Curriculum Development
Centers Program

Awardee of The Office of the National Coordinator for
Health Information Technology

Fundamentals of Health Workflow Process Analysis and Redesign

Process Mapping:
Yourdon Notation for Data Flow Diagrams
Lecture c

Process Mapping:
Yourdon Notation for Data Flow Diagrams
Learning Objectives

1. Create a process flowchart for a health care system (or system component) using appropriate ISO 5807 symbols and conventions. (Lecture b)
2. Create context and data flow diagrams for a health care system (or system component) using appropriate Yourdon symbols and conventions (Lecture c)
3. Choose the correct scope and detail level for a process flowchart and data flow diagram (Lecture b, c)
4. Read and interpret Gane-Sarson data flow diagram (Lecture d)
5. Read and interpret an entity relationship diagram in crow's foot notation (Lecture e)
6. Read and interpret UML class, activity, and state diagrams (Lecture f)

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Process Mapping:
Yourdon Notation for Data Flow Diagrams
Topics - Lecture c

- Yourdon data flow diagram symbols and conventions
- Creating data flow diagrams (DFDs) for a given a health care scenario

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Background

- Data flow diagrams (DFDs) provide a way to document and visualize the movement of data through a process
- Yourdon notation was introduced in Edward Yourdon's 1989 book
  - Modern Structured Analysis
- Yourdon notation exists for three types of diagrams :
  - Data flow diagrams
  - State transition diagrams
  - Entity-relationship diagrams
- The most commonly used in health care is the data flow diagram covered in this lecture

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Methods for Diagramming Processes

Process Aspects	ISO 5807	Yourdon data flow	Gane-Sarson	UML	E-R diagram
Context		**X**	X		
Process steps	X	**X**		X	
Data flow steps	X	**X**	X	X	
Information content		**text**	text	X	X
Data transformation	X	**X**	X	X	
Flow control and state	X		text	X	
Roles involved	X		X	X	

Table 3.3 Methods for Diagramming Processes. Nahm, M, 2012.

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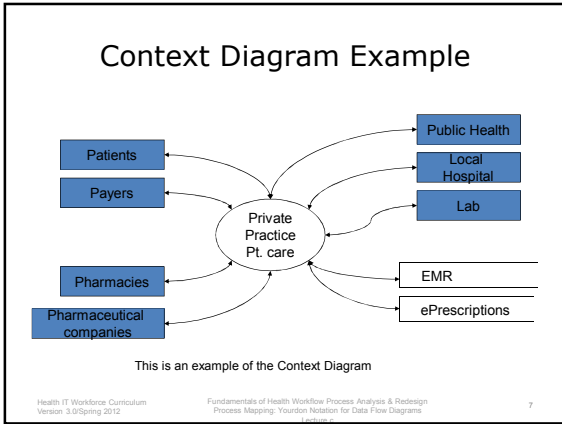Process Mapping: Yourdon Notation for Data Flow Diagrams
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Use

- The most popular use of Yourdon notation is to depict the context in which a process operates, i.e., high level interactions among
  1. Major entities
  2. Interactions between the process and outside entities.
- Context and more detailed DFDs show
  - Entities
  - Processes (the data transformation part)
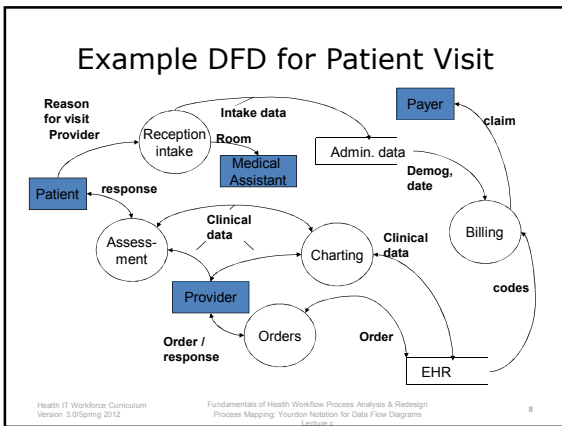 - Data stores

