12BECS8E23   KNOWLEDGE BASED DECISION SUPPORT SYSTEMS

INTENDED OUTCOMES:

- There has been a radical shift in the management parlance. Organizations can use Intranets and Internets to analyze various aspects about the performance and predict the future. This course aims at exposing the student to one of the important applications of the computer.
- The course has been so designed as to include.
- Development of support system
- Methods of managing knowledge
- Intelligent decision system development

UNIT- I   INTRODUCTION

Decision making, Systems, Modeling, and support – Introduction and Definition – Systems – Models – Modeling process – Decision making: The intelligence phase – The design phase - The choice phase – Evaluation: The implementation phase –Alternative Decision – Making models – Decision support systems – Decision makers - Case applications

UNIT -II   DECISION SUPPORT SYSTEM DEVELOPMENT

Decision Support System Development**:** Introduction - Life cycle – Methodologies – prototype – Technology Levels and Tools – Development platforms – Tool selection – Developing DSS
Enterprise systems: Concepts and Definition – Evolution of information systems – Information needs – Characteristics and capabilities – Comparing and Integrating EIS and DSS – EIS data access, Data Warehouse, OLAP, Multidimensional analysis, Presentation and the web – Including soft information enterprise on systems - Organizational DSS – supply and value chains and decision support – supply chain problems and solutions – computerized systems MRP, ERP, SCM – frontline decision support systems.

UNIT- III   KNOWLEDGE MANAGEMENT

Introduction – Organizational learning and memory – Knowledge management –Development –methods, Technologies, and Tools – success –Knowledge management and Artificial intelligence – Electronic document management.Knowledge acquisition and validation: Knowledge engineering – Scope – Acquisition methods - Interviews – Tracking methods – Observation and other methods – Grid analysis – Machine Learning: Rule induction, case-based reasoning – Neural computing – Intelligent agents – Selection of an appropriate knowledge acquisition methods – Multiple experts – Validation and verification of the knowledge base – Analysis, coding, documenting, and diagramming – Numeric and documented knowledge acquisition – Knowledge acquisition and the Internet/Intranets. Knowledge representation: Introduction – Representation in logic and other schemas – Semantic networks –

Production rules – Frames – Multiple knowledge representation – Experimental knowledge representations - Representing uncertainty.

UNIT- IV   INTELLIGENT SYSTEM DEVELOPMENT

Inference Techniques: Reasoning in artificial intelligence – Inference with rules: The Inference tree – Inference with frames – Model-based and case-based reasoning - Explanation and Meta knowledge – Inference with uncertainty – Representing uncertainty – Probabilities and related approaches – Theory of certainty – Approximate reasoning using fuzzy logic.

Intelligent Systems Development: Prototyping: Project Initialization – System analysis and design – Software classification: Building expert systems with tools – Shells and environments – Software selection – Hardware –Rapid prototyping and a demonstration prototype - System development – Implementation – Post implementation.

UNIT -V   MANAGEMENT SUPPORT SYSTEMS

Implementing and integrating management support systems – Implementation: The major issues - Strategies – System integration – Generic models MSS, DSS, ES – Integrating EIS, DSS and ES, and global integration – Intelligent DSS – Intelligent modeling and model management – Examples of integrated systems – Problems and issues in integration. Impacts of Management Support Systems – Introduction – overview – Organizational structure and related areas – MSS support to business process reengineering – Personnel management issues – Impact on individuals – Productivity, quality, and competitiveness – decision making and the manager manager's job – Issues of legality, privacy, and ethics – Intelligent systems and employment levels – Internet communication – other societal impacts – managerial implications and social responsibilities

TEXT BOOKS:

S.NO	Author(s) Name	Title of the Book	Publisher	Year of publication
1	Efrain Turban, Jay E.Aronson	Decision Support Systems and Intelligent Systems	Pearson Education	2001

