-operational unit and system test plans, executing unit and system tests, and analyzing and reporting test results for review.

Development Programmer is a programmer who has been assigned by the Development Lead to one or more of the tasks of preliminary design and detailed design of pre-operational code, writing pre-operational code, integrating code into a pre-operational system, and supporting Development Testers in testing pre-operational code.

Technical Review Lead is responsible for leading the team of Technical Reviewers for one or more of the six Technical Reviews. The Technical Review Lead works with the Development Lead and the Technical Reviewers to ensure that the review is prepared for, conducted, and closed according to review standards.

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Technical Reviewer is responsible for reviewing and approving project artifacts and project status at one or more of the six Technical Reviews. Technical Reviewers work with the Technical Review Lead to ensure that the review is prepared for, conducted, and closed according to review standards.

Stakeholder satisfaction is a critical component of the process. The intention is for the process to be more of a benefit that a burden to stakeholders. If stakeholders are not satisfied that this is the case, the process will require improvement.

Stakeholders are strongly encouraged to provide feedback to the EPG. Comments and suggestions for improvement of the process architecture, assets, artifacts and tools are always welcome. Stakeholders can provide feedback by contacting:

Ken.Jensen@noaa.gov

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4. REVIEWS

4.1. Critical Design Review

Critical Design Review (CDR) is the final Design Phase Technical Review. Its purpose is to assess the detailed design for the pre-operational system. Upon successful completion of this review, a Gate 4 Review is held to determine whether the project should proceed to the Build phase.

Standard CDR objectives:

- Identify relevant stakeholders and document their involvement according to the project plan.

- Identify requirements changes since PDR

- Provide all applicable technical data for the selected solution, including:
    o   Operations concept
    o   Theoretical Basis
    o   Architecture, specifications, interfaces, detailed design description
    o   Performance requirements, QA procedures, test data requirements
    o   Verification and validation plans

- Provide an updated allocation of requirements to product components and system components of the detailed design.

- Identify and update project risks. Make recommendations for risk mitigation plans and actions.

- Document the closing of all action items since PDR. Make recommendations for open actions and new actions.

Standard CDR entry criteria:

- Entry # 1 - A Preliminary Design Review Report (PDRR) has been written. The CDR reviewers have access to the current baseline version of the PDRR.

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- Entry # 2 - A Development Project Plan (DPP) has been written. The CDR reviewers have access to the current baseline version of the DPP.

- Entry # 3 - An Operations Concept Document (OCD) has been written. The CDR reviewers have access to the current baseline version of the OCD.

- Entry # 4 - A Requirements Allocation Document (RAD) has been written. The CDR reviewers have access to the current baseline version of the RAD.

- Entry # 5 - An Algorithm Theoretical Basis Document (ATBD) has been written. The CDR reviewers have access to the current baseline version of the ATBD.

- Entry # 6 - A Software Architecture Document (SWA) has been written. The CDR reviewers have access to the current baseline version of the SWA.

- Entry # 7 - A Detailed Design Document (DDD) has been written for each software unit in the software architecture. The CDR reviewers have access to the current baseline version of each DDD.

- Entry # 8 - A Verification and Validation Plan (VVP) has been written. The CDR reviewers have access to the current baseline version of the VVP.

- Entry # 9 - A Critical Design Document (CDD) has been written. CDR review objectives are clearly stated in the CDD.

- Entry # 10 - A Project Baseline Report (PBR) has been written. The CDR reviewers have access to the current baseline version of the PBR.

Standard CDR exit criteria:

- Exit # 1 - PDR "Conditional Pass" items have been satisfactorily disposed of.

- Exit # 2 - PDR "Defer" items have been satisfactorily disposed of.

- Exit # 3 – Project plan and DPP are satisfactory

- Exit # 4 - Operations concept and OCD are satisfactory.

- Exit # 5 - Requirements changes since PDR are approved.

- Exit # 6 - Algorithm theoretical basis and ATBD are satisfactory.

- Exit # 7 - Software architecture and SWA are satisfactory.

- Exit # 8 – Software detailed design and DDDs are satisfactory.

- Exit # 9 - Verification and validation plan and VVP are satisfactory.

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- Exit # 10 - Requirements allocation and RAD are satisfactory.

- Exit # 11 - Project baseline and PBR are satisfactory.

- Exit # 12 - The CDRR documents the current status of project risks, actions and CDR exit criteria.

- Exit # 13 - Project risks and actions are acceptable. Project is ready for the Build phase.

Refer to PRG-7 for a more detailed description of the CDR. The standard CDR entry criteria, exit criteria, and check list is documented in the process asset CL-8.1 (c.f. Section 2).

CDR objectives, entry criteria, exit criteria, and check list may be tailored. Tailoring guidelines are provided in the process asset PG-2 (c.f. Section 2). Refer to the Development Project Plan (DPP) Section 5 to determine whether there has been any project-specific tailoring for the CDR.

4.2. Gate 4 Review

Gate 4 is a review of the project status following the CDR, under the direction of STAR. Its purpose is to determine whether the project is ready to begin development of the pre-operational code and test data. If a project passes Gate 4, the project proceeds to the Build phase.

Standard Gate 4 Review objectives:

- Review the implementation of the Integrated Master Plan (IMP) and Integrated Master Schedule (IMS)

- Review the technical status and risks of the project

- Review the cost status and risks of the project

- Review the schedule status and risks of the project

- Determine whether corrective actions are needed to allow the project to proceed to the Build phase as planned

- Determine whether a re-plan and a delta Gate 4 Review are needed.

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Standard Gate 4 Review entry criteria:

- Entry # 1 - A Gate 3 Review Report (G3RR) has been written. The Gate 4 reviewers have access to the current baseline version of the G3RR.

- Entry # 2 - A Critical Design Review Report (CDRR) has been written. The Gate 4 reviewers have access to the current baseline version of the CDRR.

- Entry # 3 - A Development Project Plan (DPP) has been written. The Gate 4 reviewers have access to the current baseline version of the DPP.

- Entry # 4 - A Project Status Report (PSR) has been written. The Gate 4 reviewers have access to the current baseline version of the PSR.

- Entry # 5 - A Gate 4 Document (G4D) has been written. The Gate 4 reviewers have access to the current baseline version of the G4D.

- Entry # 6 - A Project Baseline Report (PBR) has been written. The Gate 4 reviewers have access to the current baseline version of the PBR.

Standard Gate 4 Review exit criteria:

- Exit # 1 – CDR status and CDRR are satisfactory

- Exit # 2 - Project plan and DPP are satisfactory.

- Exit # 3 - Project status and PSR are satisfactory.

- Exit # 4 - Project baseline and PBR are satisfactory.

- Exit # 5 - Project risks are acceptable.

- Exit # 6 - Status of risk mitigation actions is acceptable

- Exit # 7 - Project is ready for the Build phase

Refer to PRG-8.2 for a more detailed description of the Gate 4 Review. The standard Gate 4 Review entry criteria, exit criteria, and check list is documented in the process asset CL-8.2 (c.f. Section 2).

