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# An Object-oriented Design for an Adaptive System to Augment a Telecommunication and Networking Systems (TNS) Course

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## Abstract

*An object-oriented system is designed to enhance the instruction in a telecommunication and networking course. The areas covered include rationale for using a hypermedia structure, multi-modal instruction and development strategies, instructional design components, systems architecture, and course content and unit organization.*

Telecommunication is a highly abstract subject area. Unlike much of IS technology, telecommunication signals, nor the devices that support such signals, can be 'seen or touched'. The physical devices, whether they be hubs, routers or bridges, cannot be visually discriminated. Thus, most of the technology associated with telecommunication can not be concretely understood. Coupled with this is the complexity of the subject area. To be literate in the area requires a broad scale of knowledge and the adoption of irregular rules to meet situational demands. Given these factors it is proposed here that a hypermedia system (Marchionini, 1988) may be an effective tool for enhancing learning in this field. From the student's perspective hypermedia may prove to be a more efficient and efficacious means for learning a skill. That is to say, the student may be able to learn more about the subject domain than could reasonably be provided in a traditional semester classroom course. Moreover, each student will be free to learn topics that are more relevant to their needs. This would provide the students with both concrete and affective benefits. From an instructor's standpoint, hypermedia instruction will help to supplement classroom training. This in turn would have the effect of decreasing instructional load, while at the same time increasing topic coverage. This is of some importance in the current environment. Course work in skill subject areas like telecommunication systems development and analysis require the coverage of quite a number of topics. Because of time restraints, many topics receive only the most rudimentary attention, and this attention is given at the cost of other equally worthy topics. Thus, the pace of the class and its subsequent attention to topic areas, suffers. Classroom supplementary material can help to alleviate this situation. In addition, traditional instruction in such domains requires numerous case observations. Such cases are both timely to create and implement. By delegating some of this instruction to a hypermedia system, the instructor is free to concentrate on other relevant topics.

Many have asserted that hypermedia offers a number of advantages over traditional based instruction in ill-structured domains. These include:

- Learner directed instruction;
- Nonlinear access to instructional material; and a
- Multi-modal instructional context

Positive results have been found in studies examining the ability of hypermedia to enhance the performance level of both low ability students and students with low knowledge in the domain (Barba & Armstrong, 1992; Bransford et.al., 1989; Mayer & Gallini, 1990).

The chief requirement of the system described here (TNS) is that the courseware be available to the broadest segment of the learner (user) population. This would imply the need for a course delivery platform that would provide shared access and centralized storage of computer-based courseware or CBT. Such a delivery system would necessarily be separate from the system platform used to develop the courseware. The development platform would support the initial development and testing of the TNS application software.

## Development and Delivery Solution Alternatives

There are three different delivery alternatives that may be used to meet the system objective described above:

1. Traditional CBT Development and Delivery
2. Traditional CBT Development and CD-ROM Delivery
3. Webpage Development and Web-based Delivery

We use the third option to develop the system. Courseware could be developed using the Hypertext Markup Language (HTML) and JAVA. This would allow the course to be made available over the Internet. This strategy would also increase courseware availability by making it available to a wider range of audiences. This alternative would require that the developed software conform to the standards required by HTTP protocol, and be bound to the capabilities of JAVA and HTML. Moreover, it would suggest the need for a webserver capable of supporting simultaneous access of the courseware

One of the most common hypertext system structure is the hybrid structure. These structures attempt to combine both the hierarchical design with some elements of network designs. Typically, hybrid designs may take two forms: the directed acyclic graph and the jump linear design. The jump linear structure is quite similar to the tree structure in its use of anchoring nodes and branch tree structures. However, in this design the user is not required to return to the anchor node. Thus, the learner may choose other paths. In the directed acyclic graph topology, most but not all, nodes have a single point of entry. In this manner at higher levels of abstraction the acyclic graph structure appears similar to the tree structure. However, at lower levels of the hierarchy the learner is permitted to reverse and even cross traverse subject nodes. Thus, as shown in figure 3, this topology provides both instructional guidance and user flexibility.

## TNS Instructional Architectural Design

The goal of TNS is to provide broad range of instruction, that is both flexible to the instructional needs of the user, while at the same time providing the needed level of instructional guidance. For this reason the initial panel of TNS, the TNS homepage, will provide a non-linear gateway to all the resources included in TNS. The homepage will provide access to the four major categories of TNS resources: Course Instruction, Learning Resources, User Tools, and Instructor Tools.

## Course Instruction.

The course instruction structural link will provide access to the course materials in TNS. This link will allow the students to choose from an instruction level menu. This menu will link to the course topic menu, which will allow students to select the course they choose to pursue. It is proposed that there be three different instructional mastery levels for each topic module or unit: Summary Overview, Beginner, and Advanced Instruction. The summary overview course level will provide the reader will the fundamentals and high level concepts of the subject matter. This will allow a beginning student who wishes to gather only the most basic knowledge of an area to do so quickly. This level of course instruction will rely on catagorial threads and index access constructs to provide brief and concise information on the topic. However, at the end of the overview the user will have the ability to access more detail information. As might be expected, the beginner course level will provide more in depth coverage of the subject matter. This level of instruction is proposed to support freshman classes and non-IS majors. Thus, this level of instruction will rely on a hierarchical hypermedia topology and a guided tour access construct as a means for providing maximum instructor control of the learning process. This level will also rely on structural, i.e. menus and fold links, i.e. hot links, as the major associative links. Access to other learning resources in TNS during subject content presentations will be limited to relevant multimedia video clips and the glossary in order to reduce learner disorientation. In more critical topic areas a linear design will be used. This will serve to ensure that the learner proceeds through the entire subject segment. In addition, frequent student assessments, including sub-unit exams will be provided.

The advance course level is geared towards seniors and graduate level IS majors. While the beginner and overview levels provide conceptual knowledge, the advance level provides more detail conceptual and task related, e.g. applied, knowledge. This mastery level will use structural and allutive links to present topic matter within an index guided tour access construct. Thus, this mastery level will provide the learner with the least amount of instructor guidance; allowing students to access other learning resources at will. Other types of non-goal oriented, i.e. exploratory learning will be supported through use of other learning resources and user tools. Based on these considerations, detailed tables are prepared that describe course content and unit organization.

### *References*

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