# Using the Multilayered Structure to Design a Genealogy Website
## by Thornton and Marty Gale

Note – This article is a summary of the topic of using a multilayered structure to design a genealogy website.  For a complete explanation of this topic, see the book "Getting Started on Your Genealogy Website" available from the *www.genealogyhosting.com* website.

T he design phase of a genealogy website starts by defining and giving a structure to its information contents.  The first and best design approach that authors of a genealogy website should consider in designing the information structure of their website is the multilayered structure.  A multilayered structure is a theoretical construct to organize a body of information.  The multilayered structure is often used by authors to organize a non-fiction literary work such as a book, a chapter in a book, an article, or in our case, a genealogy website.  The multilayered structure is a perfect way to organize a complex topic such as a genealogy website.  We can say emphatically that a genealogy website should take advantage of this design approach!

## Giving a Structure to the Information Content

Most of the features to be implemented in a genealogy website will require, produce, or be associated with information.  It is this information and how to structure it that we are discussing here.

### A New Term:  Information Element

In particular, the design of a website is concerned with the placement of information on web pages.  The packets of information of a topic that are placed on web pages, are given a special name at *www.genealogyhosting.com*:  we call them "information elements."  An information element is one or more pieces of information about a specific topic that can be thought of as a whole.  For example, a family group sheet, a person on the family group sheet, a list of people buried in a cemetery, a description of the cemetery itself, a plat map of a county, a description of the county itself are all examples of information elements.  Notice that information elements always can be decomposed into lower-level information elements.  Structuring the information of a genealogy website comes down to the actual placement of the information elements at a certain level of decomposition on specific web pages of the website.

## A New Term:  Hyperlink Model

Websites are different from other non-fiction literary works such as books.  In a website, not all the information for a topic is put together in one place as it is in a typical non-fiction book.  Rather, the author can take advantage of the idea of hypermedia – the linking of web pages so readers are not limited to reading the material sequentially and can jump around using hyperlinks based on their needs.  With hypermedia, the information elements of a topic are spread over more than one web page.  Then the web pages are interlinked via hyperlinks so that visitors can access the information elements in a nonsequential and ad-hoc manner based on their needs.

So how does the author of a website know on which web page a particular information element goes?  The placement of information elements is controlled by what we call "the hyperlink model" at *www.genealogyhosting.com*.  The hyperlink model provides the view of the information – all the visitor sees is what is revealed by the hyperlink model.

The hyperlink model is actually implemented by making use of hypermedia in which hyperlinks are placed in the information elements of the web pages of the website.  Thus, the hyperlink model is distributed throughout the information elements on the various web pages of a website.  However, the hyperlink model is a logical structure that is designed and thought of as a single entity.  In other words, the author designs the hyperlink model as a whole even though it is implemented by distributing it in the content throughout the website.

This means the information elements of the web pages of a genealogy website have two duties:  first the information elements carry the actual genealogy information of the website and second, the information elements have the hyperlinks of the hyperlink model embedded in them to implement the hyperlink model.

In effect, the hyperlink model is an abstraction mechanism which hides complexity from the visitor.  The hyperlink model hides the physical location of web pages.  Web pages can be located anywhere on the internet.  That is, the actual physical location of web pages referenced by the hyperlink model is transparent to the visitor and all he or she sees is the hyperlink model.

An important point about the hyperlink model is that it creates in the mind of the visitor a <u>model</u> of the structure of the website, hence the name "hyperlink model."  The formation of this mental construct, the model,  in the mind of the visitor is the goal of the design of the website – the quicker and more complete the hyperlink model is understood by the visitor, the better the website is designed.  That is, the author of the website purposely designs the hyperlink model so that visitors will quickly and efficiently grasp the model of the information structure of the website as a whole and hopefully, at a glance.  In this way, they can anticipate the structure of the website and quickly understand how to navigate the website even as first time visitors.

## So what's a multilayered structure?

A multilayered structure is a theoretical construct used to organize information.  In a multilayered structure, the author places the information elements of the non-fiction literary work in logical "layers."  The non-fiction literary work can be anything from a non-fiction book, an article, or in our case, a genealogy website.  The information

elements of the literary work, by definition, come from one coherent subject matter which we call a "body of related information."   That is, the non-fiction literary work is written by a practitioner who draws on the body of related information of the discipline to produce the work.  In fact, the information of a genealogy website is a prime example of a body of related information.

## *Categories are the Key*

Multilayered structures are created by the author by classifying the information elements and placing them in categories.  It is always possible to perform this categorization of the information elements because the body of related information in question comes from an underlying discipline (field of study, business, avocation) which has methodologies, theories, and practices.  In our case, the author is a genealogist and the discipline is genealogy.  Also, whenever a practitioner reads a non-fiction literary work, he or she would quickly understand the categories and would thus instantly understand the organization of the literary work.

So the information elements of the body of related information are classified into categories based on the expertise of a practitioner from the underlying discipline.  Also, any practitioner who works in the discipline would naturally classify the information elements into these categories.  So, in the case of a genealogy website, it is the discipline of genealogy as practiced by genealogists that define and classify their genealogy information into categories widely recognized and used by most genealogists.  Also, the primary audience will be genealogists who will understand and appreciate the categories and the classification of the information elements into those categories.

Once the information elements from a body of related information have been classified into categories, then the categories can be manipulated to organize the body of related information.  This is done by focusing on the categories just defined.  The categories are arranged into layers, stacked like bricks, in which the order of a category in the stack is important.  The layers will be carefully arranged by the author so that practitioners of the body of related information can understand it and navigate it (get from one place in the body of related information to another).

The order of the stacking of the categories into proper layers is based on the internal relations between the information elements from one layer to another.  A "relation" is a logical connection between two information elements.  The practitioners of the discipline would naturally associate those information elements together.  We'll return to the subject of relations in a moment but for now let's look at some examples of multilayered structures.

## *Example:  Cars in the County*

Figure 1 shows a typical multilayered structure.  This multilayered structure organizes all the new cars in the county.  Notice that this structure is not necessarily a website and could take the form of a hardcopy pamphlet.  Remember – we are talking about the multilayered structure as a theoretical construct.  The body of related information of this multilayered structure are the cars in the county and the discipline is the car industry.  Practitioners in the car industry would naturally classify the cars into the categories shown as layers in Figure 1.

- There are five "layers" of information elements.

- The top layer 5 contains all the car manufacturers (Ford, Dodge, Toyota, GMC, etc.) that manufacture cars that are sold in the United States.

- Layer 4 contains all the car dealerships in the county.

- Layer 3 contains all the body styles of cars (sedans, luxury, SUVs, minivans, etc.) possible.

- Layer 2 contains all the car models (Aspen, Explorer, Civic, LaCrosse, etc.) of all the manufacturers.

- Layer 1 contains all the actual new cars for sale in the county.

Figure 1 has arrows representing the information navigation that a consumer of this body of related information might want to take. The navigation is achieved by navigational links. A navigational link is a way for the reader to get from one point in the multilayered structure to another point. For a website, these would by hyperlinks. For a hard copy publication, the navigational links would be cross references (e.g., "see page 12"). The navigational links are made from one upper layer information element to one or more lower layer information elements (one to many). Thus, sometimes the navigational links take the form of lists of pointers for the true one to many situation.

Often the author makes navigational links bi-directional. That is while navigational links are defined from one upper layer information element to many lower layer information elements, the author often creates backward navigational links. These "back-links" start at one lower level information element and point up to one upper layer information element. The author would do this to make the information more accessible and usable. For example, in Figure 1, a back-link has been defined between a specific car on layer 1 and its car model on layer 2.

