

PRODUCT DEVELOPMENT PROCESS

Description and Summary



Enron Communications

REVIEW DRAFT

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Reference documents

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Approvals

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Process Overview

Scope and purpose

This document describes the process for designing, building and implementing products that are composed of hardware systems, software, and network components. A set of companion documents describes each stage of the process in more detail and includes outlines for the content of key documents. Together, all these documents establish procedures and requirements to ensure Enron Communications Inc. (ECI) produces quality products.

Process overview

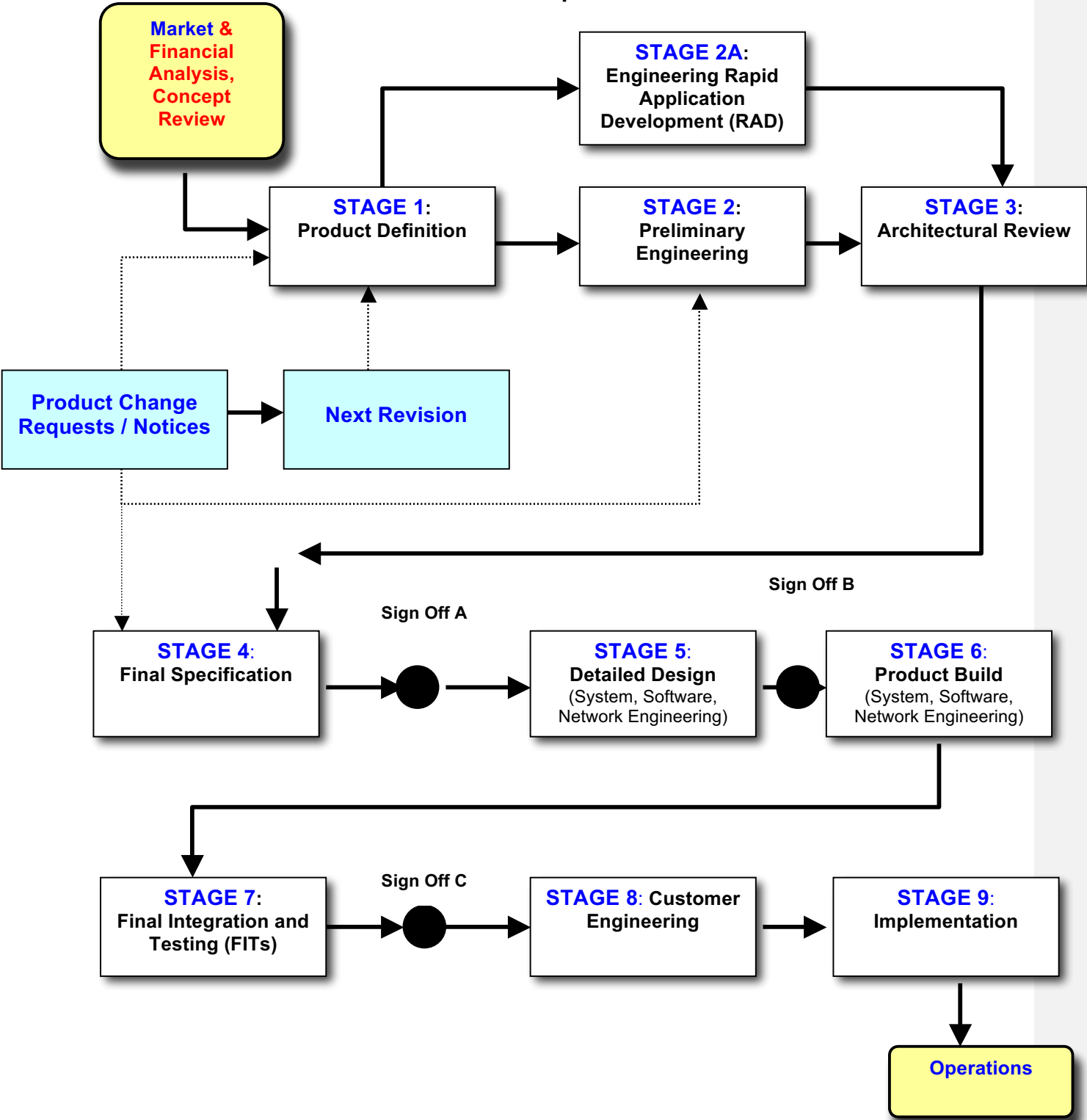
Product development is a multi-stage, cross-functional process that involves all the technical groups in the company. The figure on the next page—reading from left to right, top to bottom—diagrams the major stages of the process.