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S.NO	Author(s) Name	Title of the Book	Publisher	Year of publication
1	Ganesh Natarajan, Sandhya Shekhar	Knowledge management – Enabling Business Growth	Tata McGraw-Hill	2002
2	George M.Marakas	Decision Support System	Prentice Hall	2003
3	Efrem A.Mallach	Decision Support and Data Warehouse Systems	Tata McGraw-Hill	2002

Lecture Plan

Faculty Name : S.Rinesh   **Subject Code: 12BECSE23**
Subject Name : Knowledge Based Decision Support
System   **Class   : IV-BE-CSE**

- **Week 1** Intro to decision making and the organization, Simon's decision-making model, CSF, intro to DSS
- **Week 2** Recap of last week, DSS defined
- **Week 3** Recap of last week, DSS for ski resort planning, data warehouses and data mining, OLAP, GIS
- **Week 4** Recap of last week, 'Are DSS effective?', modeling, GSS
- **Week 5** Recap of last week, GSS, EIS
- **Week 6** Recap of last week, GSS, EIS
- **Week 7** KM, AI, expert systems
- **Week 8** KM and org absorptive capacity, expert systems, knowledge acquisition
- **Week 9** Knowledge acquisition
- **Week 10** SAS decision trees, neural networks
- **Week 11** Fuzzy logic, genetic algorithms (GA)
- **Week 13** Intelligent agents
- **TEXT BOOKS:**

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1	Efrain Turban, Jay E.Aronson	Decision Support Systems and Intelligent Systems	Pearson Education	2001

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MODULE - 9 LECTURE NOTES – 4

DECISION SUPPORT SYSTEMS

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INTRODUCTION

DSS is an interactive computer-based system to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems, complete decision process tasks, and make decisions. Geographic Information Systems (GIS), Enterprise Information Systems (EIS), Expert Systems (ES), On-Line Analytical Processing (OLAP), software agents, knowledge discovery systems and group DSS can all be lumped into the category of systems we call as DSS.

DSS FOR DECISION-MAKING

Decision Preparation

– DSS environments provide data required as input to the decision-making process.

– This is what almost all data mart and data warehousing environments do today.

Decision structuring

– DSS environments provide tools and models for arranging the inputs in ways that make sense to frame the decision.

– These tools and models are not pivot tables and other aspects of data presentation found in query tools.

– They are actual decision-making tools, like fault tree analysis, Bayesian logic and model-based decision-making based on things like neural networks.

Context Development

– DSS environments again provide tools, and provide the mechanisms for capturing information about a decision's constituencies (who are affected by this decision), outcomes and their probabilities, and other elements of the larger decision-making context.

Decision-making

– DSS environments may automate all or part of the decision-making process and offer evaluations on the optimal decision.

– Expert systems and artificial intelligence environments can do this

Decision Propagation

– DSS environments take the information gathered about constituencies, dependencies, outcomes and drive elements of the decision into those constituencies for action.

Decision Management

– DSS environments inspect outcomes days, weeks and months after decisions to see if the decision was implemented/ propagated and if the effects of the decision are as expected.