  Rather than procedural details

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Context Diagram Example

Patients

Payers

Pharmacies

Pharmaceutical companies

Public Health

Local Hospital

Lab

Private Practice Pt. care

EMR

ePrescriptions

This is an example of the Context Diagram

Example DFD for Patient Visit

Reason for visit
Provider

Intake data

Payer

claim

Reception intake

Room

Admin. data

Medical Assistant

Demog, date

Patient

response

Clinical data

Billing

Assessment

Clinical data

Charting

Clinical data

Provider

codes

Orders

Order

Order / response

EHR

Yourdon Symbols

Entity

Process

Flow

Data store

Dataflow diagrams consist of processes, data stores, entities, and flows

These symbols are Yourdon Symbols

Entities

Entity

- Represent people, organizations, or other things that interact with an information processing system
  - Computerized or manual
- Named with a noun or noun phrase
- Send or consume information
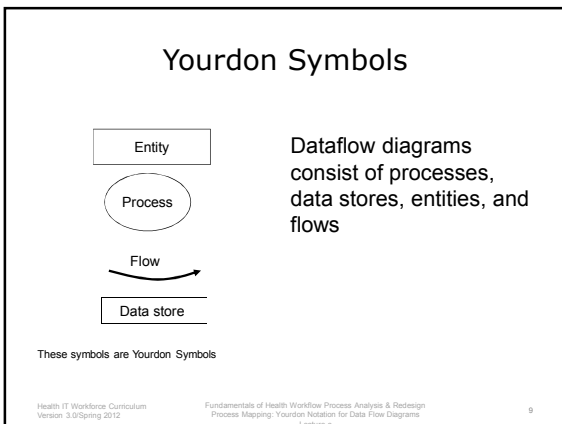- Data flows can come to and from entities only from processes

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Lecture c

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Process

Process

- Named with a single word, phrase, or simple sentence that describes *what* the process does:
  - A good name consists of a verb-object phrase
    - Such as assessment or assess patient
- Alternatively, a name may be a person, group of people, computer, or mechanical device
- It must have both inputs and outputs

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Flow

Flow

- Represented by curved arrows
- Arrow heads on the flow indicate direction
- Name represents the meaning of the data that moves along the flow
- The same content may have a different meaning in different parts of the system

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Data Store

Data store

- Represents a collection of data at rest
- Named with noun or noun phrase
- Can be computerized or non-computerized, such as paper charts
- Data stores are passive
  - Arrows to data stores mean write, update, delete
  - Arrows from data stores mean read, retrieve, use
- Data flows to data stores can NOT come from other data stores or from entities

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Event List

- In Yourdon notation, an event list accompanies a data flow diagram
- An event list contains things that stimulate action from the system
- For example, for prescribing:
  - A patient calls for a re-fill
  - A pharmacy calls for a re-fill
  - A patient presents with a problem requiring medication

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Conventions

- Choose meaningful names for processes, flows, stores, and terminators
- Number the processes by placing a unique number in the circle at the top
- Redraw the DFD as many times as necessary until it is clear and complete
- Simplify DFDs
  - A good DFD fits on one page and is not too crowded. If additional details are needed, processes can be "exploded" on a new page
  - Everything on one page should be at the same detail level

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Matters of Style

- Size and shape of bubbles are up to the diagram creator and their client
- Curved or straight arrows can be used. Looks neater with one or the other but not both
- There is no excuse for hand-drawn diagrams today except during a white-boarding stage
- Some name the processes for the role that they perform
- Some use color to differentiate types of entities or flows

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Beware of

- Black holes
  - Processes that have inputs but no outputs

- Miracles
  - Processes that have outputs but no inputs

- Mysteries
  - Unlabeled flows and unlabeled processes

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Leveled Diagrams

- Are encouraged
- Start with higher level (context) diagrams to understand the scope and boundaries
- Decompose processes to lower levels of detail when needed
- Remember the ultimate goal is an optimized clinic process not a large detailed set of diagrams

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Guidance from Yourdon

"…even if our job were to 'design the world,' we would have to recognize that the world is only a part of the solar system, which is part of a small, obscure galaxy, which is (ultimately) part of the universe."