Gate 4 Review objectives, entry criteria, exit criteria, and check list may be tailored. Tailoring guidelines are provided in the process asset PG-2 (c.f. Section 2). Refer to the Development Project Plan (DPP) Section 5 to determine whether there has been any project-specific tailoring for the Gate 4 Review.

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5.   PROJECT ARTIFACTS

Project Artifacts are a set of items that must be produced by the appropriate stakeholders during the product life cycle to support the reviews. They are established and maintained under Configuration Management (CM) by an Enterprise Process Group (EPG) under the direction of a Steering Committee.

The project artifacts are maintained in a project artifact repository. This is a complete set of configuration-managed artifacts developed by each project in accordance with STAR standards. When a project artifact has been approved at a Technical Review or Gate Review, it is placed in the project artifact repository under CM.

Project artifacts that are recommended for development during step 8 are listed in Table 5.1.

TABLE 5.1 – Step 8 Artifacts

Artifact	Type	Review	Baseline Build
Development Project Plan v2.x	Document	CDR	2.4
Algorithm Theoretical Basis Document v2.1	Document	CDR	2.4
Software Architecture Document v2.1	Document	CDR	2.4
Operations Concept Document v1.2	Document	CDR	2.4
Requirements Allocation Document v1.2	Document	CDR	2.4
Verification and Validation Plan v1.2	Document	CDR	2.4
Detailed Design Document v1.0	Document	CDR	2.4
Critical Design Document	Presentation	CDR	2.4
Project Baseline Report v2.4	Report	CDR	2.4
Critical Design Review Report	Report	Gate 4, TRR	2.5
Development Project Plan v2.0	Document	Gate 4	2.5
Project Status Report v2.0	Report	Gate 4	2.5
Gate 4 Document	Presentation	Gate 4	2.5

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Project Baseline Report v2.5	Report	Gate 4	2.5
Gate 4 Review Report	Report	Gate 5	2.6
Project Baseline Report v2.6	Report	None	2.6

Development Project Plan v2.x: The Development Project Plan (DPP) documents the plan for the development, testing, review, and transition to operations for the project, including stakeholders, tasks, work breakdown structure (WBS), schedule and resources. The initial DPP v2.0 should have been produced in step 6 for the PRR, and may be revised (v2.x) as a result of PRR actions PDR actions, and detailed design impacts on the plan. Refer to DG-5.1 for detailed DPP guidelines.

Algorithm Theoretical Basis Document v2.1: The Algorithm Theoretical Basis Document (ATBD) provides a theoretical description (scientific and mathematical) of the algorithm that is used to create a product that meets user requirements. The ATBD v2.1 is typically updated from the PDR version (v2.0), as detailed design provides additional maturity. The purpose of ATBD v2.1 is to help demonstrate to the CDR reviewers that the algorithm detailed design provides for an implementation that is consistent with the theoretical basis and meets requirements. Refer to DG-1.1 for detailed ATBD guidelines.

Software Architecture Document v2.1: The Software Architecture Document (SWA) complements the ATBD by providing the software architecture for the processing code that will implement the algorithm. The SWA v2.1 is typically updated from the PDR version (v2.0), as detailed design provides additional maturity. Refer to DG-1.2 for detailed SWA guidelines.

Operations Concept Document v1.2: The Operations Concept Document (OCD) is distinct from a concept of operations (ConOps). A ConOps may be generated by a potential user to provide an overview of how the user envisions a potential product system to operate. It provides a mechanism for users to describe their expectations of the target system in terms that need not be quantifiable and testable. The ConOps is typically used as input to the development of formal testable system and software requirements specifications. The OCD is a technical document created by the development team to describe how the users' vision can be realized in an operational environment. It should build on the users' ConOps, if available, and on the organization's ConOps, where relevant. OCD v1.2, produced for the CDR, adds to v1.1 by providing a refinement of the operations concept that may occur as a result of detailed design development. Refer to DG-6.1 for detailed OCD guidelines.

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Requirements Allocation Document v1.2: The Requirements Allocation Document (RAD) contains the basic and derived requirements for the work products and the allocation of the requirements to system components and product components. RAD v1.2, produced for the CDR, adds to v1.1 by updating the allocation of requirements to system and product components, based on the maturing of solutions and design since PDR. Refer to DG-6.2 for detailed RAD guidelines.

Verification and Validation Plan v1.2: The Verification and Validation Plan (VVP) describes the work products to be verified and validated, the requirements for each selected work product and the verification and validation methods for each selected work product. VVP v1.2, produced for the CDR, adds to v1.1 by updating the listing and description of verification and validation items and plans, based on the maturing of the requirements allocation, solutions and design since PDR, as documented in RAD v1.2 and SWA v2.1. Refer to DG-6.3 for detailed VVP guidelines.

Detailed Design Document v1.0: The purpose of the Detailed Design Document (DDD) is to describe the product design at a level of detail that is sufficient for the development programmers to write fully functional pre-operational code. A separate DDD is produced for each software unit that is part of the product processing system. The software units are the Layer-2 elements that are defined in the system layer product software architecture, as described in the SWA.

The standard purpose and function of the DDD is to provide a method of detailing the unit-level structural procedure within the unit, place these in the context of the product system data processing chain, and specify the data, its formats, and the relationships that exist between the data to form the basis for the detailed design of the unit code.

DDD v1.0 is the first DDD version to be created. DDD v1.0, produced for the CDR, should capture the detailed design as it exists at the completion of the Design Phase of the STAR EPL. Refer to DG-8.1 for detailed DDD guidelines.

Critical Design Document: The Critical Design Document (CDD) consists of the presentation slides for the Critical Design Review (CDR). Refer to DG-8.2 and DG-8.2.A for detailed CDD guidelines.

Project Baseline Report v2.4: The Project Baseline Report (PBR v2.4) is the document that describes the status of the configuration items that comprise the project baseline at the CDR. Refer to DG-5.4 for detailed PBR guidelines.

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Note that these artifacts are typically included in STAR Baseline Build (BB) 2.4. BB 2.4 provides the artifacts for the CDR. **STAR CM/DM** executes BB 2.4, in consultation with the developers of the BB 2.4 artifacts.

Critical Design Review Report: The CDR Report (CDRR) summarizes the CDR Reviewers' assessment of the detailed design, including identified risks and risk mitigation actions. Refer to DG-8.3 for detailed CDRR guidelines.

Development Project Plan v2.0: Following the CDR report, the DPP is updated to v2.0 for the Gate 4 Review. DPP v2.0 reflects any changes to the project plan that have resulted from the CDR risk mitigation actions.

Project Status Report v2.0: The Project Status Report (PSR) is used to manage and control the execution of the project. PSR v2.0, a Gate 4 Review artifact, complements DPP v2.0 by noting the post-CDR status of the project tasks, work products, cost, schedule, and risks. Refer to DG-5.2 and DG-5.2.A for detailed PSR guidelines.