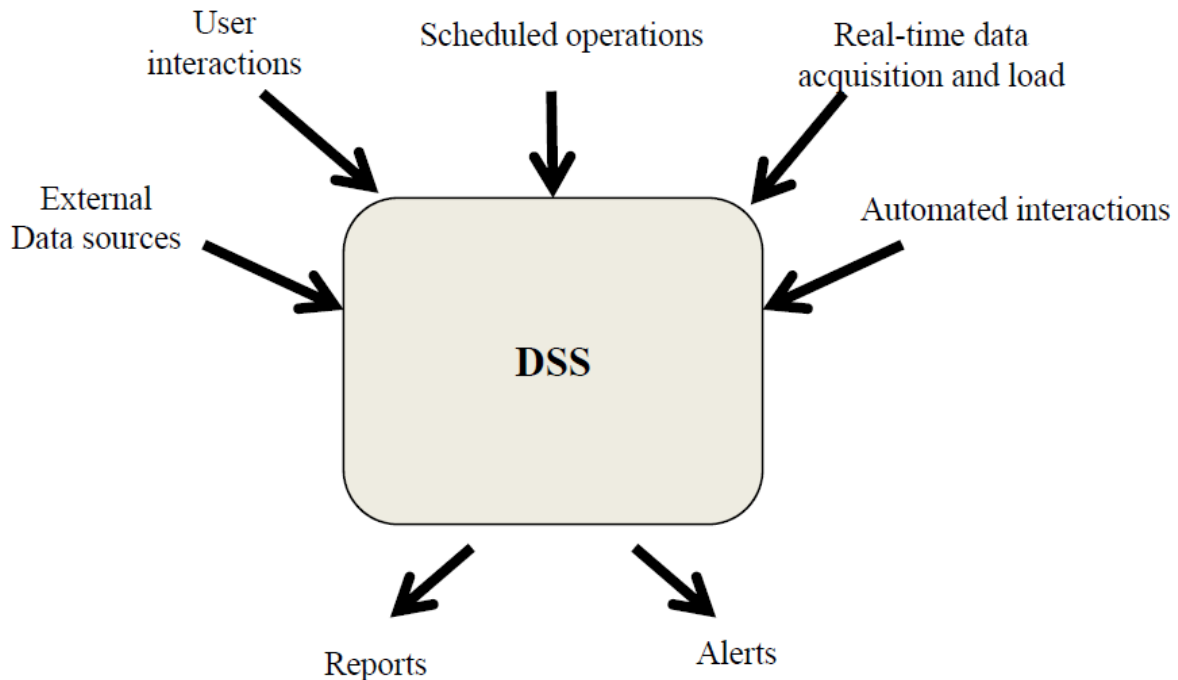The data flow in and out of a DSS is shown in figure 1.

Fig. 1 Data flow in a DSS

DECISION SUPPORT TOOLS

1. Multi-Dimensional Analysis Software: Also Known as Multi Software or OLAP (On-Line Analytical Processing) Software that gives the user the opportunity to look at the data from a variety of different dimensions.

2. Query Tools: Software that allows the user to ask questions about patterns or details in the data.

3. Data Mining Tools: Software that automatically searches for significant patterns or correlations in the data.

DSS TYPES

1. Model-driven

2. Data-driven

3. Communication-driven

4. Document-driven and
5. Knowledge-driven

Model-driven DSS

A model driven DSS emphasizes access to and manipulation of financial, optimization and/or simulation models. Model driven DSS use limited data and parameters provided by decision makers to aid them in analyzing a situation. e.g., Sprinter, Media Evaluation using Dynamic and Interactive Applications of Computers (MEDIAC) and Brandaid.

Data-driven DSS

A data driven DSS emphasizes access to and manipulation of a time series of internal company data and sometimes external and real time data. Simple file systems accessed by query and retrieval tools provide the most elementary level of functionality. Ex. WalMart's data driven DSS had more than 5 terabytes of online storage.

Communications-driven DSS

Communications driven DSS use network and communications technologies to facilitate decision relevant collaboration and communication. In these systems, communication technologies are the dominant architectural component. Tools used include groupware, video conferencing and computer based bulletin boards.

Document-driven DSS

Document-driven DSS uses computer storage and processing technologies to provide document retrieval and analysis. Large document databases may include scanned documents, hypertext documents, images, sounds and video. Examples of documents that might be accessed by a document-driven DSS are policies and procedures, product specifications, catalogs, and corporate historical documents, including minutes of meetings and correspondence.

Knowledge-driven DSS

Knowledge driven DSS can suggest or recommend actions to managers. These DSS are man machine systems with specialized problem solving expertise. The "expertise" consists of knowledge about a particular domain, understanding of problems within that domain, and "skill" at solving some of these problems. Artificial Intelligence (AI) and expert systems have

been used for scheduling in reservoir operation and web based advisory systems. In recent years, connecting expert systems technologies to relational databases with web based front ends has broadened the deployment and use of knowledge driven DSS.