The layers as well as the information elements in a layer are arranged using any useful layering criteria understandable to practitioners of the underlying discipline and which the author thinks would help present the complex topic. There are many different layering criteria which we will discuss in a moment. For now, we can see that the point of the layering criteria is to break apart complexity into a more understandable presentation.
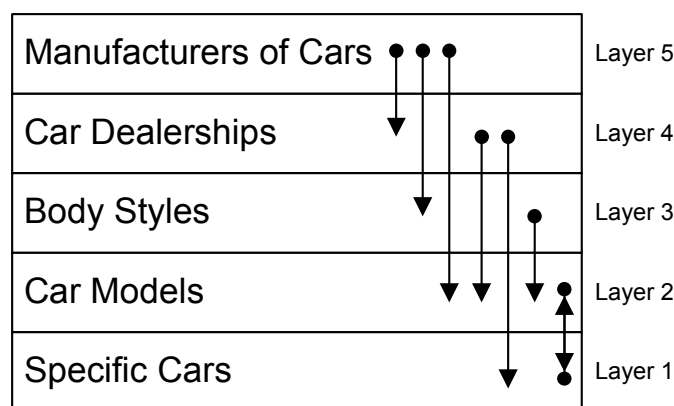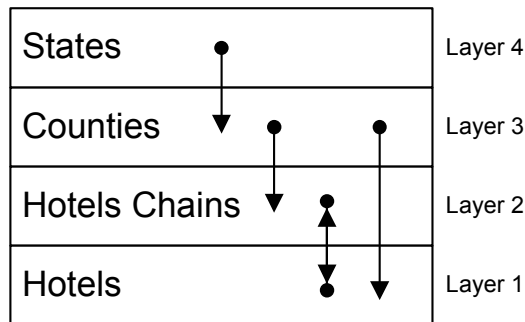


**Figure 1 - Example of a Multilayered Structure**

Notice that each layer contains a series of information elements each associated with one information element from above (i.e., one to many) using one of the layering criteria. Thus, a lower information element can participate in many different relations from above produced by the various layering criteria. Each layer is a unified collection of information elements representing the same kind of thing based on the classification criteria for the original category and the various layering criteria. The carefully designed multilayered structure has an elegance and is very pleasing to the visitor to the website.

Thus, a multilayered structure such as Figure 1 can be used to organize a huge body of related information into a structure that would be very useful to a consumer of the information.

### *Example: Hotel Locator*

Figure 2 shows another typical multilayered structure. The purpose of this multilayered structure is to organize information about hotels so a person could locate a hotel. This type of multilayered structure would be used to organize a website, a guidebook or a training course in hotel management. The discipline is the travel industry. Notice the following:



**Figure 2 - A Typical Multilayered Structure: The Hotel Locator**

- There are four "layers" of information elements.

- Layer 4 is a list of the 50 states of the United States.

- Layer 3 is a list of the 3250 (or so) counties in the United States

- Layer 2 is a list of the 600 (or so) national and regional hotel chains (e.g., Hilton, Motel 6, Day's Inn, etc.)

- Layer 1 is a list of the thousands of actual hotels (or motels) in the United States.

The "Hotel Locator" will have navigational links shown as arrows in Figure 2. Each state (layer 4) will have navigational links to the counties in that state. The counties (layer 3) will have navigational links to the hotel chains which have hotels in that county. The hotel chains (layer 2) will have navigational links to all their actual hotels in that hotel chain (no matter where they are). Each actual hotel (layer 1) will have back-links to its corresponding hotel chain (layer 2). The counties (layer 3) will also have navigational links to the actual hotels in that county (layer 1).

So, Figure 2 shows how an author can use a multilayered structure to organize a large mass of information into a meaningful and useful structure for the reader.

# Defining the Layers

The layers (and hence, the categories) are sensitive to each other because together, they form meaning to the reader of the information who is most likely a practitioner of the underlying discipline. In other words, the layers are highly inter-dependent with each other and they work together to form the overall multilayered structure. The interdependence is because, by their very nature, the information elements from a body of related information have natural "relations" with each other. Let's look at this.

## Relations Between Information Elements

A relation is a logical connection between two information elements. That is, one information element is associated with another information element by practitioners of the discipline. The connection between the two is important or pertinent to understanding or using the information. The relation is how a practitioner reading the material will correlate and bind the points contained in the information, get from one point to another. In other words, the relations are identified and used by practitioners of the underlying discipline to understand and reason about the information elements in the body of related information (e.g., genealogists talk genealogy).

Thus, the information elements in a body of related information are somehow, directly or indirectly, related as identified by practitioners because each of the information elements is drawn from the same discipline. If the information elements are not drawn from a body of related information, that is if they are random, then the ability to create a useful multilayered structure from them doesn't exist. A set of random information elements will not have any inherent capability to form relations between the information elements. Without relations, there is no ability to classify the information into meaningful categories and hence layers which is necessary to form a true multilayered structure.

## Layers and the Hyperlink Model

The navigational links (e.g., hyperlinks on a website) will be between information elements and follow the relations between the information elements. In other words, the navigational links "implement" the relations between the information elements. Often a relation and hence, the navigational link will be between information elements in adjacent layers. For example, in Figure 2, the relations between a state (layer 4) and its corresponding counties (layer 3) is an example of relations between adjacent layers. This is a particularly powerful type of relation that will resonate with the reader. However, the relation can be between information elements in non-adjacent layers too. For example, in Figure 2, the relations between counties (layer 3) and the actual hotels in that county (layer 1) is an example of relations between non-adjacent layers.

Navigational links are inserted in the information elements so that a consumer of the information can jump from one to another in the work. In effect, consumers would

naturally want to follow the relations between information elements when they navigate from one point to another in the work. The design of a multilayered structure is based on the relations between information elements on the various layers. Thus the design of the hyperlink model of a website goes hand-in-hand with the design of the multilayered structure of the website. In effect, the multilayered structure presents the author with opportunities to implement the relations between information elements as hyperlinks. Also, during the design of the website, the evolving hyperlink model helps the author to fine-tune the multilayered structure of the website.

We will return to the idea of navigational links implementing relations between information elements when we discuss the suggested layering criteria in a moment. Once the navigational links are inserted, then the set of information elements is an orderly and understandable multilayered structure.

## Two General Forms of Relations Between Layers

So two layers of a multilayered structure (not necessarily adjacent) will have information elements in an upper layer that have relations with information elements in a lower layer. There are two general forms to the relations between information elements on an upper layer and a lower layer: the "top-down" form versus the "bottom-up" form. Both are very useful in the design of the layers of a multilayered structure and both are easily understood by the consumer of the information who is most likely a practitioner. Each of the numerous criteria for defining layers listed below will be in one of these two basic forms. In either case, (top-down or bottom-up) the relation is a one-to-many in which one information element on the upper layer has relations with many information elements on the lower layer.

The two forms (top-down or bottom-up) are distinguished by the "direction" of an individual relation. Practitioners of the underlying discipline will think to the two information elements involved in a relation as being in an independent versus dependent status. The independent information element is the active side and proactively forms the relation to the dependent, passive side of the relation. The result is two very distinct forms of layering criteria: the top-down or the bottom-up forms:

### *Top-Down:  One to Many*

The top-down form means the association of one information element on the upper layer with many (i.e., one or more) information elements on the lower layer. In other words, the direction of the relation is from the upper layer to the lower layer. Thus, in the one-to-many form of relations, the one upper layer information element is the active, independent side and the many information elements on the lower layer are the passive, dependent side of the relation. The upper layer information element is refined in some sense by the lower layer information elements. In other words the lower layer information elements clarify, enhance, bolster, breakdown, etc. the information element on the upper layer.

The top-down form helps the reader's understanding because the simpler lower layer information elements are easier to understand or work with then their complex upper layer information element.

A good example of the top-down form is the *decomposition* classification criteria. In the *decomposition* classification criteria, a whole on the upper layer is decomposed into its parts on the lower layer. The upper layer contains information elements representing various wholes and the lower layer contains information elements representing the parts of the various wholes above. Navigational links connect each upper layer information element to its lower layer information elements. For example, in Figure 2 the states (layer 4) are decomposed into the counties (layer 3).

Thus, decomposition can be used for actual physical objects (states to counties). However, decomposition can also be used for breaking down complex ideas into simpler ideas. For example, a goal can be broken down into sub goals, or the explanation of a complex task can be broken down into a series of simpler subtasks, etc.

The basic shape of the top-down form is shown in Figure 3. The figure shows an upper layer information element being refined in some sense by lower layer information elements.
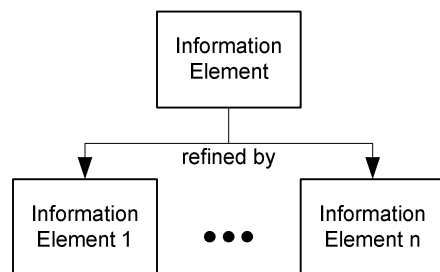


**Figure 3 – Top-Down Form of Relations Between Information Elements**

Here is a list of the most common top-down forms of layering criteria:

- *Cause-Effect:* An information element on the upper layer represents a cause (an agent, phenomenon, or action which results in change) and the information elements on the lower layer represent the effect (results, outcomes, responses).

- *Conclusion:* A statement (i.e., a piece of writing) is on the upper layer and the conclusions (pieces of writing containing the consequences, deductions, inferences, upshots) are on the lower layer.

- *Decomposition:* An information element representing the whole on the upper layer is decomposed into information elements representing the parts on the lower layer. This is by far the most commonly used top-down form.

