

Fundamentals of Health Workflow Process Analysis and Redesign

Unit 10.3d Process Mapping Gane-Sarson Notation

Component 10/Unit 3d

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Welcome to the Gane-Sarson Notation for Data Flow Diagrams Subunit. This is the third Subunit of the Process Mapping Unit.

Upon successful completion of this sub-unit the student is able to:

- Describe Gane-Sarson notation (symbols and conventions) for process diagramming.
- Read a data flow diagram in Gane-Sarson notation and describe the information generated and used, and the path of that information through the system.

This subunit provides details about Gane-Sarson notation for data flow diagrams. We describe the standard diagramming symbols and conventions so that you will be able to read a Gane-Sarson data flow diagram and understand the data content and flow being communicated.

This sub-unit does not cover other parts of Gane-Sarson notation, and is not meant to teach you how to draw the diagrams, only to understand and interpret them in case you encounter them in practice.

Methods for Diagramming Processes

Process Aspects	ISO 5807	Yourdon	Gane-Sarson	UML	E-R diagram
Context		X	X	X	
Process steps	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	

Each of the methods for diagramming a process has its own set of capabilities. Gane-Sarson represents the process context (that is, the process or system boundaries, interactions with the outside world, and the major functions). It also represents information content, the order or sequence of the data flow steps involved in the process, transformations that occur or should occur, and the roles of the persons completing the steps in the process. While Gane and Sarson recognized the importance of representing information content and flow control, they did so through text data dictionaries (lists of the data elements) and structured English If-Then type statements. Since these are not graphic representations, we will not cover them here.

Gane and Sarson represented context, data flow and data transformation through one diagram type, the Data Flow Diagram (DFD). Their approach used a high-level DFD to show context, and a more detailed (or series of more detailed) diagrams to show data flow steps. Data transformation is represented on the DFD by a “process” symbol that indicates that data transformation occurs. Then the actual transformation is specified using text.

Background

- Gane-Sarson notation was introduced in Chris Gane and Trish Sarson's 1977 book *Structured Systems Analysis: Tools and Techniques*
- Gane-Sarson notation is used for data flow diagrams.
- Although we have not seen Gane-Sarson notation used in healthcare, this notation is used in systems analysis and health IT analysts might encounter Gane-Sarson style diagrams.

Gane-Sarson notation was introduced in Chris Gane and Trish Sarson's 1977 book *Structured Systems Analysis: Tools and Techniques*. The book was later published in 1979 by Prentice-Hall.

Gane-Sarson notation is used for data flow diagrams.

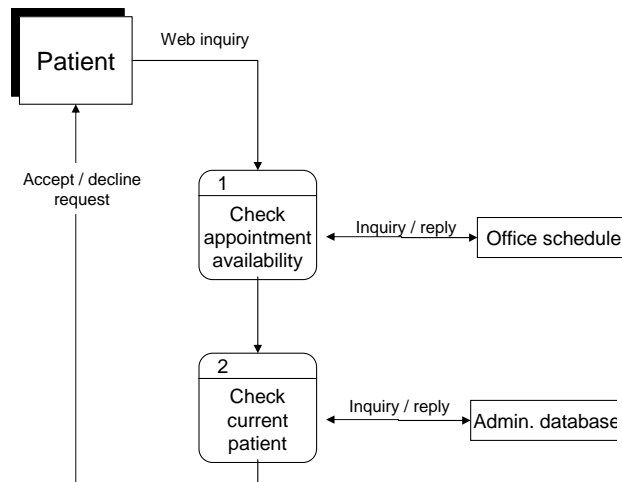
Although we have not seen Gane-Sarson notation used in healthcare, process analysts might encounter Gane-Sarson style diagrams, thus, we provide introductory-level information to the notation.

Use

- Gane-Sarson notation is specific to data flow diagrams to show the movement, transformation and storage of data.

Gane-Sarson notation is specific to data flow diagrams which show the movement, transformation and storage of data.