WHEN TO BUILD A DSS ?

The need for building a DSS depends on the following factors:

- Can the problem be solved effectively by conventional programming?
- Is the domain well-bounded?
- Is there a need and a desire for an expert systems?
- Is there at least one human expert who is willing to cooperate?
- Can the expert explain the knowledge so that it is understandable by the knowledge engineer?
- Is the problem-solving knowledge mainly heuristic and uncertain?

DSS in Water Resources

DSS is extensively used in Hydrology, water resources planning and management and environmental engineering for data analysis and decision making. Considerable numbers of DSS were developed for river basin planning and management with number of features and attributes specific to a river basin under consideration. DSS can consider multiple reservoir systems with multiple purposes for optimal operation in real time.

EXAMPLES OF DSS
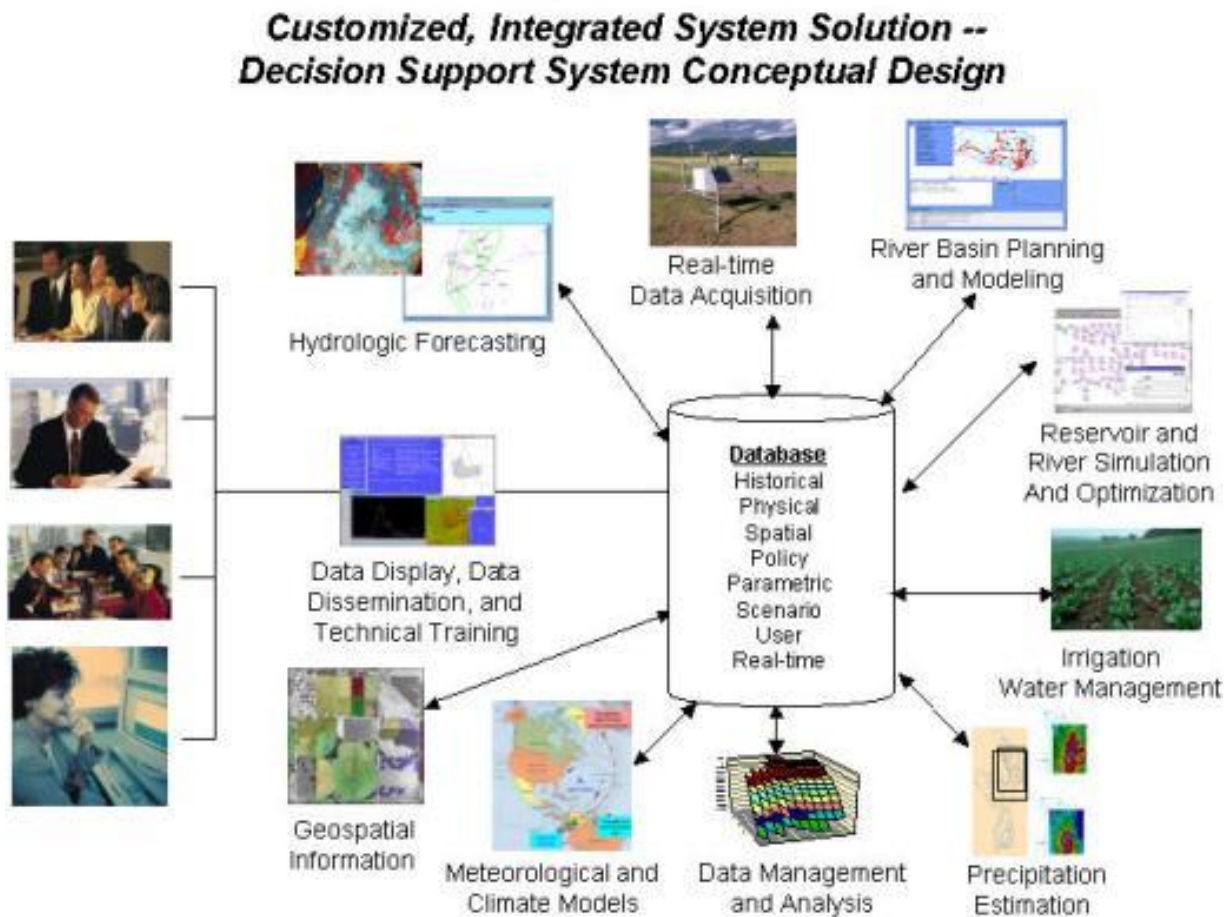## Components of DSS for River Basin Planning and Management