Gate 4 Document: The Gate 4 Document (G4D) consists of the presentation slides for the Gate 4 Review. Refer to DG-8.4 and DG-8.4.A for detailed G4D guidelines.

Project Baseline Report v2.5: When the CDRR, DPP v2.0, PSR v2.0 and G4D are completed, they are added to the baseline for BB 2.5. The PBR is updated to v 2.5 to include the addition of the CDRR, DPP, PSR and G4D, as well as any CDR artifacts that are revised as the result of CDR actions. BB 2.5 provides the artifacts for the Gate 4 Review. **STAR CM/DM** executes BB 2.5, in consultation with the developers of the BB 2.5 artifacts.

Gate 4 Review Report: The Gate 4 Review Report (G4RR) summarizes the Gate 4 Reviewers' assessment of the project plan and project status, including identified risks, risk mitigation actions, and status of readiness to proceed to the Build phase. Refer to DG-8.5 for detailed G4RR guidelines.

Project Baseline Report v2.6: When the G4RR is completed, it is added to the baseline for BB 2.6. The PBR is updated to v 2.6 to include the addition of the G4RR as well as any Gate 4 Review artifacts that are revised as the result of Gate 4 Review actions.

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6. TASK DESCRIPTION

6.1 Requirements Development Process

Requirements development is an iterative process that occurs throughout the Design phase of the product lifecycle, as explained in the Project Requirements Training Document (TD-9). This phase includes three steps that produce a detailed requirements allocation through an iterative (spiral) development of requirements, solutions, and design:

- Project Requirements (step 6 of the STAR EPL)
- Preliminary Design (step 7 of the STAR EPL)
- **Detailed Design (step 8 of the STAR EPL)**

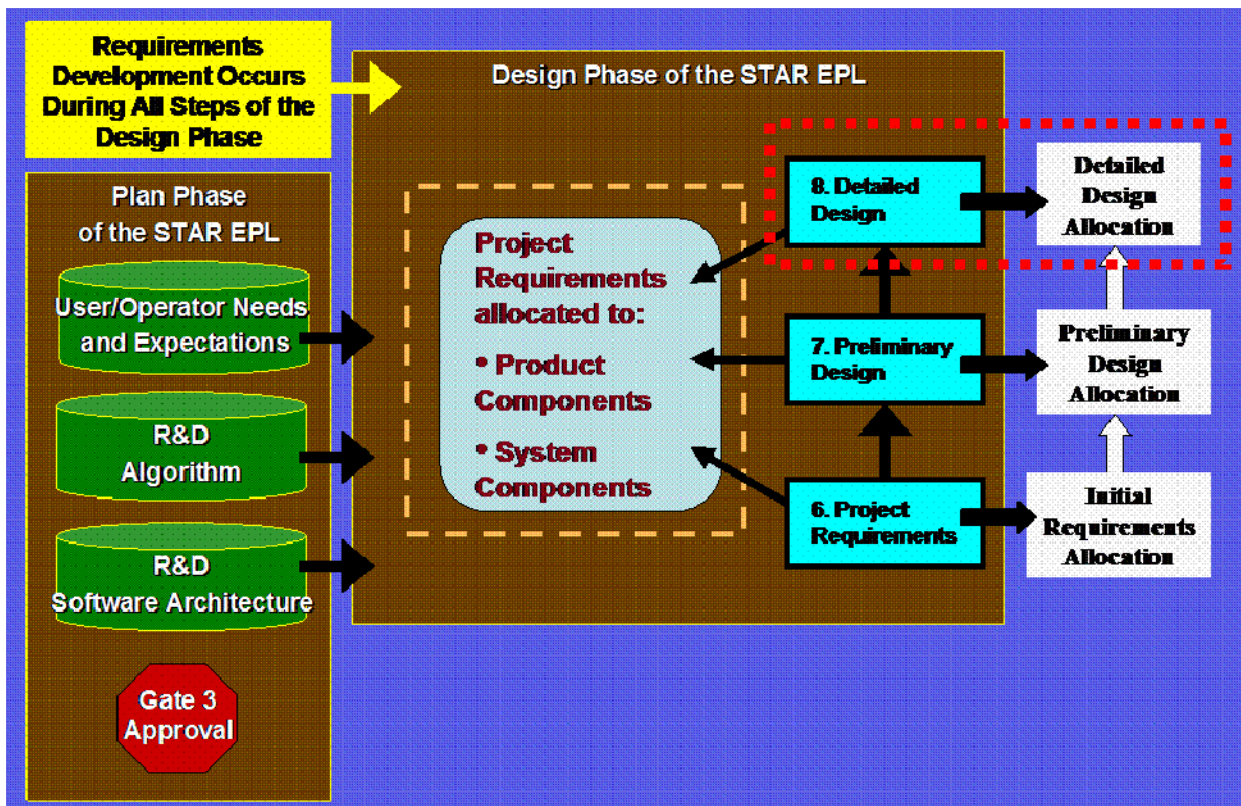Figure 6.1 illustrates the Requirements Development process, with step 8 highlighted.

Figure 6.1 – Requirements Development Process

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As Figure 6.1 shows, the objective of step 6 is to produce an initial requirements allocation that consists of requirements derived from user/operator needs and expectations and the allocation of these requirements to product components and system components that have been identified in the Research and Development (R&D) algorithm and software architecture.

Note that steps 7 and 8 continue the requirements development process. This is because the requirements development process produces the requirements statements **and** their allocation to product components and system components of a design that is matured to an increasing amount of detail and completeness throughout the Design phase.