There are nine stages, starting with Stage 1, Product Definition, and ending with Stage 9, Implementation. The process begins once a **development project** has had financial and managerial approval and the market analysis is complete. The process ends at the point where a product, with its full complement of documentation, is turned over to Operations for maintenance and support.

In the most general sense, the process is designed to create a definitive, standard product, one that can be rolled out in “cookie cutter” fashion for any number of customers. Although this approach is most often the case, each product requires some customization. The custom design stage begins after final integration and testing, Stage 7, when Customer Engineering takes over the process, just prior to implementation and handing off the project to Operations.

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Product Development Process



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Market analysis: Process foundation

Before product development begins, market analysis identifies where the convergence of emerging technologies and market applications present profitable business opportunities. A Market Requirements Document (MRD) and business case are prepared. The MRD is a high level overview of the market for the product, and includes size, segmentation, competition review, and projections of capture and penetration rates. The document summarizes functional requirements, proposes a product roadmap for phased development, describes a sales and distribution strategy, and suggests a method for customer billing. The MRD may also detail product packaging, pricing requirements, promotion, and market positioning strategy. The MRD and business case are the basis for a financial review of the product that is submitted through the Deal Approval Process. Once the product is approved for development, the Product Development Process begins.

Process description

Here is a general description of each stage of the Product Development Process:

STAGE 1: Product Definition

In this stage, the Product Development group defines the product from a customer's perspective. The principal information required to kick off the process is the *Product Financial Approval* and the *Market Requirements Document*, especially the product road map from the MRD. The main output is the *Product Requirements Document (PRD)*. The PRD details the features, costs, and a proposed development schedule for the product. This document must be approved by the by the Manager of Product Development, the Vice President of Engineering, and the Director of Product Development.

STAGE 2A: Preliminary Specification

In this stage, the company defines, from an engineering perspective, the product that will satisfy the specifications and requirements of the PRD. The main output is the *Preliminary Engineering Specification (PES)*.

The PES, which refines the information in the PRD, contains a complete list and description of features and a quarterly schedule for the product development. The PES also specifies which product features should be assigned to which engineering group for development.

STAGE 2B: Engineering Rapid Application Development (RAD)

The role of RAD engineering is to contribute to the completion of the *Preliminary Engineering Specification* by performing supporting analysis, and prototyping if necessary, for proof-of-concept. Once RAD has demonstrated the technical

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feasibility of the product, a lead engineer is assigned to head the product develop. Which engineering group assumes the lead engineering role depends on whether the product has a hardware, software or network focus; the lead engineer assignment is made accordingly.

STAGE 3: Architecture Review

At this stage, the Architecture Review Committee reviews the PES to ensure the design is consistent with the long term vision of the Enron Intelligent Network.

The Architecture Review Committee consists of the Vice Presidents of Software Architecture, Product Development and Engineering, Network and Service Implementation, and Research and Technology. The outcome of the committee’s review is either approval of the PES, or a set of recommended changes to the PES

STAGE 4: Final Specification

During this stage, the lead engineering department uses the approved PES to prepare the *Final Engineering Specification* (FES), which will be used for completing detailed engineering of the product. The FES must be approved by the managers of the lead engineering department and RAD, and by the Vice President of Engineering.

STAGE 5: Detailed Design

In this stage software, hardware, and network engineering use the *Final Engineering Specification* to develop a detailed engineering design for the product. These engineering groups contribute to and complete an *Engineering Design Document* (EDD) that specifies all functional aspects of the product for each of the (1) software, (2) hardware, (3) network systems and components, and **4) process requirements for operational support**. These are the build-to designs and specifications for the product. They include operational requirements that will eventually be part of the product documentation handed off to Customer Engineering and Operations.

The EDD documents must be approved by each member of the Design Review Committee.

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STAGE 6: Product Build

In this stage the engineering groups develop the software, specify the hardware, and complete the network engineering for the product. Their outputs consist of the hardware components, software, and network specifications and diagrams, such as drawings and bills of materials, that fulfill each requirement set forth in the *Engineering Design Documents*.

The manager of each engineering department is responsible for certifying build completion of his or her respective product hardware, software, and network systems.

STAGE 7: Final Integration and Testing (FITS)

This stage addresses the integration and testing of all the product software, hardware, and network components. FITS engineering writes a *Test Plan* and conducts complete testing of the product. The *Test Plan* must be reviewed and signed by the managers of the engineering departments, as well as the FITS manager.