Fig. 2 Components of DSS

MODel_SIMulator (MODSIM) DSS

MODSIM (Labadie et al, 2000) is a generic river basin management decision support system developed in Colorado State University, USA. MODSIM is designed for developing basin-wide strategies for short-term water management, long-term operational planning, drought contingency planning, water rights analysis and resolving conflicts between urban, irrigation, hydropower and environmental concerns.
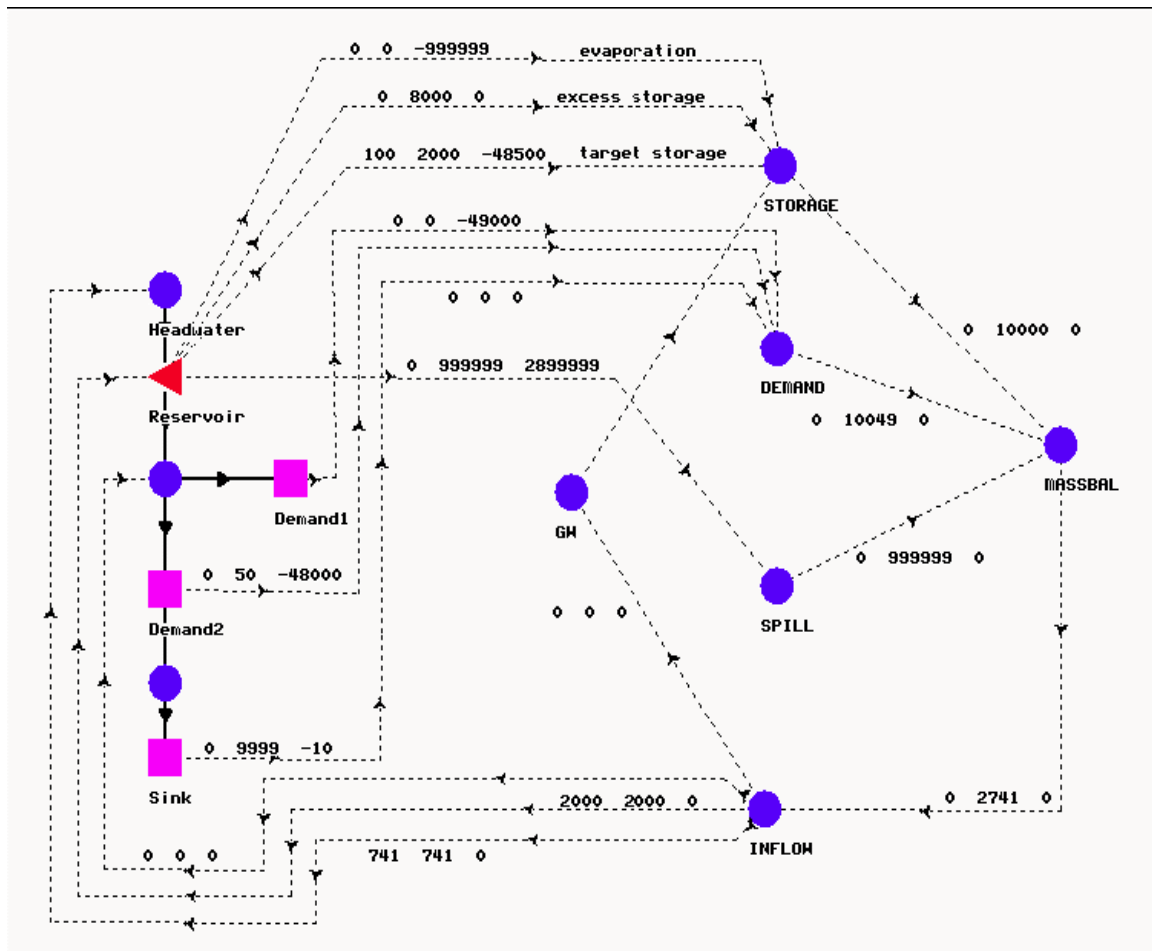
Fig. 3 MODSIM network