Simplified On-line Appointment Scheduling Example



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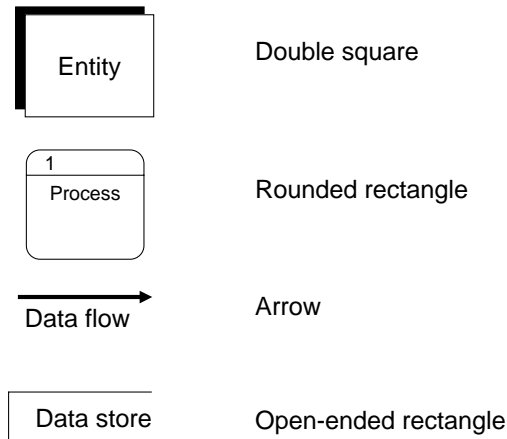
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This is an example of a simplified on-line appointment scheduling Gane-Sarson diagram.

Note that the patient enters a web inquiry which generates 2 checks against different databases, and the information is returned to the patient for acceptance.

Gane-Sarson Symbols



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Gane-Sarson uses these four symbols.

Entities show the people, roles, organizations or other things with which the system communicates, i.e. sources or consumers of data.

Processes are shown by square rectangles with rounded corners. They represent the various individual functions that the system carries out to transform data inputs into outputs. Process boxes can be numbered to show the sequence in which they are carried out.

Flows are shown by straight arrows. They are the connections between the entities, processes, and data stores. They represent the information that the processes require as input and the information they generate as output.

Data stores are shown by an open-ended long rectangle. They represent collections of data that the system must access (read from or write to) or remember for some period of time. Data stores typically exist as files or databases.

Entities

Nurse

Nurse

Patient

- **Entities**
 - represent people, organizations, or other things that interact with the system.
 - send or consume information
- If the same entity is shown more than once in a diagram, a diagonal line is added to the lower right-hand corner to visually distinguish it

Medical assistant

Medical assistant

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Entities represent people, organizations, or other things that interact with the system, i.e. entities are “outside of the system”, that is they are part of a process, but external to the information system.

Entities send or consume information, and in Gane-Sarson notation are also called sources or sinks of information.

If the same entity is shown more than once in a diagram, a diagonal line is added to the lower right-hand corner to visually distinguish it. For example, if the Nurse entity was drawn twice, to keep from having a lot of criss-crossing lines, a single diagonal line would be added to the lower right-hand corner. Further, if a medical assistant entity was similarly drawn twice on the same diagram, two diagonal lines would be added to visually distinguish it from the Nurse and patient entities.

Process

1
Assess patient

- Processes transform data
- Process should be named or described with a single word (a verb), phrase, or simple sentence that describes **what** the process does.
- Similar to other notations, a good name will generally consist of a verb-object phrase such as check availability.
- In some cases, the process are named for a role, an organization, or a machine that performs the process.

Processes transform data

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In some cases, the processes are named for a role, an organization, or a machine that performs the process.

Processes are given a number in the upper right-hand corner; this is an identifier and does NOT imply sequence. Optionally, processes can also have a lower section, similar in appearance to the process identifier part at the top, in which the role or machine that accomplishes the process, or the physical location of the process is undertaken.

Flow

→
prescription

- A data flow is a pipe through which data travel
- Straight lines indicate flow or movement of information
- Flow names indicate the meaning of the data that moves along the flow.
- A flow can:
 - represent only one type of data, e.g., request or reply , OR
 - consolidate several elementary data flows into one flow, e.g., request and reply
- the same content may have a different meaning in different parts of the system
- Every line needs an arrow head to indicate direction of the data flow

Similar to ISO 5807, Gane-Sarson notation uses straight arrows

Arrows should be named to indicate the meaning of the data that moves along the flow, i.e., a noun. Data flows with a verb name signify a process that has been omitted. Data flow in and out of a process must be altered in some way, i.e., not labeled the same thing.

A flow can:

represent only one type of data, e.g., request or reply , OR

consolidate several elementary dataflows into one flow, e.g., request and reply. This is dependent on the intended detail-level of the diagram.

The same content may have a different meaning in different parts of the system, e.g., address (as input by the receptionist) versus address after validation with the directory.