"…the first major model that you must develop as a systems analyst is one that does nothing more than define the interfaces between the system and the rest of the universe, that is, the environment."

-Yourdon, *Just Enough Structured Analy*sis

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There have been variations on Yourdon notation

- Yourdon-Code
- Yourdon-DeMarco
- Yourdon concepts and notation have been adapted to suit needs of individual projects
  - Yourdon notation for data flow diagrams has been adapted for health care process analysis and redesign by the Pubic Health Informatics Institute (PHII) in their recent Common Ground Initiative
  - Agency for Healthcare Research and Quality (AHRQ) funded initiatives
- Yourdon himself makes the point that the actual shape chosen is not important as long as the analyst uses the shape to consistently represent the same meaning

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Example of a Modified Yourdon DFD

- **Modifications:**
- Uses one shape and does not distinguish between process, entity and data store
- Calls it a context diagram
- Differentiates types of flows

Reprinted from Cabarrus Health Alliance http://www.cabarrushealth.org/

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Context Diagram Example

Without looking at the next slide, draw a one-page DFD for a prescription refill process at a primary care provider based on the following scenario:

Mrs. Jones takes Benecar 20mg QD for blood pressure control. She has taken this medicine for two years with good results. She does not use the "auto refill" program at her local pharmacy. Today, she called her provider, who does not use e-prescribing, and asked if the prescription could be called in to her pharmacy.

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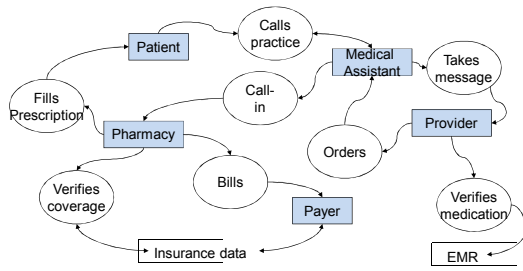Process Mapping: Yourdon Notation for Data Flow Diagrams
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Prescription Refill Context Diagram

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Maintenance

- Yourdon notation is a set of symbols and conventions named for the person who developed it, Edward Yourdon
- Yourdon notation has not been adopted as a standard
  – There is no formal maintenance organization
- Individuals use and adapt it to suit their needs
- For an adaptation to "still be" a context diagram, it must show entities, processes and interactions

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Summary – Lecture c

At this point you should be able to:

– Explain two ways process diagrams are used as models
– Distinguish the physical steps from information flow in a health care process involving an EHR
– Choose an appropriate process diagram to model given aspects of a process

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Diagrams
References – Lecture c

References
• **Yourdon, E. (2006).** *Just Enough Structured Analysis* **(Rev ed.). Retrieved from** http://yourdon.com/strucanalysis/wiki

Charts, Tables, and Figures
3.3 Table. Nahm, M, *Methods for diagramming processes,* 2012.

Images
Slide 7: Context Diagram Example. Nahm ,M., Duke University, 2012.
Slide 8: Example DFD for Patient visit. Nahm, M. Duke University, 2012.
Slide 9: Yourdon Symbols or dataflow diagrams. Nahm ,M., Duke University, 2012.
Slide 10: The "Entity" symbol in Yourdon notation. Nahm ,M., Duke University, 2012.
Slide 11: The "Process" symbol in Yourdon notation. Nahm, M., Duke University, 2012.
Slide 12: The "Flow" symbol in Yourdon notation. Nahm M., Duke University, 2012.
Slide 13: "Data Store" symbol utilization in Yourdon notation. Nahm, M., Duke University, 2012.
Slide 21: Diagram showing relationships of software processes in public health departments. Cabarrus Health Alliance.   http://www.cabarrushealth.org/
Slide 23: Example prescription refill context diagram. Nahm, M., Duke University, 2012.

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