The process of producing an increasingly mature and complete requirements allocation involves an iterative development of the requirements, solution, design, and requirements allocation. Figure 6.2 illustrates this.
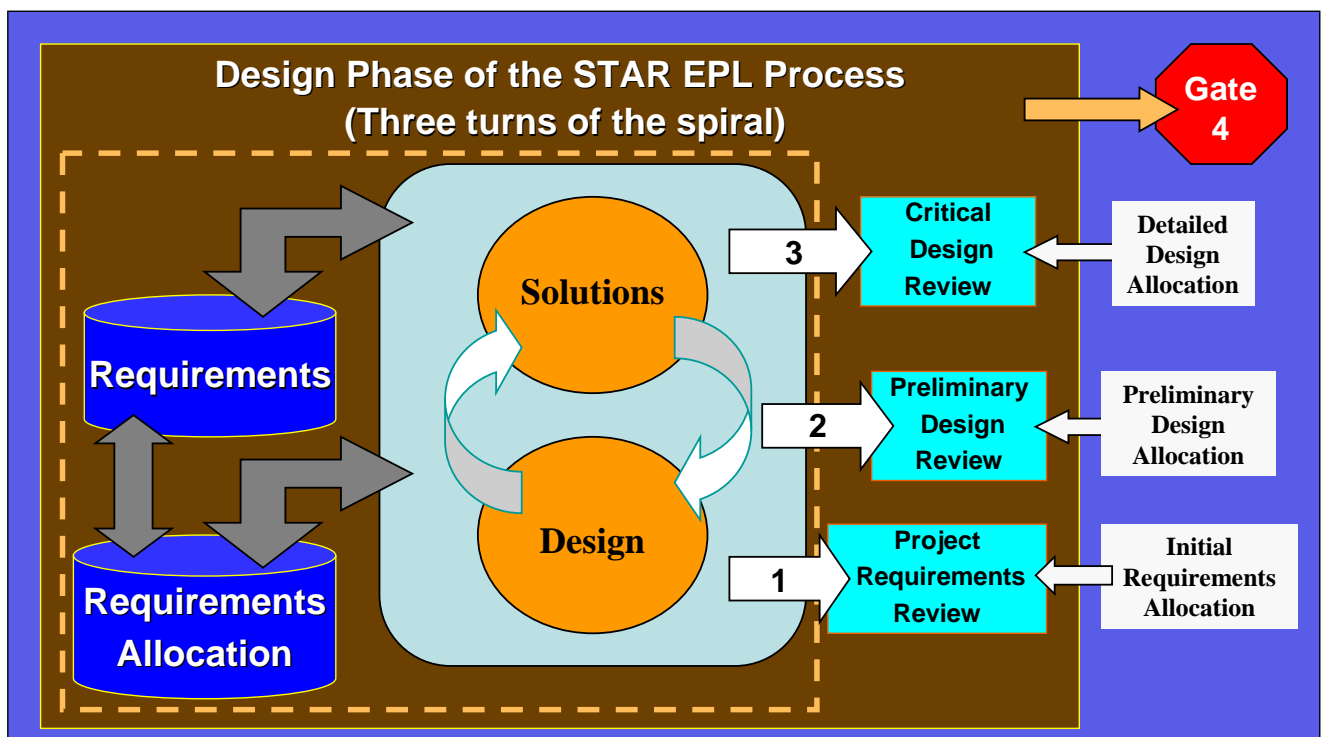

Figure 6.2 – Iterative (Spiral) Development of Requirements Allocation

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As shown in Figure 6.2, requirements drive solutions, solutions drive design, and design determines requirements allocation. Gaps and/or inconsistencies between the requirements and the requirements allocation will then drive revisions to solutions and design. Revised solutions and design then drive revisions to requirements and/or requirements allocation, etc.

As the project matures throughout the Design phase, an increasingly comprehensive and mature requirements allocation is reviewed at each of the three technical reviews of this phase (Project Requirements Review (PRR), Preliminary Design Review (PDR), and CDR).

This process is continuous and iterative, but is also characterized by three distinct milestones:

1) The Initial Requirements Allocation is achieved when it is determined that the set of stated requirements is complete. That is, it is not expected that additional maturation will result in additional requirements. At that point, a PRR is conducted to complete step 6. Refer to TG-6 for a description of the tasks that achieve an Initial Requirements Allocation.

2) The Preliminary Design Allocation is achieved when it is determined that a preferred solution has been identified to meet the set of requirements that were approved at the PRR. That is, it is not expected that additional maturation will result in a different solution. At that point, a PDR is conducted to complete step 7. This does not preclude the possibility that the set of requirements will be revised during step 7, as a result of issues discovered during the preliminary design development. Refer to TG-7 for a description of the tasks that achieve a Preliminary Design Allocation.

3) The Detailed Design Allocation is achieved when it is determined that a complete design has been developed to implement the preferred solution that was approved at the PDR. At that point, a CDR is conducted to complete step 8. This does not preclude the possibility that the set of requirements will be revised during step 8, as a result of issues discovered during the detailed design development.

The iterative nature of this development means that requirements are not expected to be finalized until the complete convergence of requirements, solution, and design is finalized at the end of step 8, resulting in the detailed design allocation. Once this is accomplished, the project is ready to proceed to a Gate 4 Review and the Build phase.

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6.2 Detailed Design Process Flow

Figure 6.3 shows the process flow for step 8.

Figure 6.3 – Step 8 Process Flow

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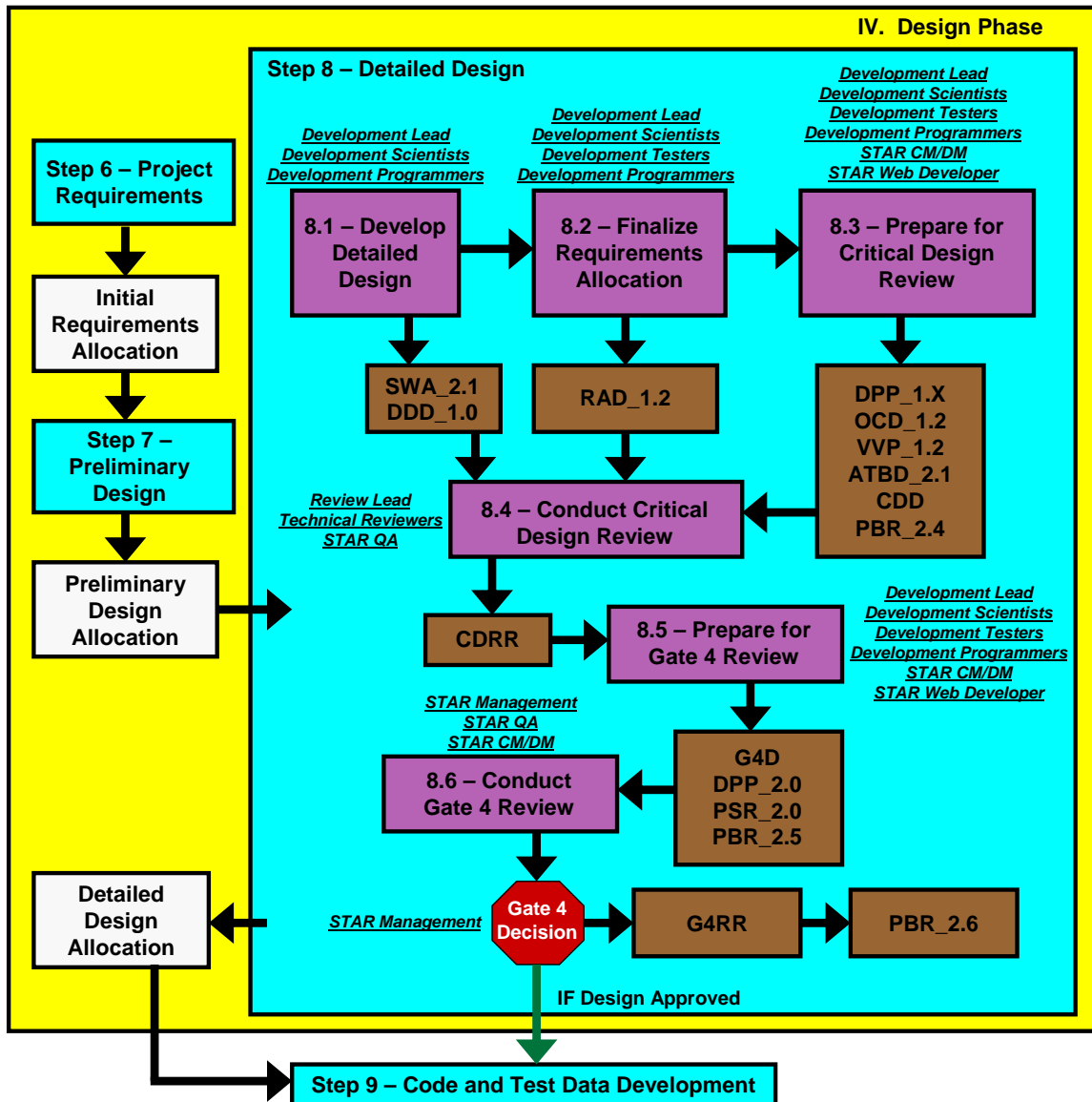Date: October 1, 2009