The outcomes of the tests are documented in bug reports and test results compiled into the *FITS Results Document*.

STAGE 8: Customer Engineering

At this point, Customer Engineering customizes a product's application and configured it to meet a specific customer's needs. Customer Engineering obtains customer requirements, with a site survey or similar document, and uses the *Customer Engineering Service Request* to kick off its work.

Through the methods of discovering, baselining, profiling, analyzing, and designing, Customer Engineering creates "build-to" drawings and design specifications. In cooperation with the Project Engineer, Customer Engineering completes a Statement of Work, site-specific Installation Documents, and a Project Plan. The documentation includes purchase orders, bills of materials, software patches (if required), QA test results from staging and burn in, operations manuals, and checklists. Altogether, this set of information is called the *Customer Engineering and Implementation Documentation Package*.

The Design Review Committee reviews and approves this documentation package.

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STAGE 9: Implementation

In the final stage of the process, Network and Service Implementation (NSI) takes the *Customer Engineering and Implementation Documentation Package* from Customer Engineering and provisions circuits, adapts the design to the customer's location, orders stages, ships and possibly installs equipment, and creates "as-built" documentation. NSI also prepares customer-specific documentation for Operations to take over the maintenance and support of the installation. When implementation is complete, NSI "walks down" the installation with Operations, reviews the as-built documentation, including test results and documents deficiencies. Once the deficiencies are corrected, Operations signs off the As-built package, accepting the installation.

After this, Operations is responsible for the maintenance and support of the product at the customer's site

Sign offs

There are three junctures in the process where signatures are required:

- **Sign Off A—Final Specification** . The managers of the lead engineering department, RAD, the VP of Engineering, **and the Director of Product Marketing**, all approve the *Final Engineering Specification*. No "feature creep" is allowed after this point, so no more additions or revisions to the product design will be admitted. Only under extraordinary circumstances, and then only after another architectural review and approval, can the *Final Engineering Specification* be amended.
- **Sign Off B—Detailed Design**. The Design Review Committee approves all three *Engineering Design Documents*, one for each for software, hardware, and network engineering. All documentation necessary for product build must be included in the design package. Once approved, these documents are the blue prints for the product build.
- **Sign Off C—Final Inspection and Testing**. The Product Manager (of the lead engineering department), the FITS manager and the manager of Operations must approve the product design after testing is completed. Signatures at this stage indicate the product is ready for implementation.
- **Sign Off D – Operations Acceptance**. Once an installation is complete, operations must accept it, formally signifying it's acceptance and completion.

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Signatures indicate a commitment to proceed with the product development. At each successive stage, signatures lock in the product with more and more specification and definition, eliminating further changes or redirections that would expand the scope and timelines of the product development process.

Additional steps

Product Change Requests/Notification

This is the process used to modify product design and fix bugs or problems found in the product once its been placed in service.

Next Product Revision

The company will accumulate requests for new features or enhancements to an existing product and factor these into the next version of the product. Enron Communications will update products incrementally, and not continuously. This idea implies that each model, except for the customer-specific configuring done by Customer Engineering, will be interchangeable with other models of the same product.

Roles and responsibilities

Each stage of the process involves different people and departments within the company. The following table summarizes the roles and responsibilities of key participants in this process.

Role or Job Title	Summary of Responsibilities
Project Manager	The project manager is responsible for completing the product on time, within budget and ensuring that the product meets the needs of the customer as defined by the Product Manager.
Product Manager	The product manager is from the Product Marketing department and is responsible for defining the product in the Marketing <i>Requirements Document</i> and is also responsible for the marketing and public relations aspects of the product. The Product Manager has overall responsibility for the financial success of the product.
Vice President of Engineering	The Vice President of Engineering ensures that there are adequate resources available to the project manager.
Lead Engineer	The lead engineer has overall technical responsibility for the product. He or she may be from System Engineering, Software Engineering or Network Engineering. He or she ensures that the engineering efforts of the separate disciplines are coordinated.