- *Design:* An information element representing a description of what is to be designed and created is on the upper layer and the functional descriptions of how it will be achieved are represented by information elements on the lower layer. In effect, the upper layer is the "what" and the lower layer is the "how".

- *Explanation:* An information element on the upper layer is explained or clarified by information elements in the lower layer.

- *Harmony:* An information element on the upper layer represents a real world entity that is in harmony (conformity, compatibility, agreement) with other real world entities represented by information elements on the lower layer. Alternatively, an information element on the upper layer represents a real world entity that is in disharmony (disagreement, discord, difference) with other real world entities represented by information elements on the lower layer.

- *Hierarchy:* An information element of the upper layer represents a real world entity that has a higher status (i.e., importance, value, power) than the entities represented by the information elements of the lower layer.

- *Regulation:* An information element representing a regulation (law, rule, ordinance, order, principle) is on the upper layer and the various actions which the regulation constrains are on the lower layer.

- *Specification:* A general information element of the upper layer consists of detailed information elements at the lower layer. In effect, the upper layer is specified by the lower layer.

## Bottom-Up: Many to One

The bottom-up form is the association of many information elements (one or more) on the lower layer with one information element on the upper layer. In other words, the direction of the relation is from the lower layer to the upper layer. Thus, in the one-to-many characterization of relations, the one upper layer information element is on the passive, dependent side and the many information elements on the lower layer are the active, independent side of the relation. In other words, many lower layer information elements are combined, blended, integrated, mixed, merged, etc. into one upper layer information element.

The bottom-up form helps the reader because the upper layer information element is much more meaningful than the collection of lower layer information elements. In fact the reader will find that the lower layer information elements, being much more detailed, are devoid of meaning or significance which the upper information element is able to provide. Often the bottom-up form has the aspect of discovery in which the upper layer information element is tentative, speculative or conjectural and the corresponding lower layer information elements are definite, certain, or true.

A good example of the bottom-up form is the *synthesis* classification criteria. In the *synthesis* classification criteria, information elements on the lower layer are synthesized into an information element on the upper layer. Synthesis means integrating, combining, or consolidating information elements into a whole in some sense. The whole has more meaning or significance than the constituents. Navigational links connect the upper layer information element with the lower layer information elements which are consolidated into the upper layer information element. As we will see in a moment, the *synthesis* classification criteria is by far the most used by authors creating non-fiction literary works.

The basic form of the bottom-up form is shown in Figure 4. In the figure, information elements on the lower layer are being consolidated (in some sense) into an information element on the upper layer.
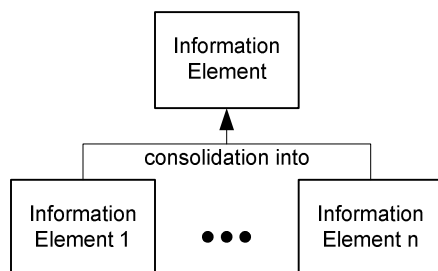
**Figure 4 – Bottom-Up Form of Relations Between Information Elements**

Here is a list of the most common bottom-up forms of layering criteria:

- *Abstraction:* An information element on the upper layer abstracts many (one or more) information elements of the lower layer. Abstraction is defined as drawing out the essential meaning and disregarding for the time being those aspects that are not relevant.

- *Emergence:* The entities represented by the information element of the upper layer have or will emerge from the entities represented by the information elements of the lower layer much like geological layers.

- *Planning:* Planning is the process of analyzing a series of conditions represented by information element on the lower layer from the standpoint of changing the conditions some way based on a purpose. Then a proposal is put forth and recorded on the upper layer which satisfies the purpose and contains proposed changes to the conditions below.

- *Product:* A product is a good or service sold by a vendor which addresses a customer's needs. The information element representing a description of the product is on the upper layer. The lower layer contains information elements representing the various needs of the customer which are satisfied by the product.

- *Proof:* An upper layer proposition is proven by the statements on the lower layer.

- *Synthesis:* The lower layer information element are synthesized into an upper layer information element which has more meaning than the mundane lower layer information elements. This is by far the most common usage of the bottom-up form and we will discuss it further in a moment.

## Guidelines for Defining Layers

The following are some general guidelines and rules-of-thumb for actually classifying the information elements into categories then arranging the categories into layers of a multilayered structure.

### General - Special

Layers can usually be arranged in a top down relationship (Figure 5) starting with the most intangible or general top strata and descending to the most concrete or specialized

strata.  Lower layers often provide details while upper layers provide deeper understanding or significance of the subject matter.
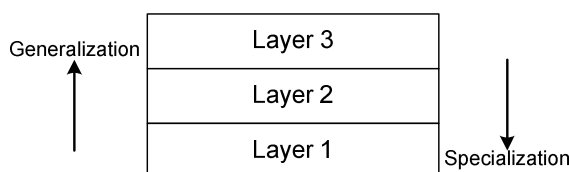


**Figure 5 – Generalization-Specialization of Layers**

### Independence of Information Elements on a Layer

The information elements on a particular layer are independent from each other and shouldn't overlap.  This means a given layer is often self-contained, interesting in its own right, and often can be thought of as a collection worthy of browsing.  Browsing means reading them on their own without first going through the upper layer information elements that refer to them.  For example, in Figure 2, all the roughly 3250 counties (layer 3) can be arranged alphabetically and browsed.  At the same time, each county participates in the decomposition of its corresponding state of the upper layer.

### Whole - Part

In fact, the collection of the information elements on the lower layer are often equivalent to the collection of information elements on the upper layer in the whole-part sense.  This is obvious for the *decomposition* layering criteria but is also true of many of the others.  The equivalence is that the parts could stand in for the whole in many contexts.  In effect, the lower layer is a more detailed view or perspective of the upper layer.

For example, in a discussion of the demographics of the united states, the collection of the 3250 counties (lower layer) of the 50 states (upper layer) is equivalent to the 50 states in the whole-part sense.  The parts could stand in for the whole in many contexts.  For example, the 3250  counties can stand in for the 50 states when discussing the occupations of the population of the United States.

### Dependence - Independence

The information elements of the upper layers often depend on the information elements on the lower layers in some sense determined by the layering criteria (Figure 6).  However, the reverse is seldom true.  That is, the lower layers don't depend on upper layers and are independent of them.  In effect, lower layers don't "know" about upper layers – they don't need to record the ways upper layers depend on them (although we may do this anyway when designing the hyperlink model of the website to implement back-links in order to make the information access more efficient for the visitors to the website as explained above).
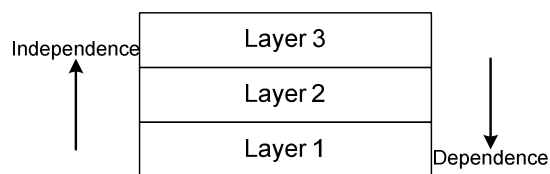
**Figure 6 – Layer Dependence**

## *Bottom "Atoms"*

The bottom layer is where the information "atoms" of the structure reside – the very basic information elements. The bottom "atoms" don't need relations with yet lower layer information elements. These information elements are at the lowest layer because we either decide not to create yet lower layers after that (e.g., due to a limited scope) or because we cannot for other practical reasons.

## *Top Generality*

The top layer is where the broadest information resides, the information elements which have the greatest meaning or significance or generality or complexity or inclusiveness. These information elements are at the top layer because we either cannot or decide not to create layers above it (e.g., scope again).

## *At Least Two Layers*

Thus, any multilayered structure has at least two layers: an upper layer of the highest information elements in some sense and a lower layer of the atomic information elements in some sense.

# Special Case:  The Three-Layered Structure

As stated previously, the major use of a multilayered structure is to organize a non-fiction literary work. A non-fiction literary work is an organized presentation of a topic in which the information is structured for public consumption but with originality and creativity – in other words a book, an article, a report, or in our case, a genealogy website.

Many non-fiction literary works that deal with complex topics will use a three-layered structure (Figure 7):  a top "General" layer, a middle "Synthesis" layer and a bottom "atom" layer. This particular multilayered structure is very important because many different types of literary works seem to fall naturally into these three layers. For example, it is common to organize a non-fiction book in these three layers. Also, websites and especially genealogy websites fall naturally into this three layered structure.

Also, recall that we introduced the *synthesis* layering criteria above. In other words, many authors use the three-layered structure founded on the *synthesis* layering criteria to organize their literary works. This is not surprising since the reader of a literary work needs more than facts to understand a topic. Synthesis provides the means to

understanding – the integrating, generalizing, combining, consolidating, or abstracting of facts to form meaning.

| General |
| :---: |
| Synthesis |
| Atoms |
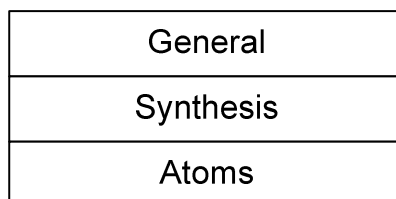
**Figure 7 – Three-Layered Structures to Organize Information**

Let's describe a generic non-fiction literary work which uses this three layered structure.