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6.3 Expected BEGIN State

- REQUIRED: A PDR has been conducted

- REQUIRED: A preferred solution to meet the requirements has been selected and approved.

- REQUIRED: A Preliminary Design Allocation for the selected solution has been developed and approved

- REQUIRED: Baseline Build (BB) 2.3 has placed the following items in the project artifact repository:
    - DPP, including Appendices
    - OCD
    - RAD, including Appendices
    - VVP
    - ATBD
    - SWA
    - Preliminary Design Document (PDD)
    - Preliminary Design Review Report (PDRR)

- EXPECTED: BB 2.3 has placed the following items in the project artifact repository:
    - R&D code
    - R&D test data
    - PP
    - Gate 2 Review Report (G2RR)
    - Gate 3 Review Report (G3RR)
    - Project Requirements Document (PRD)
    - Project Requirements Review Report (PRRR)

- REQUIRED: PBR_2.3 documents the status of the BB 2.3 project baseline

- REQUIRED: PDR reviewers have approved the project to proceed to the Detailed Design step, and have documented this approval in the PDRR.

6.3.1 Task Inputs

Task inputs consist of the following BB 2.3 items:
- DPP_1.x,

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- OCD_1.1
- RAD_1.1, including Requirements/Needs Matrix (RNM) and Requirements Allocation Sheet (RAS)
- VVP_1.1
- ATBD_2.0
- SWA_2.0
- Project Risks and Actions (PSR_1.x Appendix)
- PDD
- PDRR
- PBR_2.3

6.3.2 Corrective Actions

The PDRR will document any actions that are needed to reduce risk during step 8. Usually, these actions should be closed before the CDR.

Additional corrective actions are typically generated during step 8, to mitigate project risks that are identified during detailed design. Project risks and risk mitigation actions should be identified in the PSR Appendix.

The needed corrective actions may require revisions to the project plan, typically by the addition of sub-tasks and revisions to the task schedule. The **Development Lead** should determine whether these revisions are manageable or are so significant that a re-plan is needed. If necessary, the **Development Lead** should consult STAR Management on the advisability of a re-plan. Re-planning is expected to be a rare event, but it may occur if the project requirements have added significant scope or if unexpected technical issues have been discovered.

6.3.2.1 Delta Gate 3 Review

If it is determined that a re-plan is needed, the **Development Lead** should consult STAR Management to determine whether there should be a delta Gate 3 Review. This determination should depend upon whether the re-plan will significantly affect the Detailed Design Allocation. If not, consideration of the re-plan may be deferred to the Gate 4 Review. If so, a delta Gate 3 Review should be prepared for and conducted in the same manner as the normal Gate 3 Review. Refer to the step 5 Task Guideline (TG-5) and the

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Gate 3 Peer Review Guideline (PRG-5) for guidance. Following approval of the re-plan, the project can return to its step 8 activities under the new plan.

6.4   Desired END State

- An operations concept, developed from user/customer needs and expectations, explains what products are to be produced, why they are being produced, and how they will be produced in an operational environment,

- Basic project requirements have been developed from the operations concept

- Requirements have been analyzed in light of the customer's needs, mission objectives, system constraints, and design constraints to develop more specific product, system, and process requirements for the system.

- Derived project requirements have been developed from analysis of the basic requirements and other derived requirements

- A detailed software architecture has been developed.

- A Detailed Design Allocation of the requirements identifies product and system components down to the Sub-Unit-Layer, and traces each component to one or more requirement.

- A plan has been developed for monitoring the status of the requirements and their allocation to ensure that the integrity of the requirements allocation is preserved as the implementation of the detailed design proceeds through the Build phase.

- A plan has been developed to verify the identified work products, validate the identified requirements, and validate the identified products.

- The project plan has been updated as necessary

- The status of project risks and actions has been updated

- A CDR of the project plan, operations concept, requirements, software architecture, and requirements allocation has been conducted

- A CDRR has been written

- A Gate 4 Review of the project plan and project status has been conducted.

- A Gate 4 Review Report (G4RR) has been written, approving the project for the Build phase.

- Baseline Build 2.6 has placed the required items in the project artifact repository

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- PBR_2.6 documents the status of the BB 2.6 project baseline

6.4.1 Task Outputs

Task outputs consist of the following BB 2.6 items:

- DPP_2.0
- ATBD_2.1
- SWA_2.1
- OCD_1.2
- RAD_1.2, including RNM and RAS
- VVP_1.2
- DDD_1.0
- CDD
- CDRR
- PSR_2.0, including Appendix
- G4D
- G4RR
- PBR_2.6

6.5 Detailed Design Activities

Step 8 activities include:

1) Develop detailed design
2) Finalize requirements allocation
3) Prepare for CDR
4) Conduct CDR
5) Prepare for Gate 4 Review
6) Conduct Gate 4 Review

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6.5.1 Develop Detailed Design

The development of the detailed design for the product processing system is usually a collaboration between **Development Scientists** and **Development Programmers**, with **Development Scientists** usually taking the lead.

