chap9

Process Modeling

Objectives
Draw event diagrams and merge them into a system diagram.
Draw primitive data flow diagrams and describe the elementary data flows in terms of data structures and procedural logic.
Synchronize(同步) data and process models using a CRUD matrix.

Process Modeling and DFDs

Process modeling – a technique used to organize and document the structure and flow of data through a system's processes.

Data flow diagram (DFD) – a process model used to depict the flow of data through a system and the work or processing performed by the system. Synonyms are bubble chart, transformation graph, and process model.

Simple Data Flow Diagram

External Agents

External agent – an outside person, unit, system, or organization that interacts with a system. Also called an external entity.
External agents define the "boundary" or scope of a system being modeled.
As scope changes, external agents can become processes, and vice versa.
Almost always one of the following:

```
Office, department, division.
An external organization or agency.
Another business or another  information system.
One of system's end-users or managers
```

Named with descriptive, singular noun

Data Stores

Data store – stored data intended for later use. Synonyms are file and database.

```
Frequently implemented as a file or database.
A data store is "data at rest" compared to a data flow that is "data in
```

第9章
流程建模

目标 绘制事件图并将它们合并成系统图。

绘制原始数据流图并用数据结构和过程逻辑描述基本数据流。

使用 CRUD 矩阵同步数据和流程模型。

流程建模和 DFD

流程建模———种用于组织和记录系统流程中的数据结构和流的技术。

数据流图 (DFD) — 一种过程模型，用于描述系统中的数据流以及系统执行的工作或处理。同义词是气泡图、转换图和过程模型。

简单的数据流程图

外部代理

外部代理——与系统交互的外部人员、单位、系统或组织。也称为外部实体。

外部代理定义了正在建模的系统的"边界"或范围。随着范围的变化，外部代理可以成为流程，反之亦然。几乎总是以下之一：

办公室、部门、部门。

外部组织或机构。

另一个业务或另一个信息系统。

系统的最终用户或管理者之一

以描述性单数名词命名

数据存储

数据存储——存储供以后使用的数据。同义词是文件和数据库。

通常作为文件或数据库实现。

数据存储是"静态数据"，而数据流是"静态数据"

```
motion."
Almost always one of the following:
        Persons (or groups of persons)
        Places
        Objects
        Events (about which data is captured)
        Concepts (about which data is important)
Data stores depicted on a DFD store  all instances of data entities
 (depicted on an ERD)
Named with plural noun
```

Process Concepts

Process – work performed by a system in response to incoming data flows or conditions. A synonym is transform(转换).

Data Flows & Control Flows

Data flow – data that is input to or output from a process.

```
A data flow is data in motion
A data flow may also be used to represent the creation, reading, deletion,
or updating of data in a file or database (called a data store).
```

Composite data flow – a data flow that consists of other data flows.

Process Decomposition

Decomposition – the act of breaking a system into sub-components. Each level of abstraction reveals more or less detail.

Decomposition Diagrams

Decomposition diagram – a tool used to depict the decomposition of a system. Also called hierarchy chart.

Types of Logical Processes

Function – a set of related and ongoing activities of a business.

```
A function has no start or end. Eg. Order management
```

 Event – a logical unit of work that must be completed as a whole. Sometimes called a transaction.

运动。"

几乎总是以下之一：

 个人（或团体）

 地点

 对象

 事件（捕获有关其数据的事件）

 概念（哪些数据很重要）

DFD 上描述的数据存储存储数据实体的所有实例

（在 ERD 上描述）

以复数名词命名

流程概念

流程——系统响应传入数据流或条件而执行的工作。同义词是转换（转换）。

数据流和控制流

数据流——流程输入或输出的数据。

数据流是运动中的数据

数据流还可以用来表示创建、读取、删除、

或更新文件或数据库（称为数据存储）中的数据。

复合数据流——由其他数据流组成的数据流。

流程分解

分解——将系统分解为子组件的行为。每个抽象级别都或多或少地揭示了细节。

分解图

分解图——用于描述系统分解的工具。也称为层次图。

逻辑过程的类型

功能——企业的一组相关且持续的活动。

函数没有开始或结束。例如。订单管理

事件——必须作为一个整体完成的逻辑工作单元。有时称为交易。

Triggered by a discrete input and is completed when process has responded with appropriate outputs.