### General (top) Layer:

The top layer completely covers the topic of the non-fiction literary work at a high level – the view from 40,000 feet, the big picture. This is where the author puts the general content of the work: an introduction, general statements, overview information, theories, explanation of significance, conclusions, etc. The author will make references to the middle "Synthesis" layer and the bottom "Atoms" layer in the text to backup the generalizations. In this way, the text of the top layer does not get bogged down with overly detailed information. In fact, sometimes, the top layer is the only information many readers will need. They won't bother reading the contents in the other layers since they have gotten what they want out of the work – an overview.

### Synthesis (middle) Layer:

The synthesis layer will contain the meat of the non-fiction literary work – the intellectual product of the author. The synthesis layer consolidates, integrates, categorizes, and gives insight into the "atoms" and their various combinations or configurations. The synthesis layer completely covers the subject matter of the non-fiction literary work in the whole-part sense. The synthesis layer is the place where the work is expanded as each new insight is documented.

This layer is directed at helping the reader with the bottom "atom" layer (discussed next). The "atoms" are detailed and numerous in which the average reader would be unable to grasp or appreciate or understand them on their own. So the synthesis layer attempts to do this. For example, a common approach is to use the synthesis layer to explain all the general (top) layer generalizations harnessing the bottom layer "atoms" in the explanations.

### Atoms (bottom) Layer:

The bottom layer contains information elements representing entities which are not further decomposed in the text – they stand alone for purposes of the scope of the work. Since they are so numerous, so detailed and often rich in minutia, seldom would the average reader be able to grasp the meaning or purpose of the topic of the total work by reading the "atoms" on their own, such as embarking on a sequential reading of them.

However, the "atoms" must be included in the work for backup, proof, explanation, or support. They makeup the bulk of the physical content of the work.

The "atoms" are information elements representing individual, independent concrete entities that don't overlap. The bottom layer contains every "atom" of the topic of the non-fiction literary work in the whole-part sense and the "atoms" cover the topic in the whole-part sense. That is, the topic can be viewed as consisting of these entities represented by the "atoms" on the bottom layer. A given "atom" may be referred to many times from the middle synthesis layer or the top general layer. Each "atom" may be included in multiple consolidations of the synthesis layer.

## Using the Three-Layered Structure

How are the three layers actually implemented in a non-fiction literary work? In a book or other hardcopy production, the parts of a layer are implemented by the physical placement of text (which, unfortunately, limits their versatility somewhat as layers). For example, the top (general) layer of a typical non-fiction book consists of the preface, table of contents, introduction, conclusions, and index. The bottom ("atom") layer of a typical non-fiction book contains the appendices and the glossary. No problem yet.

The middle synthesis layer is the bulk of the book consisting of all the other regular chapters. However, these chapters are a mixture of both synthesis and "atoms." That is, much of the content of the bottom layer "atoms" for the most part must be integrated into the synthesis chapters where they are discussed. This mixing of the synthesis layer and the "atoms" layer is done in the interest of coherence in the text and as a practical matter due to the limitations of a published book being linear. Otherwise the book wouldn't read very well.

Let's see what a typical non-fiction book would look like if it were reorganized into a true three-layered structure (i.e., instead of the mixing of the text of the middle synthesis layer and the bottom "atom" layer). Nonfiction books often have a glossary placed near the back of the book. A glossary is a list of terms from the topics of the book with brief definitions. The glossary represents the "atoms" of the entire subject-matter of the non-fiction literary work in the whole-part sense. If the book were structured with a true three-layered structure, then the glossary would become the bulk of the physical content of the book rather than a hand full of pages in the back matter.

To implement a true three-layered structure, the author would beef up each glossary entry into a major, all-inclusive article on that topic. The author would pull all detailed information about the topic from the regular synthesis chapters and place it in the corresponding article for that topic in the glossary. Then each time the topic was mentioned in the main text of the book such as from the top (general) layer or the middle (synthesis) layer, a navigational link (e.g., a text cross-reference) to the corresponding article in the glossary would be made. In this way, the glossary would be a fully functional bottom "atom" layer of the book. If a book were structured like this, it would be very choppy and difficult to read as a hardcopy text, but it would be very well structured!

However, this is exactly how a website would be implemented as a three-layered structure. A website is not limited by physical placement or the need for linear presentation like the printed book is. The hyperlink model (described above)

determines the information structure of a website instead of the physical placement of information as in the book. In a website, the physical files are organized independently of how they are consumed, usually to make the website easier to update or maintain. This is why a website lends itself to being organized using a multilayered structure and especially the three-layered structure.

# Process to Create the Multilayered Structure for a Genealogy Website

Now that we have an introduction to multilayered structures the next question is how does one actually create one? In this section, we will give a detailed explanation of the steps to create a multilayered structure for a genealogy website. The detailed steps to create a multilayered structure are shown in Figure 8. Here we will be concentrating on a genealogy website but these steps could be adapted to create a multilayered structure for any non-fiction literary work.

## Decompose the Features into Information Elements

One product of completing the requirements phase of a genealogy website is a list of features that will be implemented in the website (Figure 8, 1). We have a detailed explanation of how to conduct the requirements phase of genealogy website in the book "Getting Started on Your Genealogy Website" which is available from the *www.genealogyhosting.com.* In summary, the requirements phase results in a list of wants and needs that the visitors to the website will require of it. The wants and needs are then decomposed to a set of features which will be implemented in the website. Each feature may imply the need for information (i.e., some features may not need any information). You must decompose the feature into information elements as necessary (Figure 8, 2). Keep in mind that you are building a website and you will be putting the information elements on web pages eventually. The following rules of thumb should be used to identify and decompose information elements:

- The "information element" was defined above (see "A New Term: Information Element," page 1). In summary, an information elements is a set of information (normally text but could be images) which can be thought of as a whole. It is under consideration because the author has decided that it is significant for some reason as implied by the features of the website.

- Information elements are always composite and contain lower information elements corresponding to the real world entities they represent. That is, an information element can always be decomposed following the decomposition of the real world entity they represent. Be on the lookout for these natural hierarchies because they are very useful in creating a multilayered structure. For example, a family group sheet can be decomposed into information elements representing the people in the family.

- The point is that when we later put information elements on web pages, we must find the correct level of decomposition of each information element. This means there is no "correct" level of decomposition and it depends entirely on the level of

detail needed for the design of the resulting web pages considering the hyperlink model and lower layers, if any.