The most recent version, MODSIM 8.0, is developed under the MS .NET framework and is comprised entirely of native code written in MS Visual C++.NET. The MODSIM graphical user interface (GUI) is developed in Visual Basic.NET, and includes both native code and software requiring a developer license. Advantage of the .NET Framework is providing users with the ability to customize MODSIM for any specialized operating rules, input data, output reports, and access to external models running concurrently with MODSIM, all without having to modify the original MODSIM source code. MODSIM data sets can be developed for daily, weekly, and monthly time steps. Streamflow routing can be handled through the use of lag coefficients. There is considerable flexibility in representing consumptive use demands and flow requirements and their associated water rights, including exchanges. Reservoir operations include target storage, hydropower, tail water effects, evaporation, and seepage. Optimization model in MODSIM provides an efficient means of assuring that all system targets and rule curves are achieved according to user-specified priorities based on water rights or economic valuation, while insuring that water is allocated according to physical,

hydrological, and institutional/ legal/ administrative aspects of river basin management. A powerful GUI connects MODSIM with database management components and an efficient network flow optimization model.
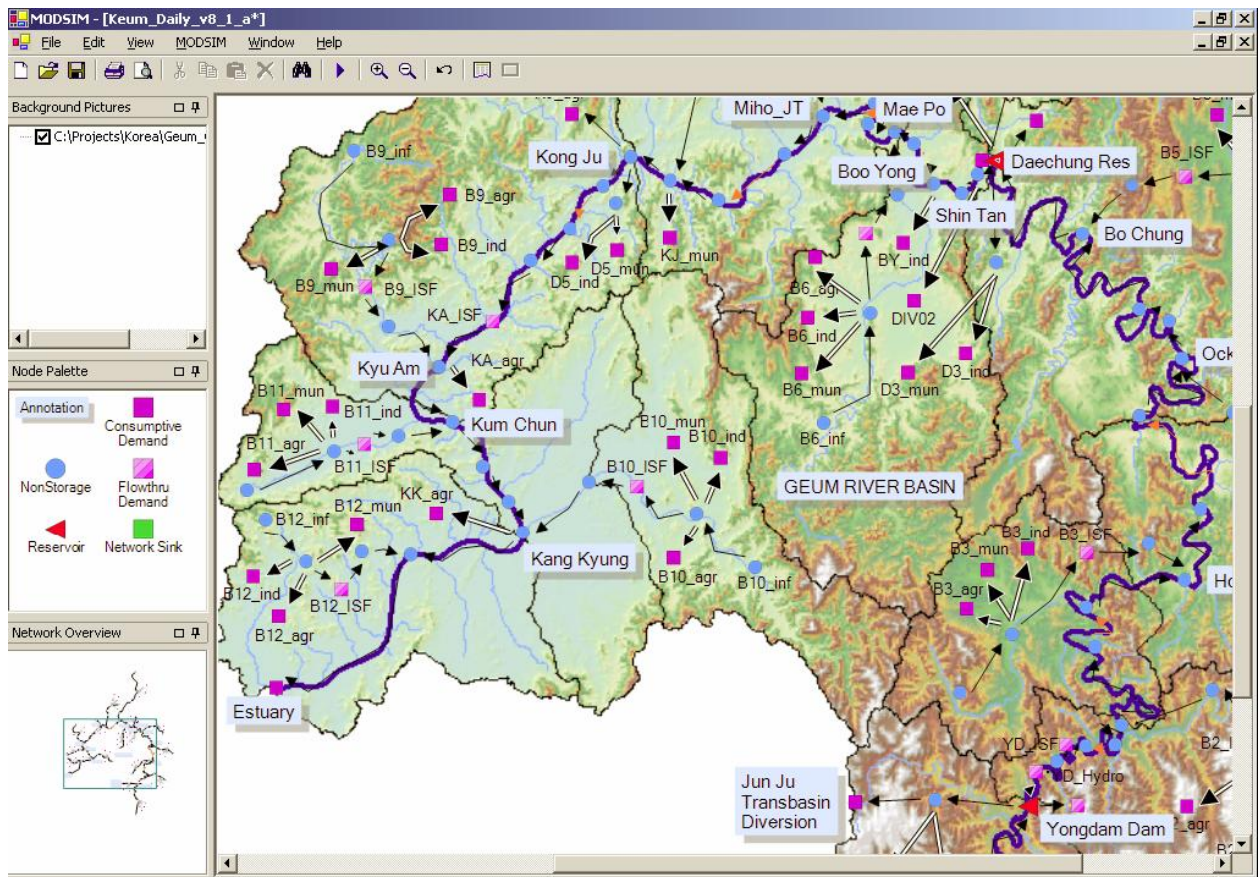