Functions consist of processes that respond to events.

eg. process order

Elementary process – a discrete, detailed activity or task required to complete the response to an event. Also called a primitive process.

```
The lowest level of detail depicted in a process model.
Eg. Calculate order cost
```

Composite and Elementary Data Flows

Common Process Errors on DFDs

Data Flow Packet Concept(报文)

Data that should travel together should be shown as a single data flow, no matter how many physical documents might be included.

Data Flows to and from Data Stores

Rules for Data Flows

A data flow should never go unnamed.

In logical modeling, data flow names should describe the data flow without describing the implementation

All data flows must begin and/or end at a process.

Data Conservation数据流的守恒

Data conservation – the practice of ensuring that a data flow contains only data needed by the receiving process.

```
Sometimes called starving the processes.
Must precisely define the data composition of each data flow, expressed in
the form of data structures.
```

由离散输入触发，并在流程响应适当的输出时完成。

函数由响应事件的进程组成。例如。流程顺序 基本流程——完成事件响应所需的离散、详细的活动或任务。也称为原始过程。

流程模型中描述的最低细节级别。

例如。计算订单成本

复合和基本数据流

DFD 上的常见流程错误

数据流包概念(报全文)

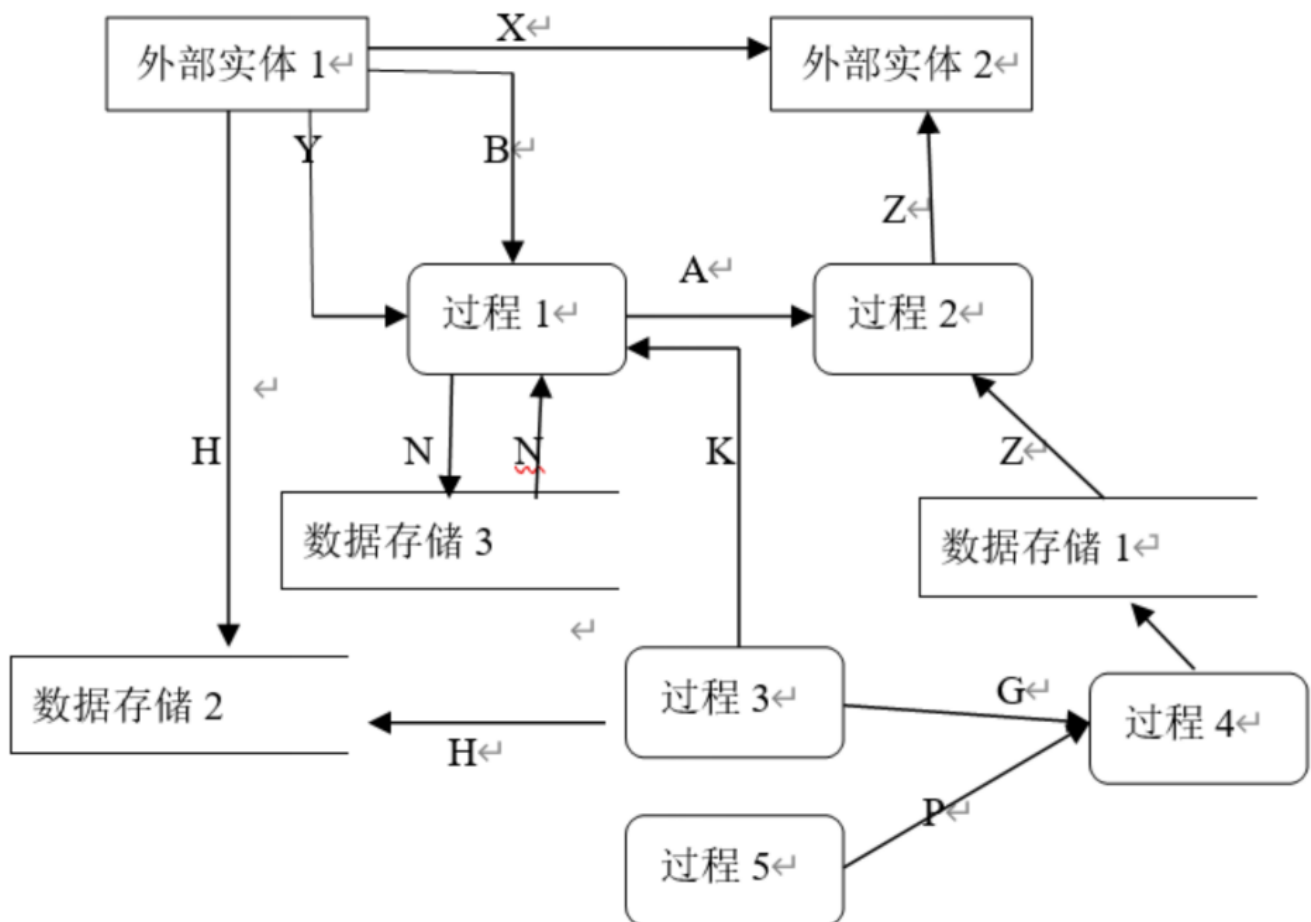无论包含多少物理文档，应一起传输的数据都应显示为单个数据流。

数据流入和流出数据存储

数据流规则

数据流永远不应该是未命名的。

在逻辑建模中，数据流名称应该描述数据流，而不描述实现。所有数据流必须在流程中开始和/或结束。

Data Conservation数据流的守恒

数据保存——确保数据流仅包含接收过程所需的数据的做法。

有时称为进程饥饿。

必须精确定义每个数据流的数据组成，表示为

数据结构的形式。

外部实体 1   X   外部实体 2

Y   B

过程 1   A   过程 2

Z

H   N   N   K   Z

数据存储 3

数据存储 1

数据存储 2   过程 3   G   过程 4

H

P

过程 5

Data Structures

Data attribute – the smallest piece of data that has meaning to the users and the business.
Data structure – a specific arrangement of data attributes that defines an instance of a data flow.

```
The data attributes that comprise a data flow are organized into data
structures.
Data flows can be described in terms of the following types of data
structures:
        A sequence or group of data attributes that occur one after
another.
        The selection of one or more attributes from a set of attributes.
        The repetition of one or more attributes.