- Also, don't worry about losing information or meaning when you decompose information elements. This is because additional web pages can be used to catch the lower layer details of a decomposed general information element (i.e., using the *decomposition* layering criteria). Thus, a web page on the upper layer can contain the general information element (e.g., the family group sheet). Then the web pages on the lower layer can contain the detailed information elements to which the general information element is decomposed (e.g., the people in the family).
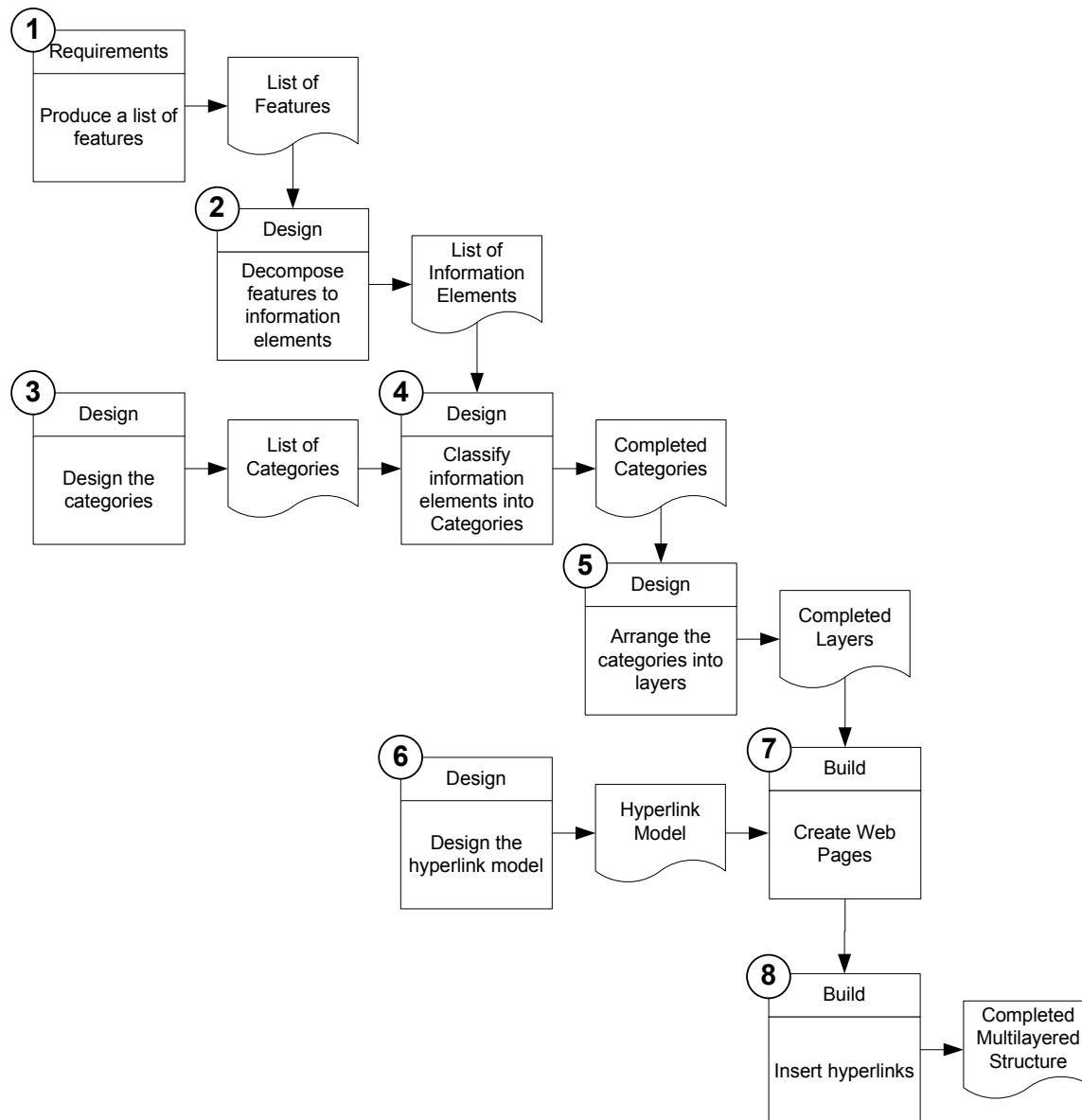
**Figure 8 – Process to Create a Multilayered Structure for a Genealogy Website**

- A good rule of thumb for decomposing your information elements is to start out by decomposing them to the equivalent of a written paragraph. Remember from your high school English classes that a paragraph consists of several sentences and deals

with a single thought or topic or idea.  This means the average web page in the website will have a handful of information elements corresponding to the quantity of information contained in a corresponding handful of paragraphs.  This rule of thumb – decompose information elements to the equivalent of a paragraph – is only a starting point.  Later the information elements can be fine-tuned by further decomposition or recomposition to find the right level.

## Classify the Information Elements into Categories

Next, the author designs the categories (Figure 8, 3) then classifies the information elements into these categories (Figure 8, 4)).  Recall (see "Categories are the Key." page 3) that a category is just an isolated layer that has not yet been stacked into a multilayered structure.  The design of the categories will depend on your gut feeling.  It's often not difficult to define the categories and the information elements fall naturally into a series of categories based on the practices of the underlying discipline which in our case is genealogy.  Notice that the product of this task is a set of categories populated with information elements and not the actual design of web pages (the web pages will be designed in a later step).  No matter how you decide to define your categories, the following rules of thumb can be used during the classification of the information elements into categories:

▪ The classification of the information elements into a category is based on the primitive idea that the items seem to fit together.

▪ The information elements of a category all seem to represent the same type of real-world entity.  That is, the information elements of a category seem to represent a series of similar entities in some sense.

▪ The information elements of a category are all at about the same level of detail versus generality.

▪ The information elements of a category all have the same type of subject in the language sense.  They are all apples or all oranges but not a mixture of the two.

## Arrange the Categories into Layers of a Multilayered Structure

Next, the categories are arranged in proper layers (Figure 8, 5) using one of the many layering criteria (several are listed above) or a layering criteria designed by the author.  There will be several layering criteria actually used in a multilayered structure each harnessing the relations between information elements in pairs of layers.

Here are some rules-of-thumb to help identify the layers of a genealogy website (i.e., to complete the task of taking the categories and stacking them into a layered structure).

▪ Start organizing the layers by identifying the "atoms" of your structure.  These will be the category of information elements which will not depend on a lower layer either because there is no need to (i.e., the information elements of the category are independent and can stand on their own) or because it is beyond the scope of the website.  In a genealogy website, examples of the "atoms" might be the reference documents (e.g., images of historical records).  Since reference documents will be

    used to backup other information on the website, they will stand on their own without further lower layer dependence.

- Identify the broadest, most general category of information elements. The information elements in this category will relate directly to the purpose of the website, its meaning or conclusions. That is, the information elements of the top layer will focus on the purpose or message of the website and a reader can tell what it is by looking at the top layer. The information elements at the top layer will depend on lower layers. For example, in a surname genealogy website, the top layer might contain a broad history of the ancestors with that surname making reference to the people on a lower layer.

- All the remaining categories of information elements will fall somewhere in the middle layers. Normally there is only one remaining category if a three-layered structure described above (see "Special Case: The Three-Layered Structure," page 12) is used. The middle layers will be the most fun and challenging to create. It is where genealogy expertise really comes into play. The information elements of a middle layer will be harnessed by layers above them (i.e., in a three-layered structure, this would be the general (top) layer) in some relation of the layering criteria between the two layers. They will not have the stature of the top layer generalizations nor will they will have the independence of the bottom layer "atoms."

- Notice that there will be many information elements on each layer but their numbers will tend to increase as you go downward. So at the top layer there will be only one or a few very general information elements and on the bottom layer there will be numerous detailed information elements. The overall structure will resemble a pyramid.

## Create the Web Pages: Design the Hyperlink Model and Insert the Hyperlinks

Next in the normal sequence of creating a website, the web pages themselves are designed and constructed. This is the bulk of the work of creating a website. In this article, we are focused on the multilayered structure and how to construct one and not on creating a website per se. Thus, we won't discuss the details here for designing and creating the web pages. However, we have a detailed explanation of how to design the and construct web pages of a genealogy website in the book "Getting Started on Your Genealogy Website" which is available from the *www.genealogyhosting.com* website.

The first order of business in this part of the project is to design the hyperlink model of the website. We introduced the hyperlink model above (see "A New Term: Hyperlink Model," page 2). Recall that the hyperlink model is the presentation of the information of the website. The hyperlink model is implemented as a series of hyperlinks which takes advantage of the concepts of hypermedia. The hyperlinks are spread throughout the information elements of the web pages of the website but the hyperlink model is a single, logical structure designed as a whole. The idea is that the hyperlink model should instill a "model" of the information structure in the mind of the visitor so that he or she can anticipate the information structure. The book "Getting Started on Your

Genealogy Website" has a detailed explanation of the hyperlink model and how to design and build it.

Next the web pages are actually built (Figure 8, 7) using the information elements categorized for their layer (see the book "Getting Started on Your Genealogy Website" for a detailed explanation).  In summary, each information element of a layer is put on an appropriate web page for that layer.  This will be a large part of the whole project.

Then the final step in creating the multilayered structure for a genealogy website is to insert the hyperlinks (Figure 8, 8).  The author is implementing the hyperlink model for the website.  Here are some rules-of-thumb to help insert the hyperlinks to complete the multilayered structure:

- The hyperlinks will follow the relations between information elements.  Recall that a relation is a logical connection between information elements that visitors to the website will take advantage of to correlate or bind the information.  In effect, the hyperlink "implements" the relation between information elements.

- The hyperlinks will point downward for the most part.  Thus, information elements on the upper layer will point to information elements on lower layers.

- This will be true of both the top-down form and the bottom-up form of the layering criteria.  Thus even though the bottom-up forms are directed from the lower layer information elements to an upper layer information element, the hyperlinks will be from the upper to the lower information elements.

- However, the upper to the lower hyperlinks is not a hard-and-fast rule and "back-link" hyperlinks may be used to point from one lower layer information elements to its corresponding upper layer information element to make the information more understandable or to make it easier for the visitor to get around on the website.