The detailed design consists of the detailed software architecture, developed by the **Development Scientists**, and a detailed code description, developed by the **Development Programmers**. The software system is an integrated collection of software elements, or code, that implements a solution, producing well-defined output products from a well-defined set of input data. The software architecture describes the structure of the system software elements and the external and internal data flows between software elements. The software architecture is structured in four layers, as illustrated in Figure 6.4.
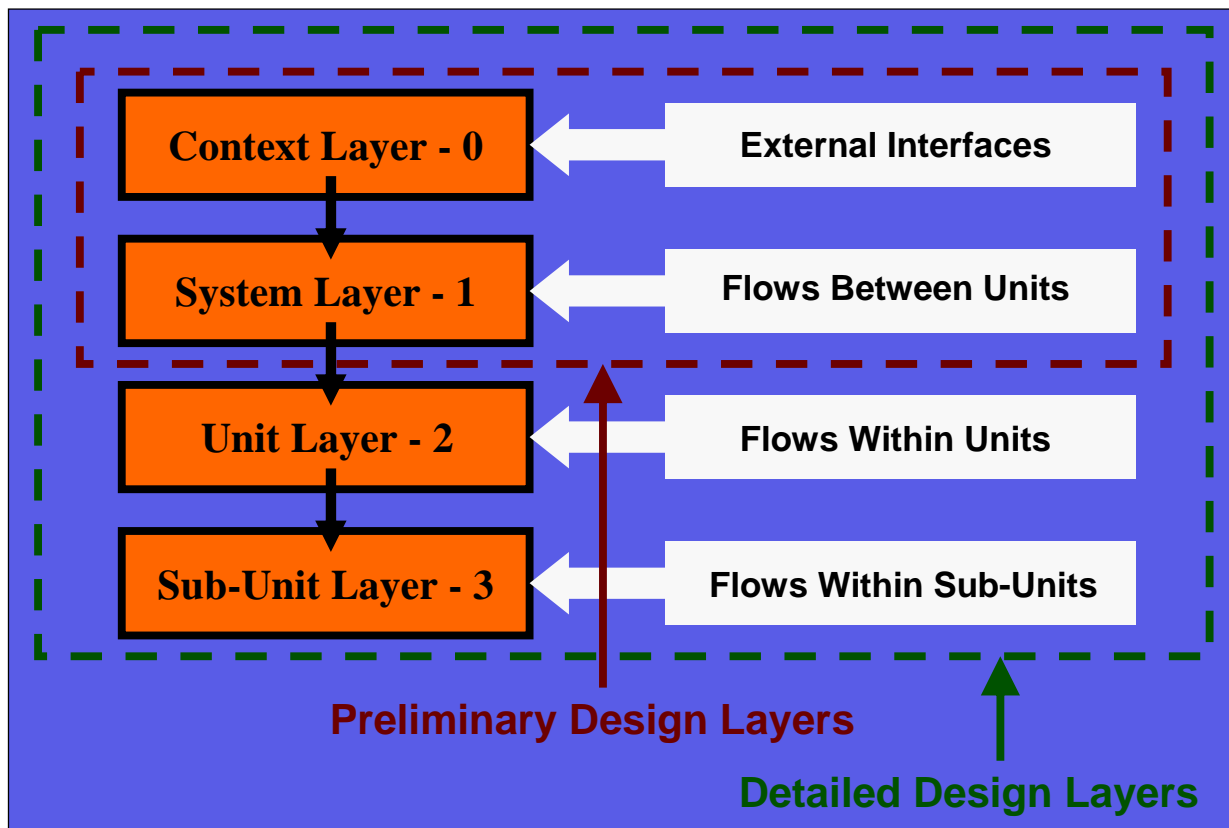

Figure 6.4 – Detailed Design Software Architecture

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As shown in Figure 6.4, the first two layers of the software architecture comprise the preliminary design that is approved at PDR and is input to the step 8 activities. These are the Context Layer and the System Layer.

6.5.1.1 The Context Layer

The Context Layer describes the flows between the system and its external interfaces (inputs and outputs).

An external input is defined as a data source needed by the system that is produced or made available by a process external to the system. Examples are raw sensor data, ancillary data, etc. External inputs should have been developed during step 7 and documented in SWA_2.0 (c.f. TG-7). Additional external inputs may be identified during the process of detailed design. This will occur as the functional requirements and detailed functional architecture uncover the need for additional input to support the functionality of the product processing system.

External output is defined as a data sink that is produced by the system for an external user; for example, archived environmental products (e.g. Sea Surface Temperature). External outputs should have been developed during step 7 and documented in SWA_2.0 (c.f. TG-7). Additional external outputs may be identified during the process of detailed design. This will occur if additional requirements are identified to respond to additional requests from approved end users. It is important that risks associated with these additional requests be identified and evaluated as soon as possible. This is essential to the containment of requirements creep.

If additional end user requests are received during step 8, the **Development Lead** should consult with **STAR Management** to determine whether a delta PRR is needed to approve or reject them. A delta PRR is recommended if the additional requirements may affect the selection of a preferred solution. A delta PRR may also be decided upon if the additional requirements are determined to add significant cost, schedule, and/or technical risk. If a delta PRR is not conducted, it is still important to document the changes to the requirements allocation for review at the CDR.

If a delta PRR results in the approval of new requirements that may affect the selection of the preferred solution, the **Development Lead** should consult with **STAR Management** to determine whether a delta PDR should be conducted to re-evaluate the preferred solution.

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In any case, the Preliminary Design Allocation will have to be revised to accommodate the changed set of requirements.

6.5.1.2 The System Layer

The System Layer expands upon the Context Layer, describing the first layer of decomposition. In addition to the System Layer inputs and outputs, the major processing units are identified along with their inputs and outputs.
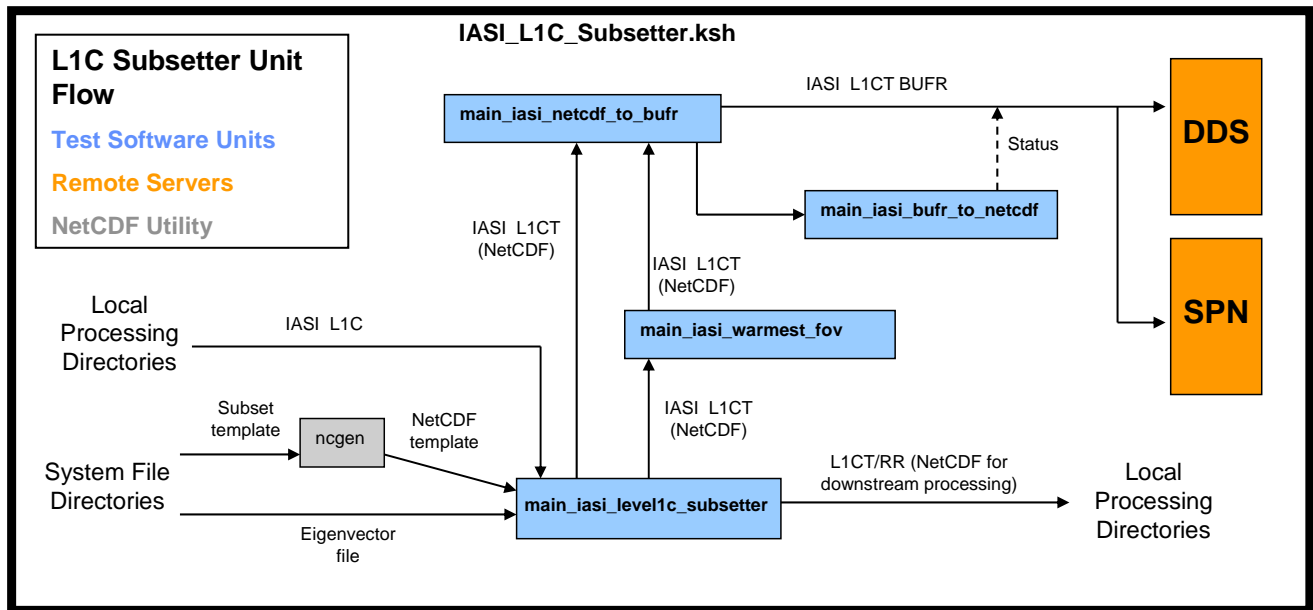
The software units should have been established and the flows between the units developed during step 7, resulting in a well-defined System Layer architecture that was approved at the PDR (c.f. TG-7). This architecture may need to be revised if the external interfaces are changed during step 8 (c.f. Section 6.5.1.1).