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Role or Job Title	Summary of Responsibilities
RAD Engineer	The RAD engineer builds a prototype of the product for proof of concept. The RAD engineer also helps the Lead Engineer develop the <i>Preliminary Engineering Specification</i> .
FITS Engineer	The FITS engineer integrates and then tests the separate components of the complete product. The FITS engineer is responsible for the preliminary and final quality assurance of the product.
Customer Engineer	The Customer Engineer takes the completed product and prepares an implementation plan for the Network and Service Implementation Service group to use for rolling out the product.
Design Review Committee	<p>The design review committee is lead by the Vice President of Engineering and consists of representatives of the cross functional core and extended teams:</p> <ul style="list-style-type: none"> • Core team. This team comprises the Project Manager, Product Manager, System Engineer, Network Engineer, Software Engineer, representatives from Field Operations • Extended team. This team comprises the Provisioning Representative, Customer Engineer, Sales Engineer, Marketing Representative. <p>The design review committee reviews and approves the <i>Final Engineering Specification</i> as well as the <i>Customer Engineering and Implementation Documentation Package</i>. This process requires buy-in from members of both the core and extended cross-functional teams.</p>
Architecture Review Committee	The architecture review committee is led by the Vice President of Engineering and consists of the vice presidents of Software Architecture and Engineering and the Directors of Product Marketing Network and Service Implementation, and Research and Technology. Their responsibility is to review the <i>Preliminary Engineering Specification</i> to ensure that it is consistent with the long term vision of the Enron Intelligent Network.

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Product Development Stages

	1. Product Definition	2A. Preliminary Engineering	2B. Engineering Rapid Application Development (RAD)	3. Architectural Review	4. Final Specification
Purpose	Define product from customer's perspective	Define product from engineering perspective; satisfy product requirements.	Demonstrate proof-of-concept through analysis and prototyping	Reviews the PES to ensure the design is consistent with the long term vision of the Enron Intelligent Network	Uses the approved PES and addendum to prepare the <i>Final Engineering Specification</i> (FES)
Information inputs	<i>Product Financial Approval</i> and the <i>Market Requirements Document</i> (MRD), which includes the "product road map"	<i>Product Requirements Document</i> (PRD)	<i>Product Requirements Document</i> (PRD)	<i>Preliminary Engineering Specification</i> (PES).	Approved <i>Preliminary Engineering Specification</i> (PES)
Information outputs	<i>Product Requirements Document</i> (PRD)	<i>Preliminary Engineering Specification</i> (PES)	<i>Preliminary Engineering Specification</i> (PES)	Addendum to the <i>Preliminary Engineering Specification</i> (PES)	<i>Final Engineering Specification</i> (FES),
Approvers	Vice President of Engineering, Manager of Product Development	Product Development, RAD	Product Development, RAD	Architectural Review Committee	Managers of the lead engineering department and RAD, and by the Vice President of Engineering
Participating departments or groups	Product Development	Lead engineering department with support from RAD	Lead engineering department with support from RAD	Architectural Review Committee	Lead engineering department
Owner	Director of Product Marketing	Manager of lead engineering department	Manager of RAD	Vice President of Engineering	Manager of the lead engineering department

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	5. Detailed Design	6. Product Build	7. Final Integration and Testing (FITs)	8. Customer Engineering	9. Implementation
Purpose	Complete software, hardware, and network engineering using the FES to develop a detailed engineering and process design for the product	Develop the software, specify the hardware, and complete the network engineering and operational process for the product	Integration and testing of all the product software, hardware, and network components	Customize a product's application and configured it to meet a customer's specific needs	Complete product installation and start-up
Information inputs	<i>Final Engineering Specification (FES)</i> ,	<i>Engineering Design Document (EDD)</i> for the software, hardware, and network systems	<i>Engineering Design Document (EDD)</i> , and completed software, hardware, and network systems and components	<i>Customer requirements (such as a Site Survey) and Customer Engineering Service Request</i>	<i>Customer Engineering and Implementation Documentation P</i>
Information outputs	<i>An Engineering Design Document (EDD)</i> for the software, hardware, and network systems	Hardware components, software programs, and network specifications and diagrams, such as drawings and bills of materials (BOMs)	<i>Test Plan</i> and <i>FITS Results Document</i>	<i>Customer Engineering and Implementation Documentation Package</i> (includes "build-to drawings and specs)	circuit provisioning (if required); "as-built" drawings and other customer-specific documentation
Approvers	Each member of the Design Review Committee	Managers of RAD, FITs, and engineering departments	Managers of FITs and lead engineering departments	Design Review Committee members	Design Review Committee members
Participating departments or groups	Lead engineers of the software, hardware, and network engineering departments	Engineering and Operations departments	FITs and engineering departments	Customer Engineering, Operations, NIS, and Product Marketing	Customer Engineering, Operations, NIS
Owner	Manager of the lead engineering department	Manager of the lead engineering department	Manager of FITs	Manager of Customer Engineering	Manager of NIS

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