```
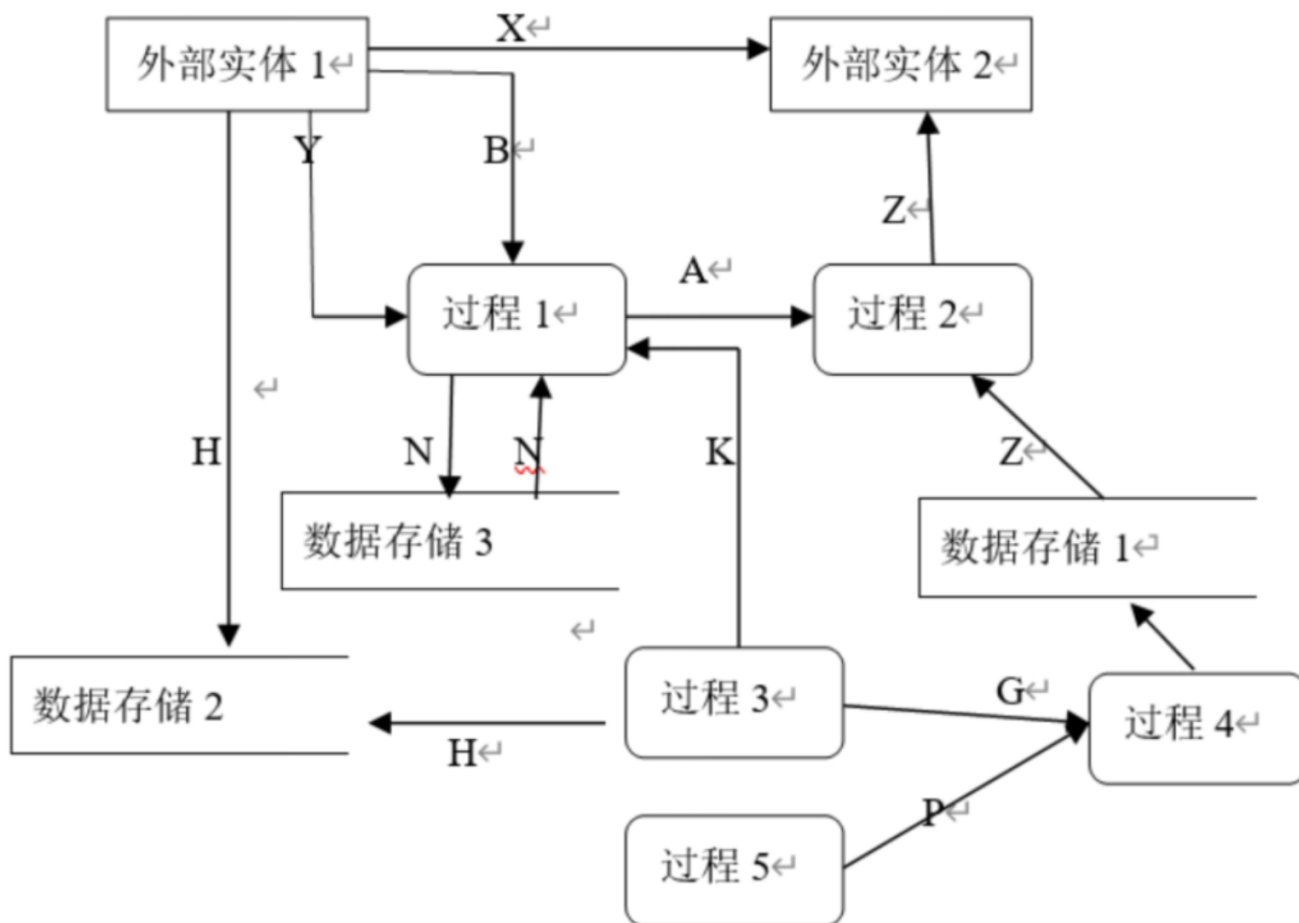
Data Structure for a Data Flow
Data Structure Constructs

Data Types and Domains

Data attributes should be defined by data types and domains.

Data type - a class of data that be stored in an attribute.

数据结构

数据属性——对用户和业务有意义的最小数据。数据结构——定义数据流实例的数据属性的特定排列。

构成数据流的数据属性被组织成数据结构。

数据流可以用以下数据类型来描述结构：

之后出现的一系列或一组数据属性

其他。

从一组属性中选择一个或多个属性。

一个或多个属性的重复。

数据流的数据结构　数据结构构造

数据类型和域

数据属性应由数据类型和域定义。

数据类型 – 存储在属性中的一类数据。

```
Character, integers, real numbers, dates, pictures, etc.
```

Domain – the legitimate values for an attribute.

Diverging and Converging Data Flows

Diverging data flow （分支数据流）– a data flow that splits into multiple data flows.
Indicates data that starts out naturally as one flow, but is routed to different destinations.
Also useful to indicate multiple copies of the same output going to different destinations.
Converging data flow （合并数据流）– the merger of multiple data flows into a single packet.
Indicates data from multiple sources that can (must) come together as a single packet for subsequent processing.