6.5.1.3 The Detailed Layers

The Unit Layer expands upon the System Layer, describing the second layer of decomposition. In this layer, the data flows within units are described.

The process of establishing the software units in step 7 should also have resulted in the development of software functions that meet the functional requirements, and the grouping of these functions into the software units. Complete this process by establishing the major functions of each unit. These should constitute the major elements of the Unit Layer architecture, also known as the Sub-Units. The Sub-Units constitute, the third, most detailed layer of decomposition.

To develop the Unit Layer, identify the data flows into and out of each function. This should establish a sequential order for the Sub-Units within each Unit. Once the Sub-Unit data flows and sequence are established, a Unit Layer flow diagram can be constructed. An example is shown as Figure 6.5.

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Figure 6.5 – Unit Layer Data Flows

To complete the detailed design, develop and describe the functions of each Sub-Unit. These may become software functions or may be components of a software function. The level of detail in this description should be sufficient to enable the Development Programmers to write the pre-operational code.

Upon completion of the Unit Layer and Sub-Unit Layer software architecture, the SWA should be updated to version 2.1. This update will include any revisions to the Context Layer and System Layer that were made during step 8 and add the Unit Layer and Sub-Unit Layer descriptions. Refer to DG-1.2 for SWA guidelines.

6.5.1.4 Detailed Design Document

The detailed design for each software unit should be documented in its own DDD. The DDD should provide the information needed for **Development Programmers** to write fully functional pre-operational code. Refer to DG-8.1 for DDD guidelines. The DDD should describe the unit's software functionality and design characteristics. In particular, each DDD should include design language and file descriptions.

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6.5.1.5 Design Language

Upon completion of the detailed software architecture, a detailed code description that implements the detailed functionality can be developed. It is recommended that the software functionality be expressed in Pseudo Design Language (PDL). PDL is an exposition of the data flows and functional sequences in a style that resembles code. The idea is to use the software architecture to begin to visualize how the code will look. It is here that the design begins to be translated into a "pseudo-code" in a way that is understandable by both the designer and the programmer. In this way, the designer verifies that the programmer understands how to implement the design and the programmer is assured that the pseudo-code is a satisfactory basis for programming. The **Development Programmers** should take the lead in writing the PDL, in close consultation with the **Development Scientists** who developed the detailed software architecture.

6.5.1.6 File Descriptions

The DDD complements the SWA by providing detailed descriptions of the input files, intermediate files, and output files, including control files, parameter files, look up tables, input data files, ancillary data files, intermediate data files, and output data files. The **Development Programmers** should take the lead in writing the file descriptions, in close consultation with the **Development Scientists** who developed the detailed software architecture.

Control files are typically scripts that define run control parameters. For each file, indicate the variables it contains, the file format, and how the values of the variables are read into the program or subprograms that use them. The file format is usually best described by a table.

Parameter files contain the values of variables that are fed into the unit program or sub-programs. For each file, indicate the variables it contains, the file format, and how the values of the variables are read into the program or subprograms that use them. The file format is usually best described by a table.

Look up tables typically contain the values of variables binned by a range of conditions, or stratifications. For each file, indicate the variables it contains, how they are binned, the file format, and how the values of the variables are read into the program or subprograms that use them. The file format is usually best described by a table.

For each ancillary data file, indicate the source of the file, how the file is obtained, references to relevant file description documentation by the file provider, the variables

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contained in the file, how they are binned (if they are binned), the file format, and how the values of the variables are read into the program or subprograms that use them. The file format is usually best described by a table.

For each input data file, indicate the variables it contains, the file format, and how the values of the variables are read into the program or subprograms that use them. The file format is usually best described by a table.

For each intermediate data file, indicate the variables it contains, the file format, and how the values of the variables are read into the program or subprograms that use them. The file format is usually best described by a table.

For each output data file, indicate the variables it contains, the file format, and how the values of the variables are read into the program or subprograms that use them. The file format is usually best described by a table.

6.5.2 Finalize Requirements Allocation

The Detailed Design Allocation represents the culmination of the iterative development of requirements, solutions, and design during the Design phase (c.f. Section 6.1). The Detailed Design Allocation is achieved when it is determined that a complete design has been developed to implement the preferred solution that was approved at the PDR, including all four layers of the software architecture, and a detailed code description.

Development Scientists and **Development Testers** assist in a revision of the RAD, following the guidelines in DG-6.2. RAD v1r2 adds to v1r1 by updating the allocation of requirements to system and product components, based on the maturing of solutions and design since PDR, as documented in SWA v2r1. It is possible that the requirements themselves must be changed by addition, deletion, or modification, based on feedback from the development of solutions and design during step 8. In that case, the RAD update should document the changes and the CDD should note what has been changed and provide a rationale for the changes.

The **Development Lead** reviews RAD_1.2 to confirm that all requirements have an allocation to one or more components (product and system) of the detailed design, and that all product components and system components of the detailed design are traceable to the requirements.

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6.5.3   Prepare for CDR

The CDR review lead (**Technical Review Lead)** and review team (**Technical Reviewers)** should have been selected during steps 5, 6, or 7, and listed in the DPP. If this selection was not completed in step 7, the **STAR Branch Chief**, in consultation with the **Development Lead**, should make this selection as soon as possible during step 8.

Development Scientists assist in a revision of the OCD, following the guidelines in DG-6.1. OCD v1r2 adds to v1r1 by providing a refinement of the operations concept for the preferred solution that was approved at the PDR.

Development Scientists and **Development Testers** assist in a revision of the VVP, following the guidelines in DG-6.3. VVP v1r2 adds to v1r1 by updating the listing and description of verification and validation items and plans, based on the maturing of the requirements allocation, solutions and design since PDR, as documented in RAD v1r2 and SWA v2r1.

Development Scientists produce a revision (v2r1) of the project ATBD, in accordance with DG-1.1. This version of the ATBD should demonstrate that the algorithm detailed design provides for an implementation that is consistent with the theoretical basis and meets requirements.

If the project plan has been modified since the PDR, the **Development Lead** prepares a revision to the DPP for presentation at the CDR.

The **Development Lead** leads the preparation of the CDR presentation.

The CDR slide package is the CDD. The CDD is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with CDD guidelines DG-8.2. DG-8.2.A provides CDD slide templates that can be adapted for the project's CDD. The CDD developers should examine the DPP to determine whether the CDR objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the CDD slide templates must be adapted to accommodate the tailoring. The CDD developers should use the project's PDD as a source for CDD slides, as many PDD slides can be re-used or adapted.