Arrows indicate direction of the data flow, i.e., from the practice EMR to the pharmacy.

Data Store

EMR

- A collection of data at rest
- Can be in computerized or non-computerized format
- Stores are passive; processes put data in or read data

D1 Claims database

The store is used to model a collection of data at rest.

Data stores can be in computerized or non-computerized form, such as paper charts, microfiche, index cards, etc.

Stores are passive; processes put data in or read data.

Like processes, data stores can be given an identifying number, e.g., D1, D2, etc., where the D denotes a data store and the number serves as a unique identifier.

Like entities, data stores can be drawn more than once on a diagram to avoid criss-crossed lines, in this case, a vertical line is added to the closed end of the data store shape.

Event List ?

- Unlike Yourdon notation, Gane-Sarson does not use an event list to indicate things that stimulate action from the system.
- Things that stimulate action from a system are indicated by entities.

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Things that stimulate action from a system are indicated by entities.

Diagram Levels

- Diagram levels are
 - a roll-up and drill-down
 - functional decomposition is used to represent each process in more detailed steps / processes
- Context diagram is highest level
- There are as many lower-levels as needed

Gane-Sarson, like Yourdon notation uses leveled diagrams, that is, a roll-up and drill-down approach where increasing levels of detail are shown on successive diagrams.

A process called functional decomposition is used to represent each process in more detailed steps / processes. Each process in a DFD can be “exploded” to become a DFD. When this is done, decimal numbers can be used to identify the process while maintaining the links to the “parent” or higher level process on the parent diagram.

Context diagram is highest level

There are as many lower-levels as needed

Conventions

- Meaningful names
- Number processes and data stores
- Make sure the DFD is internally consistent and consistent with any associated DFDs.
- Exceptions are shown on lower-level diagrams

Choose meaningful names for processes, flows, stores, and terminators.

Number the processes and data stores.

Make sure the DFD is internally consistent and consistent with any associated DFDs.

Exceptions and error handling are shown on lower-level diagrams.

Aesthetics

- The size of the shapes should be consistent throughout the diagram.
 - This limits the length of the name
- Color shading for shapes and arrows may be used to visually show different types of entities, processes, data stores or flows.
- Arrows in Gane-Sarson are straight and horizontal or vertical.

The size of the shapes should be consistent throughout the diagram. This limits the length of the name.

We found no guidance on the use of color shading for shapes or arrows, and expect that since the notation was developed in the 1970's that color was not commonly used on the diagrams. However, today, color may be used to visually show different types of entities, processes, data stores or flows. Arrows in Gane-Sarson are straight, and horizontal or vertical i.e., no diagonal or curved arrow lines. Double headed arrows can be used instead of two separate arrows in opposite directions, such as to represent request and reply.

Rules for Correctness

- Entities may not
 - send data directly to other entities
 - send data directly to data stores
 - get data directly from data stores
- No spontaneous data creation
- No black holes

Source: Ken Hopkins, Newman College, 2001

Entities may not send data directly to other entities

Entities may not send data directly to data stores (data must be processed in some way first)

Entities may not get data directly from data stores (data must be processed in some way first)

Information is neither created nor destroyed, it must come from and go to somewhere. Information comes from and goes to entities and data stores via processes. Watch for spontaneous data creation and black holes. Note: “in-only” data stores may be ok, as when being read by another system. Also “out-only” data stores may be ok, as when getting data from another system.

Data flows with a verb name signify a process that has been omitted

Maintenance

- Gane-Sarson is a set of symbols and conventions named for the people who developed it.
- There is no formal maintenance organization.
- Individuals use and adapt it to suit their needs.

Like Yourdon notation, Gane-Sarson is a set of symbols and conventions named for the people who developed it.

Gane-Sarson notation has not been adopted as a standard. As such, there is no formal maintenance organization.

Individuals use and adapt it to suit their needs.

References

1. Chris Gane and Trish Sarson, **Structured Systems Analysis: Tools and Techniques**, Prentice-Hall, Englewood Cliffs, NJ. 1979.

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