Fig. 4 MODSIM GUI

DESERT DSS (DEcision Support system for Evaluation of River basin sTrategies)

DESERT (Ivanov et al, 1996) is highly integrated tool for decision support for water quality management in a river basin. Computing river hydraulic characteristics, such as depth, cross-sectional area and travel time, is necessary for the simulation of water quality. The hydraulic models used in DESERT for rivers and open channels are based on mass continuity and momentum equations of fluid mechanics. It models river hydraulics through the one-dimensional shallow water equations (Saint Venant's equations).
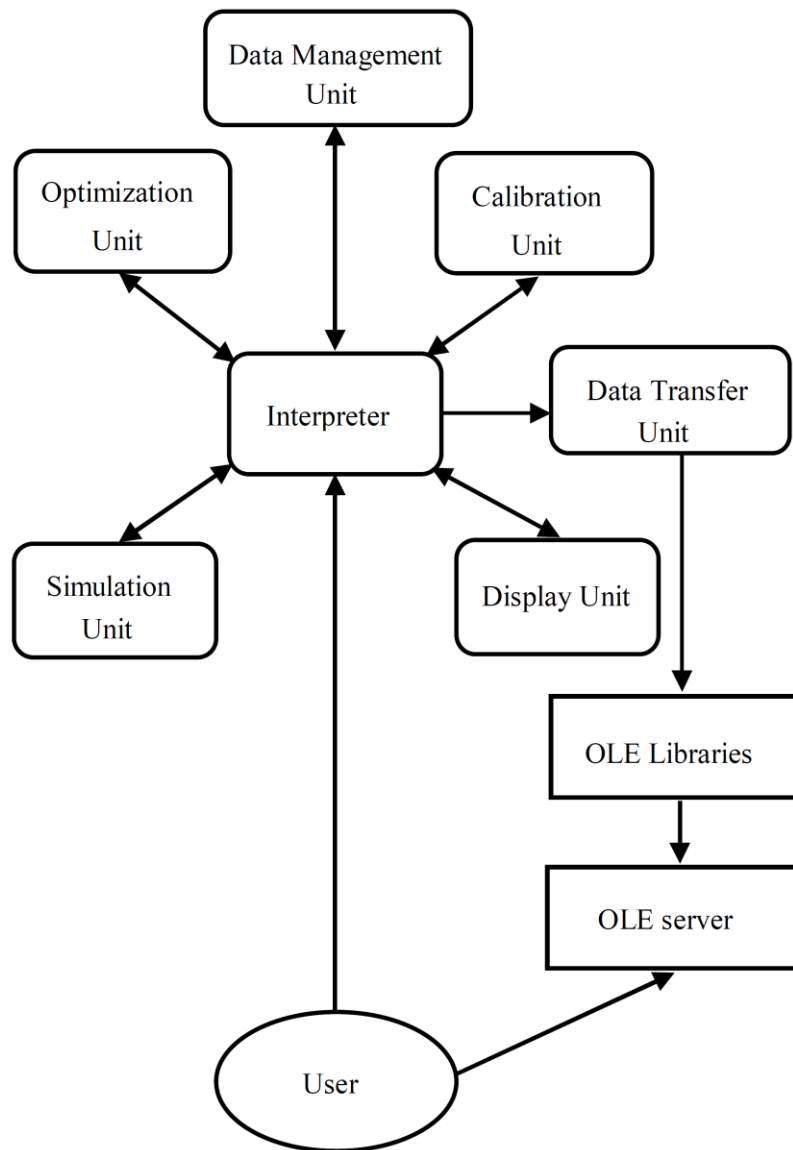
Components of DESERT