The **Development Lead,** assisted by the **Development Scientists, Development Testers,** and **Development Programmers,** updates the status of the project risks and

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associated risk mitigation actions for inclusion in the CDD and the PSR Appendix. Risk management guidelines can be found in PG-1.

The **Development Lead** determines which members of the development team will present the CDD sections. These presenters should be noted in Section Title slides. See DG-8.2.A for examples.

STAR CM/DM inserts the standard BB 2.4 items in the baseline, and updates the Project Baseline Report (PBR) to version 2.4, in accordance with PBR guidelines DG-5.4.

The **Development Lead** informs the **STAR Web Developer** that the CDR artifacts are ready for posting on the STAR EPL website. The **STAR Web Developer** works with **STAR CM/DM** to acquire the project baseline items and post them on the website.

Once these are posted the **STAR Web Developer** informs the **Development Lead**, who then informs the **Technical Review Lead** that the CDR artifacts are available for review. The **Technical Review Lead** then informs all review team members that the artifacts are available to them.

The **Technical Review Lead** and **Technical Reviewers** may at their discretion examine the artifacts and communicate issues to the **Development Lead** prior to the review date, so that the artifacts and/or review presentation may be revised to respond to reviewer concerns.

6.5.4 Conduct CDR

The CDR consists of the presentation of the Detailed Design Allocation by the development team (**Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers)** and the disposition of the review CLI, including entry and exit criteria, by the reviewers (**Technical Review Lead** and **Technical Reviewers**).

The **Technical Review Lead** and the **Technical Reviewers** conduct the CDR to determine whether the project detailed design is complete and sufficiently mature to proceed to the Build phase. Reviewers should be familiar with the CDR guidelines (PRG-8.1) and check list (CL-8.1).

The CDR reviewers complete a Critical Design Review Report (CDRR), following guidelines in DG-8.3. The CDRR will include the reviewers' assessment of the status of the CDR

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artifacts, the project risks, and associated risk mitigation actions, and an Appendix that consists of the reviewers' disposition of each CDR CLI.

On the basis of its disposition of the CDR CLI, the **Technical Review Lead** and the **Technical Reviewers** determine whether the project is ready to proceed to the next step, "Code and Test Data Development". If not, the CDRR should direct the **Development Lead** to revise the CDR artifacts through specified actions. These actions may include a new assessment of revised CDR artifacts at a delta review.

If a delta CDR is required, the **Development Lead** and support team upgrade the CDR artifacts as requested by the CDR reviewers and present them at a delta CDR. This is repeated until the **Technical Reviewers** pass the project to Gate 4 Review.

If a delta review is not required, the revision of the CDR artifacts will be deferred to actions performed during step 9 for review at the Test Readiness Review (TRR), or during later steps for review at later reviews. All of this should be documented in the final version of the CDRR.

STAR QA verifies that the CDR was conducted in accordance with STAR EPL standards.

STAR CM/DM updates the project baseline via BB 2.5, and updates the Project Baseline Report (PBR) to version 2.5, in accordance with PBR guidelines DG-5.4. BB 2.5 will include all post-CDR revisions to the CDR artifacts, the CDRR, and PBR_2.5.

6.5.5 Prepare Gate 4 Review

Once the project passes its CDR, it is referred to the Gate 4 Review. The Gate 4 review is included in step 8 because the project status and plan will usually be modified significantly during the Design phase, so a management review of the project plan and status is typically desirable.

STAR Management selects a Gate 4 Review team, including a Review Lead. The Review Lead is nominally the Branch Chief, but an alternative lead can be selected by the Branch Chief in consultation with the Division Chief. Reviewers should be familiar with the Gate 4 Review guidelines (PRG-8.2) and Check List (CL-8.2). The Gate 4 Review team should be documented in the DPP.

Development Lead updates the PSR to version 2.0, assisted by **Development Scientists, Development Testers,** and **Development Programmers.** Version 2 of the PSR, along

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with its Appendix, documents the status of project tasks, cost, schedule, risks, and actions at the conclusion of the Design phase. Refer to PSR guidelines in DG-5.2 and DG-5.2.A.

The **Development Lead** leads the preparation of the Gate 4 Review presentation. The presentation slide package is the Gate 4 Document (G4D). The G4D is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with G4D guidelines DG-8.4. DG-8.4.A provides G4D slide templates that can be adapted for the project's G4D. The G4D developers should examine the DPP to determine whether the Gate 4 Review objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the G4D slide templates must be adapted to accommodate the tailoring.

The **Development Lead** determines which members of the development team will present the G4D sections. These presenters should be noted in Section Title slides. See DG-8.4.A for examples.

STAR CM/DM inserts the standard BB 2.5 items in the baseline, and updates the Project Baseline Report to PBR_2.5, in accordance with PBR guidelines DG-5.4.

Development Lead informs the **STAR Web Developer** that the Gate 4 Review artifacts are ready for posting in the project artifact repository on the STAR EPL website. The **STAR Web Developer** works with **STAR CM/DM** to acquire the project baseline items and post them on the website.

Once these are posted the **STAR Web Developer** informs the **Development Lead**, who then informs **STAR Management** that the Gate 4 Review artifacts are available for its assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

STAR Management may at its discretion examine the artifacts and communicate issues to the **Development Lead** prior to the review date, so that the artifacts and/or review presentation may be revised to respond to **STAR Management** concerns.

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6.5.6   Conduct Gate 4 Review

The "Detailed Design" step culminates with a Gate 4 Review.

The Gate 4 Review consists of the presentation of the project plan and project status by the development team (**Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers)** and the disposition of the review CLI, including entry and exit criteria, by the reviewers (**STAR Management**).

On the basis of the Gate 4 Review, **STAR Management** determines whether the project can proceed to the Build phase, based on information in the CDRR, DPP and PSR. If not, recommendations are made for correcting deficiencies. Deficiencies can be technical, based on the CDRR and PSR Appendix, or cost/schedule, based on the DPP and PSR. This process is iterated until the Gate 4 Reviewers are satisfied with the technical, cost and schedule status of the project.

STAR QA verifies that the Gate 4 Review was conducted in accordance with STAR EPL standards.

This step culminates with the Gate 4 Review Report (G4RR), written by the **Gate 4 Reviewers**. Guidelines for this report will be found in DG-8.5. The final version of the G4RR should include approval for the project to proceed to the Build phase, and will indicate all open actions that have been deferred to the Build phase.

Each stakeholder who performed activities during step 8 is encouraged to document an assessment of the experience in a personal record. This assessment should include: what was good, what was bad, what worked, what did not work, what can be improved, how it can be improved.

The **Development Lead** should remind the stakeholders to do this. At the conclusion of Development (step 11), the **Development Lead** will collect the final edited personal stakeholder records and incorporate them into a Development Project Report (DPR).

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