Remember – there is a substantial overhead in defining hyperlinks.  It takes time to actually connect the information elements as will as time to keep them up-to-date.  For example, the hyperlinks must be updated whenever there is a major change in the structure of the website (which is common).  It's true that most website authoring applications (e.g., Macromedia Dreamweaver) will update hyperlinks as the web pages are moved around in the website.  However, if the underlying design of the website changes, then the hyperlink model will change which will require extensive changes to the hyperlinks themselves.  Also, any new information elements added later (which is very common in a genealogy website and is in fact the point of one) will need to honor the existing conventions for hyperlinks.  So you should only insert hyperlinks that are integral to the design of the website and avoid inserting hyperlinks that might be "nice."

## Iterative Definition of the Information Elements, Categories and Layers

The process of defining information elements, categories and layers is highly interdependent and none of the results are permanent even after the website is published.  The reason the categories can be arranged into meaningful and elegant layers like this is because the information elements, categories and layers have been continually fine tuned in an iterative process by a practitioner of the discipline, namely

by you, the genealogist. Fine tuning is good. Spend the time so that the layers of your genealogy website are highly satisfying to your logical mind. Fine tuning consists of:

- As the categories are fine-tuned, the classification of individual information elements may shift from one category to another.

- Also, the level of generality versus detail of an information element may be adjusted so that broader information elements are decomposed into more detailed information elements or vice versa so they fit better in a category.

- As the categories are identified and stacked into layers, the categories may undergo redefinition which in turn causes changes in the classification and definition of the information elements in the category.

# Example of a Multilayered Structure: A Website Based on the Proof-Structure Metaphor

Many genealogy websites will use the proof-structure metaphor. A metaphor is a well-known structure with which the visitor to a website will already be familiar and which the author can plug-in to the design of the website. In the book "Getting Started on Your Genealogy Website," we have presented details of three well-known website metaphors that can be used to design a genealogy website. One of the most useful metaphors for genealogy websites is the proof-structure metaphor. The proof-structure metaphor is the traditional form of stating and proving a theory and is familiar to anyone who has ever taken high school geometry. The proof-structure metaphor is the perfect way to organize any website which advocates a theory (i.e., controversial position) then proves it. Many genealogy websites are of this basic form.

A website which uses the proof-structure metaphor has many of the characteristics discussed above of both top-down and bottom-up relations as well as top-to-bottom information navigation. The proof-structure metaphor consists of three parts 1) the statement of a theory and its proof, 2) explanations, discussions, and synthesis of facts to explain the proof or consolidate the facts, and 3) facts which are relied on in the proof. The proof-structure metaphor is ideally implemented as a multilayered structure previously discussed. As a multilayered structure, it will consists of three basic layers: 1) theory, 2) synthesis, 3) fact (Figure 9).

| Theory |
| :---: |
| Synthesis |
| Fact |
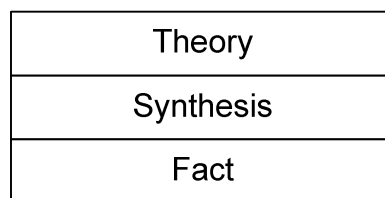
**Figure 9 - Website Based on Proof - Structure Metaphor**

The relations between information elements of a typical website based on the proof-structure metaphor is shown in Figure 10.  In Figure 10, the relations have an arrow either pointing down or up corresponding to whether they are top-down or bottom-up relations.

- For example the top web page on the "Theory" layer has relations which point downward to each of the "Synthesis" web pages on the middle layer.  This represents the top-down form of the relation between them.  That is, the proof of the theory stated on the top layer is decomposed into a the series of middle layer synthesis web pages each contributing to the chain of reasoning to complete the proof.  Also the bottom "Fact" layer web pages have bottom-up relations with the top "Theory" layer web pages.  This reflects that the "Facts" on the bottom act together to derive the theory of the top layer.

- The "Facts" web pages of the bottom layer have bottom-up relations with the "Synthesis" web pages of the middle layer.  These relations reflect how the "Synthesis" web pages are derived – by integrating, consolidating, or packaging the "Facts" on the bottom layer.  This also implies that many of the information elements on the "Synthesis" web pages are "discovered" by the author by working with the facts.  In the process, even more facts may be needed (i.e., an example of the production of information elements by this bottom-up relation).
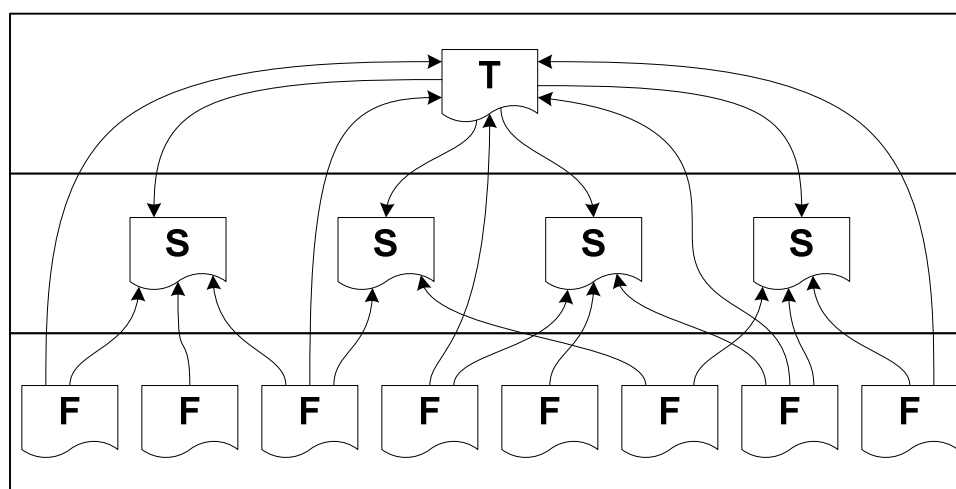


**Figure 10 - Direction of Relations in a Typical Proof-Structure**

The web-pages of our typical Proof-Structure web site are joined together by hyperlinks as shown in Figure 11.  These are the discipline-based hyperlinks which follow the natural relations between information elements and provide a structure to the information.  The various other pragmatic hyperlinks that should be included in any website aren't shown in this figure (such as hyperlinks to return to the top "Theory" home page from any other web page).

- The top "Theory" web page has hyperlinks to the middle "Synthesis" web pages.  The visitor to the website could use these hyperlinks to study the consolidation of facts of the proof.

- Also, the "Theory" web pages have hyperlinks to the "Facts" web pages.  The visitor can use these to check the facts used in the proof.

- The middle "Synthesis" layer web pages have hyperlinks to the "Facts" web pages which they synthesize. The visitor can use these to understand how a particular synthesis is formed.
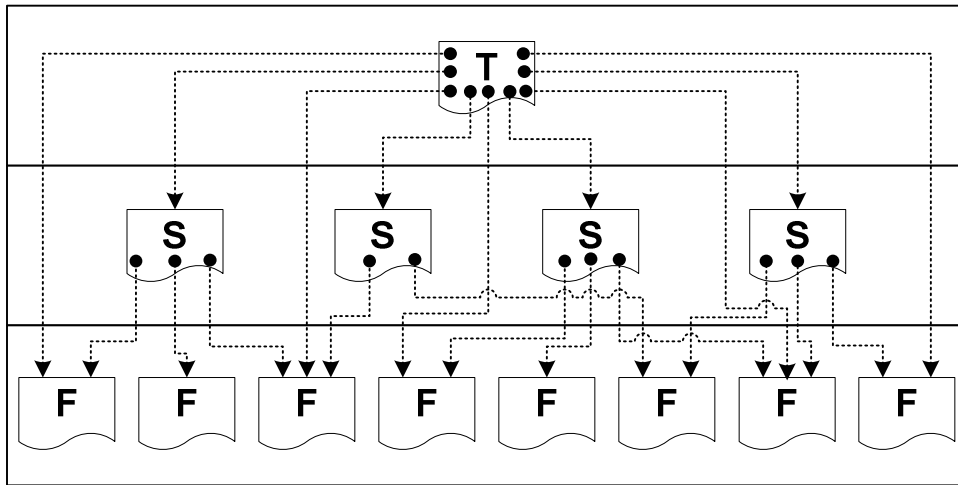


**Figure 11 – Hyperlinks(i.e., Navigational Links) of the Website of Figure 10**

# Conclusions

The multilayered structure is the premier approach to designing a genealogy website. The multilayered structure is not only understandable to potential visitors to the website, it is also straightforward to design and construct.

At *www.genealogyhosting.com* we have created two sample genealogy websites which show how multilayered structure can be used to create genealogy website. These sample website can be used as examples or as idea generators. These are working genealogy websites which we have created in the course of our own personal genealogy work:

- Elusive Ancestor Website: *www.poill27.info*

- Surname website: *www.mannigel.org*

# Glossary

This glossary defines all the terms used in the main text focusing on those that represent concepts unique to this article. Each definition will refer to other terms in the glossary as indicated by the term being in **bold** the first time it appears in a definition.