Modern Structured Analysis (More Commonly Practiced)

Draw context DFD to establish initial project scope.
Draw functional decomposition diagram to partition the system into subsystems.
Create event-response or use-case list for the system to define events for which the system must have a response.
Draw an event DFD for each event.
Merge event DFDs into a system diagram (or, for larger systems, subsystem diagrams).
Draw detailed, primitive DFDs for the more complex event.
Document data flows and processes in data dictionary.

Context Data Flow Diagram

Context data flow diagram - a process model used to document the scope for a system. Also called the environmental model.

Think of the system as a "black box."
Ask users what business transactions the system must respond to. These are inputs, and the sources are external agents.
Ask users what responses must be produced by the system. These are outputs, and the destinations are external agents.
Identify any external data stores, if any.
Draw a context diagram.

SoundStage Context DFD
SoundStage Functional Decomposition Diagram
SoundStage Partial Event   Decomposition Diagram(事件分解图)

Event Diagrams(事件图)

Event diagram – data flow diagram that depicts the context for a single event.

字符、整数、实数、日期、图片等

域——属性的合法值。

分散和聚合数据流

分流数据流（分支数据流）——分裂成多个数据流的数据流。

表示数据自然作为一个流开始，但路由到不同的目的地。对于指示前往不同目的地的同一输出的多个副本也很有用。合并数据流（合并数据流）——将多个数据流合并到一个数据包中。表示来自多个源的数据可以（必须）组合在一起作为单个数据包进行后续处理。

现代结构化分析（更常用）

绘制上下文 DFD 来确定初始项目范围。

绘制功能分解图，将系统划分为子系统。为系统创建事件响应或用例列表，以定义系统必须响应的事件。

为每个事件绘制一个事件 DFD。

将事件 DFD 合并到系统图中（或者，对于较大的系统，合并到子系统图）。

为更复杂的事件绘制详细的、原始的 DFD。

在数据字典中记录数据流和过程。

上下文数据流程图

上下文数据流图 – 用于记录系统范围的过程模型。也称为环境模型。

将系统视为"黑匣子"。询问用户系统必须响应哪些业务事务。这些是输入，来源是外部代理。询问用户系统必须产生什么响应。这些是输出，目的地是外部代理。

识别任何外部数据存储（如果有）。

绘制上下文图。

SoundStage Context DFD SoundStage 功能分解图 SoundStage 部分
事件分解图(事件分解图)

Event Diagrams(事件图)

事件图——描述单个事件上下文的数据流图。

```
One diagram for each event process
Depicts
        Inputs from external agents
        Outputs to external agents
        Data stores from which records must be "read." Data flows should
be added and named to reflect the data that is read.
        Data stores in which records must be created, deleted, or updated.
Data flows should be named to reflect the update.
```

Balancing

Balancing - a concept that requires that data flow diagrams at different levels of detail reflect consistency and completeness

Quality assurance technique
Requires that if you explode a process to another DFD to reveal more detail, you must include the same data flows and data stores

Primitive Diagrams(基本图)

Some (not necessarily all) event processes may be exploded into primitive diagrams to reveal more detail.
Complex business transaction processes
Process decomposed into multiple elementary processes
Each elementary process is cohesive - it does only one thing
Flow similar to computer program structure

Data & Process Model Synchronization CRUD Matrix

Process Distribution

每个事件过程一张图

描绘

来自外部代理的输入

输出到外部代理

必须从中"读取"记录的数据存储。数据流应

添加并命名以反映读取的数据。

必须在其中创建、删除或更新记录的数据存储。

数据流应命名以反映更新。

平衡

平衡 – 一个概念，要求不同细节级别的数据流程图反映一致性和完整性

质量保证技术 要求如果将流程分解为另一个 DFD 以显示更多细节，则必须包含相同的数据流和数据存储

原始图(基本图)

一些（不一定是全部）事件过程可以分解为原始图以揭示更多细节。复杂的业务交易流程 流程分解为多个基本流程 每个基本流程都是内聚的 – 它只做一件事 流程类似于计算机程序结构

数据和流程模型同步 CRUD 矩阵

流程分布