Fig. 5 Components of DESERT

Features

- Integration of most important stages of decision support, namely: data management, model calibration, simulation, optimization and plotting results of simulation.

- Friendly user environment based upon Microsoft Windows interface

- Unified data formats and data processing

- Flexible structure of water quality model

- Object oriented programming (C++), easily extended

- Several variants of hydraulics

- Possibility for on-line linkage to OLE servers, like Microsoft Excel, Lotus 1-2-3, etc

- Easy-to-use data handling module with a dBase style database engine

- Simulation and calibration of hydraulics and water quality models

- Display of computed data with the help of external spreadsheet software; and

- Optimization is based on Dynamic Programming algorithm

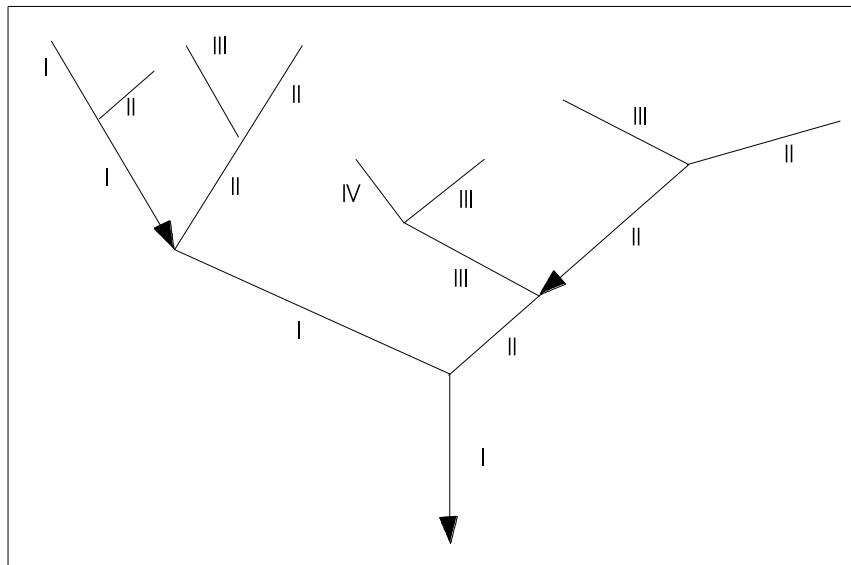Figure 6 shows the representation of a river system as a binary tree in DESERT

Fig. 6 Binary tree

In this figure arrows indicate the main direction of the flow and roman numerals indicate the order of the reaches. Water quality management problems can be formulated as a search for suitable waste-load allocation policies.

Other DSS for River Basin Management

HEC-ResSim: Developed by US Army Corps of Engineers

RiverWare: Developed in Univ. of Colorado, USA

WaterWare: Developed by Environmental Software and Services, GmbH