- **"Atoms" Layer:** The **Information Elements** of the **Bottom Layer** of a **Three-Layered Structure** representing entities that are not further decomposed due to impracticality or limited scope. The "atoms" are referenced by **Navigation Links** (e.g., **Hyperlinks**) from the information elements in the **Layers** above. In most three-layered genealogy websites the "atoms" of the bottom layer are either **Documents** or **People**.

- **Author:** The primary **Role** in creating a genealogy website. The author role is the driving force and inspiration of the website. The author performs all the creative activities including determining **Requirements**, designing, and building the website. The expertise required for the role of the author is that of writing, page design, complex document creation, project management, not to mention genealogy.

- **Body of Related Information:** A set of **Information Elements** drawn from a single subject matter no matter how extensive but confined to one **Discipline**. The information elements of the body of related information have natural **Relations** with each other and can not only be categorized (see **Categories)** but also placed in a **Multilayered Structure** by **Practitioners** of the underlying discipline.

- **Bottom Layer:** The layer in a **Multilayered Structure** containing **Information Elements** representing objective real world entities which are not further decomposed in the current work (e.g., limited scope, pragmatic reasons). The bottom layer is referred to as the **"Atoms" Layer** in a **Three-Layered Structure**. The information elements of the bottom layer are referenced by **Navigational Links** (e.g., **Hyperlinks**) from information elements in the other **Layers** especially the **Middle Layers**. Each information element in the bottom layer is an independent, passive object, standing on its own, and containing no knowledge (i.e., information element) of how it is referenced from above.

- **Bottom-Up Form** (see also **Layering Criteria, Top-Down Form (of Layering Criteria)**): One of two major families of **Layering Criteria** to create a **Multilayered Structure** (the other is the **Top-Down Form** of layering criteria). In either the bottom-up form or top-down form, the two layers in question (not necessarily adjacent) have **Information Elements** which have **Relations** with each other. In the bottom-up form of the layering criteria, the **Direction** of the relation is from the lower layer to the upper layer. That is, in the bottom-up form, many information elements (one or more) on the lower **Layer** each have a relation with one information element on the upper layer. In other words, many lower layer information elements are combined, blended, integrated, mixed, merged, etc. into one upper layer information element. The bottom-up form of the layering criteria helps the reader because the upper layer information element is much more meaningful than the set of lower layer information elements which are by nature detailed and mundane. The most common bottom-up layering criteria is *Synthesis.* Other bottom-up layering criteria include: *Abstraction, Emergence, Planning, Product* and *Proof.*

- **Browsing:** Reading a set of independent **Web Pages** as a narrative, one after the other, both on an ad-hoc basis or in some natural order appropriate for the subject matter. The browsing experience is greatly enhanced by **Hypermedia**.

- **Categories** (of a **Multilayered Structure**): A way to classify a subset of the **Information Elements** of a **Body of Related Information** to build a **Multilayered Structure**. A category is just an isolated **Layer** that has not yet been stacked into a multilayered structure. Categories are created by the **Author** using a **Classification Criteria.**

- **Classification Criteria** (of **Categories**): A filter to classify **Information Elements** from a **Body of Related Information** from an underlying **Discipline** into **Categories.** The **Author** will be a practitioner of that discipline and will use his or her expertise to define the classification criteria and to perform the classifications. The classification criteria so defined allows a subset of the information elements to be placed in a particular category. Fellow **Practitioners** of the discipline will subscribe to the classification criteria and will agree and understand the classification of the information elements.

- **Dependence – Independence:** A characteristic of the **Layers** of a **Multilayered Structure**. The **Information Elements** of the upper layers usually depend on the information elements on the lower layers in some sense determined by the **Layering Criteria**. Lower layers don't depend on upper layers and are independent of them. In effect, lower layers don't "know" about upper layers which contain **Navigational Links** to them.

- **Direction** (of a **Relation):** The distinguishing characteristic of the two major **Forms (of Layer Criteria**): The **Top-Down Form** vs. the **Bottom-Up Form**. Any relation between two **Information Elements** has a primary information element and a secondary information element. These distinguish the active and passive properties of the two. The primary information element is the pro-active origin of the relation and the secondary information element is passive and is merely "included" in the relation. In the top-down form, the primary, active information element is on the upper layer and the secondary, passive information element is on the lower layer. The bottom-up form is the opposite with the primary, active information element on the lower layer and the secondary, passive information element on the upper layer. In either case, there is always only one upper layer information element and multiple (one or more) lower layer information elements for each implementation of the relation. Also, note that any of the information elements, whether on the upper layer or the lower layer can participate in any number of other implementations of various relations.

- **Discipline:** A field of study which has clearly defined topics, theories, vocabulary, agenda, practices, and methodologies. Disciplines include not only formal academic disciplines and professions but also avocations and hobbies, etc. Genealogy is an example of a discipline.

- **General - Special:** A characteristic of the **Layers** of a **Multilayered Structure**. In a multilayered structure, the layers are usually stacked from the most general at the **Top Layer** to the most specialized at the **Bottom Layer**. Thus, as one goes down the layers, the information becomes more and more specialized.

- **General Layer:**  The **Top Layer** of a **Three-Layered Structure**.  The general layer usually contains the most general information which has the most significance or meaning.  Often in a genealogy website, the general layer consists of an essay or narrative which tells the story of the ancestors.  **Hyperlinks** to lower layer web pages (see **Synthesis Layer, "Atoms" Layer**) are imbedded in the text to support the statements or illustrate the points.

- **Hyperlink Model:**  The view of the **Information Structure** of a **Website** and the **Hyperlinks** to access it.  The hyperlink model organizes the information of the website into a meaningful structure presented to the visitor.  The hyperlink model abstracts the physical files which can be located virtually any place on the internet.  The hyperlinks of the hyperlink model are spread throughout the **Information Elements** of the various **Web Pages** of the website.  However, the hyperlink model is a single entity designed as a whole.

- **Hyperlink:**  A **Navigational Link** on a **Web Page** which takes the reader to another place in the **Content** of the **Website**.  **Hyperlinks** are activated (i.e., to cause the link) by clicking the hyperlink.  Hyperlinks are implemented by HTML and can be imbedded in any text or image of the website.  Hyperlinks have an associated URL specifying the target destination of the hyperlink.  Hyperlinks are the mechanism which permits the implementation of **Hypermedia**.

- **Hypermedia:**  The interlinking of pages of a **Non-Fiction Literary Work** so readers are not limited to reading the material sequentially and can jump around using embedded **Navigational Links** (e.g., **Hyperlinks** on a website) based on their personal needs.  Hypermedia is an entirely new way of designing non-fiction literary works which have been traditionally limited to sequential reading.  The implementation of hypermedia is the fundamental purpose of HTML which provides the hyperlink as the mechanism of linking.  Hypermedia is ideal for genealogy websites which use the **Multilayered Structure** in which hyperlinks to lower layer supporting web pages are placed in the **Information Elements** of web pages on upper layers.  A very useful application of hypermedia is to use it to implement **Browsing**.

- **Information Element:**  One or more pieces of information (typically text but also could be images) which can be grouped together or thought of as a whole (e.g., a family group sheet).  Information elements are always composites and can be decomposed into more elementary information elements (e.g., the individuals of a family group sheet).  Information elements on a **Non-Fiction Literary Work** (such as a genealogy website) are drawn from a **Body of Related Information.**  Information elements are placed on web pages to form the working contents of the website.

- **Information Structure:**  A major work-product from the design of a website consisting of the design of the **Hyperlink Model** and the design of the web pages which implement the hyperlink model as well as present the genealogy information.

- **Layer:**  The building block of a **Multilayered Structure.**  A layer is simply a **Category** that has been put into a stack of other categories to form a multilayered structure.  A layer is made up of **Information Elements** which form a series each representing the same type of real-world entity.  The information elements of a layer will have **Relations** with information elements on other layers and the relations will be created (actually recognized) by the **Author** using a **Layering Criteria**.  Also, the relations

serve as the basis for the author to define **Navigational Links** between them to implement **Hypermedia.**

- **Layering Criteria:** A classification scheme used to organize **Categories** into **Layers** (and indirectly, to organize **Information Elements** into categories). A layering criteria takes advantage of the natural levels of information elements and reflects the way most **Practitioners** of the underlying **Discipline** would think about the **Body of Related Information** in question. The information elements on an upper layer will have **Relations** with information elements on a lower layer. Two general forms of these relations are possible: the **Top-Down Form** and the **Bottom-Up Form**. The two most common layering criteria are *Decomposition,* **and** *Synthesis..* Other layering criteria include: *Abstraction, Cause-Effect, Conclusion, Design, Emergence, Explanation, Harmony, Hierarchy, Planning, Product, Proof, Regulation, Specification.*

- **Middle Layer:** A layer in a **Multilayered Structure** lying somewhere between the **Top Layer** and the **Bottom Layer.** A multilayered structure may have multiple middle layers although usually there is only one middle (i.e., to form a **Three-Layered Structure)**. The middle layers consist of **Information Elements** representing the **Synthesis** of the content of a **Non-Fiction Literary Work**. In fact, the middle layer is referred to as the **Synthesis Layer** in a three-layered structure. For example, in a three-layered structure**,** the middle layer combines, consolidates and integrates the **Bottom Layer** information elements which are by nature detailed and mundane making them useful and meaningful. Likewise, the **Top Layer** will, in turn, harness the synthesized **Content** of the middle layers to backup or explain the top layer generalizations. Often the top layer is broken down, decomposed, explained, or specified, etc. by the middle layer. The information elements of a middle layer (like any of the layers) contain **Navigational Links** (on a website, these would be **Hyperlinks**) to information elements in the other layers.

- **Multilayered Structure:** A powerful way to organize a **Nonfiction Literary Work** such as genealogy website. In the case of a genealogy website, the **Author** designs a multilayered structure by classifying the **Information Elements** of the underlying **Body of Related Information** of the website into **Categories** using a **Classification Criteria.** Next, the author arranges the categories into **Layers** using one of the **Layering Criteria**. Each layering criteria has one or more corresponding **Relation(s)** defined between information elements on the two layers (i.e., upper, lower, not necessarily adjacent). The result is that each of the information elements on a layer represent entities which are equivalent and form a series of the same type of thing. Layers are usually arranged from the most general to the most specialized (see **General – Special**) with the information elements on the top layer having the most meaning or significance (see **Top Generality**). The information elements on lower layers are independent of the information elements on upper layers (see **Dependence – Independence**) Also, general topics on the upper layers have **Hyperlinks** to the more specialized topics on the lower layers to provide details and support. For a multilayered structure, these hyperlinks between the layers follow the relations between the underlying information elements. The multilayered structure is a powerful organizational approach and it can be used to organize any non-fiction literary work such as non-fiction books, articles, reports, or genealogy websites.

- **Navigational Links:**  Information pointers added by the **Author** that allow the consumer of a **Body of Related Information** to get from one place in it to another quickly based on his or her purpose.  For a hard-copy **Non-Fiction Literary Work** (e.g., a non-fiction book), navigational links are static references such as "see page 96."  For a website, navigational links are implemented by **Hyperlinks.**  When the navigational links are purposefully designed for the body of related information to provide thorough navigation within it then the term **Hypermedia** is used.

- **Non-Fiction Literary Work:**  A creative work in which the medium of creation is, for the most part, words as well as images to supplement the words.  The non-fiction literary work lends itself to the use of **Hypermedia** in which readers can go to different parts of the work as their personal needs unfold as they make use of the work.  The non-fiction literary work is a complex document and production of a non-fiction literary work is a complex project.  Therefore,  the **Author** of the non-fiction literary work requires both writing skills and organizational skills to produce it not to mention expertise in the underlying discipline.  Genealogy websites are examples of non-fiction literary works.  Most non-fiction literary works can be organized by the author using a **Multilayered Structure** and especially the **Three-Layered Structure.**

- **Organizational Metaphor:**  A way to organize a **Body of Related Information** to take advantage of public understanding of a known analogous information structure.  Metaphors are often implemented by a **Multilayered Structure**.  The **Proof-Structure Metaphor** is especially useful for organizing a genealogy website.

- **Practitioner:**  A person who works in a **Discipline**.  Genealogists are practitioners of genealogy.

- **Proof-Structure Metaphor:**  An **Organizational Metaphor** used to design a website which proves propositions of a theory.  In the proof-structure metaphor, the website is organized into a **Three-Layered Structure** of  1) the statement of a theory, 2) the proof including explanations, discussions, and synthesis of facts to explain the proof or consolidate the facts, and  3) facts which are relied on in the proof.  Since most genealogy websites make statements then prove them, the proof-structure metaphor is perfect for them.

- **Relation:**  A logical connection between two **Information Elements**.  That is, one information element is associated with another information element by **Practitioners** of the **Discipline** from which the information is drawn (i.e., from the **Body of Related Information**).  Relations have a **Direction** in which one of the information elements is the primary or active starting point of the relation and the other information element is the secondary or passive end point of the relation.  The practitioners regard the relation between the two as important or pertinent to understanding or using the information.  Also, the relation is how a reader of the information will correlate and bind the points contained in the information and to thus get from one point to another.  Relations will be the paths of **Navigation Links.**  In effect, the navigation link "implements" the relation.

- **Synthesis:**  Bringing together disparate information into one whole.  Genealogy research produces a huge number of facts, possibly unrelated at first.  A consumer of information needs more than facts to understand a topic.  Synthesis provides the means to understanding – the integrating, generalizing, combining, consolidating or

abstracting of facts to form meaning.  This is the basic work of the genealogist – synthesis is how the genealogist adds value.  Usually, the **Author** records the resulting synthesis on a **Synthesis Layer** of a **Multilayered Structure** used to organize the website.

- **Synthesis Layer:**  The middle layer of a **Three-Layered Structure.**  Also, synthesis layers are almost always a part of any **Multilayered Structure**.  A synthesis layer will contain the **Author's** synthesis (see **Synthesis**) of lower layers which constitutes his or her added value to the topics of the website.  In a three-layered structure, the synthesis layer contain web pages that abstract or consolidate the "atoms" (see **"Atoms" Layer)** of the **Bottom Layer** making reference to them via **Hyperlinks**.  The idea is that a visitor to the website would never be able to understand the "atoms" if, for example, they embarked on a sequential reading of them.  Rather, their meaning is synthesized into the web pages of the synthesis layer.

- **Theory Layer:**  The top layer of the **Three-Layered Structure** of the **Proof-Structure Metaphor.**  The theory layer contains statements and their corresponding proofs of the theory or theories that are being advocated.  The proofs will harness the lower level **Synthesis Layers** and **Fact Layers** to make the case and support the proof.

- **Three-Layered Structure:**  The simple **Multilayered Structure** which is used to organize many **Non-Fiction Literary Works** and includes a **General Layer** (see also **Top Layer**), a **Synthesis Layer** (see also **Middle Layer**), and an "**Atoms" Layer**  (see also **Bottom Layer**).

- **Top Generality:**  A characteristic of the **Top Layer** of a **Multilayered Structure**.  The top layer is where the broadest information resides, the **Information Elements** which have the greatest meaning or significance or generality or complexity or inclusiveness.

- **Top Layer:**  The layer in a **Multilayered Structure** of **Information Elements** representing the most general or significant content (see **Top Generality**) of a **Non-Fiction Literary Work**.  These information elements are at the top layer because they either cannot or the **Author** decides not to create layers above it (e.g., limited scope).  The top layer is referred to as the **General Layer** in a **Three-Layered Structure**.  The information elements of the top layer contain **Navigational Links**  (on a website, these would be **Hyperlinks)** to information elements in the other layers.

- **Top-Down Form** (see also **Layering Criteria,** see also **Form (of Layering Criteria)**): One of two major families of layering criteria to create a **Multilayered Structure** (the other is the **Bottom-Up Form** layering criteria).  In either of the top-down form or bottom-up form, the two layers in question (not necessarily adjacent) have **Information Elements** which have **Relations** with each other.  In the top-down form, one information element on the upper layer has relations with many (i.e., one or more) information elements on the lower layer.  In the top-down form, the **Direction** of the relation is from the primary information element on the upper layer to the secondary information element on the lower layer.  The upper layer information element is refined in some sense by the lower layer information elements.  In other words the lower layer information elements clarify, enhance, bolster, breakdown, etc. their information element on the upper layer.  The top-down form helps the reader's understanding because the lower layer information elements are easier to understand or work with then their upper layer information

element.  The most common top-down layering criteria is *Decomposition.*  Other top-down layering criteria include:  *Cause-Effect, Conclusion, Design, Explanation, Harmony, Hierarchy, Regulation,* and *Specification.*

- **Whole - Part:**  A characteristic of the **Layers** of a **Multilayered Structure**.  The collection of the **Information Elements** on a lower layer are often (but not always) equivalent to the **Collection** of information elements on the upper layer (not necessarily adjacent) in the whole-part sense.  The equivalence is that the parts could stand in for the whole in many contexts.  In effect, the lower layer is a more detailed view or perspective of the upper layer.