Development of Airport Simulations

for

SIMMOD and Beyond

by

Tung Le, LeTech Incorporated

Introduction

Airport Simulation Model (LTI-ASM)

- Previously called SIMMOD Turnkey System
- Designed and developed by LeTech Incorporated
- Developed basing on users' needs and requirements

Joint-Venture Program (LeTech-IATA)

- Exclusively licensed to IATA for marketing, training, and support
- Develop and test modules (Gate Management, Terminal Simulation) on IATA's actual projects

System Design Overview

- Using the most popular Operating System: Windows 95/98/NT/2000
- One program, multiple purposes: airspace, ground, terminal, and …beyond

Satisfy Users' Point of View

- Affordable and cost effective
- Easy to use, reliable, and fast production

Maintaining Developer's Goals

- Easy to maintain: C++
- Minimize support: more internal validation
- Flexibility in adding new features and sharing features between modules: modular

System Modules

- Network Editor
- Gate Management
- Events Generator
- Simulation Engine
  - Latest FAA's SIMMOD
  - New advanced simulation engine: fast and real time
- Animator
- Reports

System Special Features

- Database: network or local drive
  - Binary for speed
  - ASCII for size and data import/export
- Study / Case directory structure
  - Long name support
  - Each study can have multiple cases
  - Each case can have multiple sub-cases
- Case Template
  - Share input data between cases to avoid duplicate data and multiple editing
- Fast cloning within single case:
  - Base, +5%, +10%, etc… or Base, +10%, +20%, etc...
- INM interface (6.x) with dispersion

Network Editor Features

- Simple and easy to use
- Visual editing and selecting the system network
- Undo and redo
- CAD Object layout design
- Background display support: CAD with layers control (DXF import), CAD Objects, NFDC data, Demography
- Instant validation of input data with self repair

Gate Simulation Features

- Gate requirements analysis
- Gate assignment
- Flights cloning
- Use standard network data and logic for gate selection
- Pre-processor for Events Generator
- Use simulation engine’s logic

Events Generator Features

- Route assignment
- Taxi path assignment
- Scenario builder
  - Runway closing
  - Flow control
  - Traffic shift (full or partial)

Simulation Engine

- Latest FAA's SIMMOD engine
- LeTech's new and advanced simulation engine

Advanced Simulation Engine Features

- Compatible with most SIMMOD data input
- Can be used as fast-time or real-time
- Some of the enhanced features:
  - Individual AC tracing for debugging
  - Procedure usages output
  - Air Traffic Controller delay actions
  - ATC actions (ATC): provide time between actions
    - RWYCROSS, DSDPATH, DEPARTQ, DEICING
  - Generates queuing information of special locations
    - DEICING, DEPARTQ, RWYCROSS

Simulation Enhanced Features

- Procedure blocking (PROCEDURES2)
  - Full matrix blocking
  - Cross runways (eliminate STAGGER)
  - Parallel dependent arrival (2+)
- Deicing special logic (DEICING2):
  - Deicing areas and pads with movements control
  - Gate deicing
- Variable runway threshold and taxi speed (RUNWAYS, TAXISPEED)
- Patterned runway and airspace closing (BLOCKCTRL)
- Gate preferences (AIRLINES)
- Runway switching (METERING)

Animation Features

- Fast and easy to use
- Multiple scenarios (4 for NT/2000, 2 for 95/98), multiple PCs replay (no limit): network, internet
- True size AC
- Background display support: CAD, CAD Objects, NFDC data, Demography, INM, Terrain

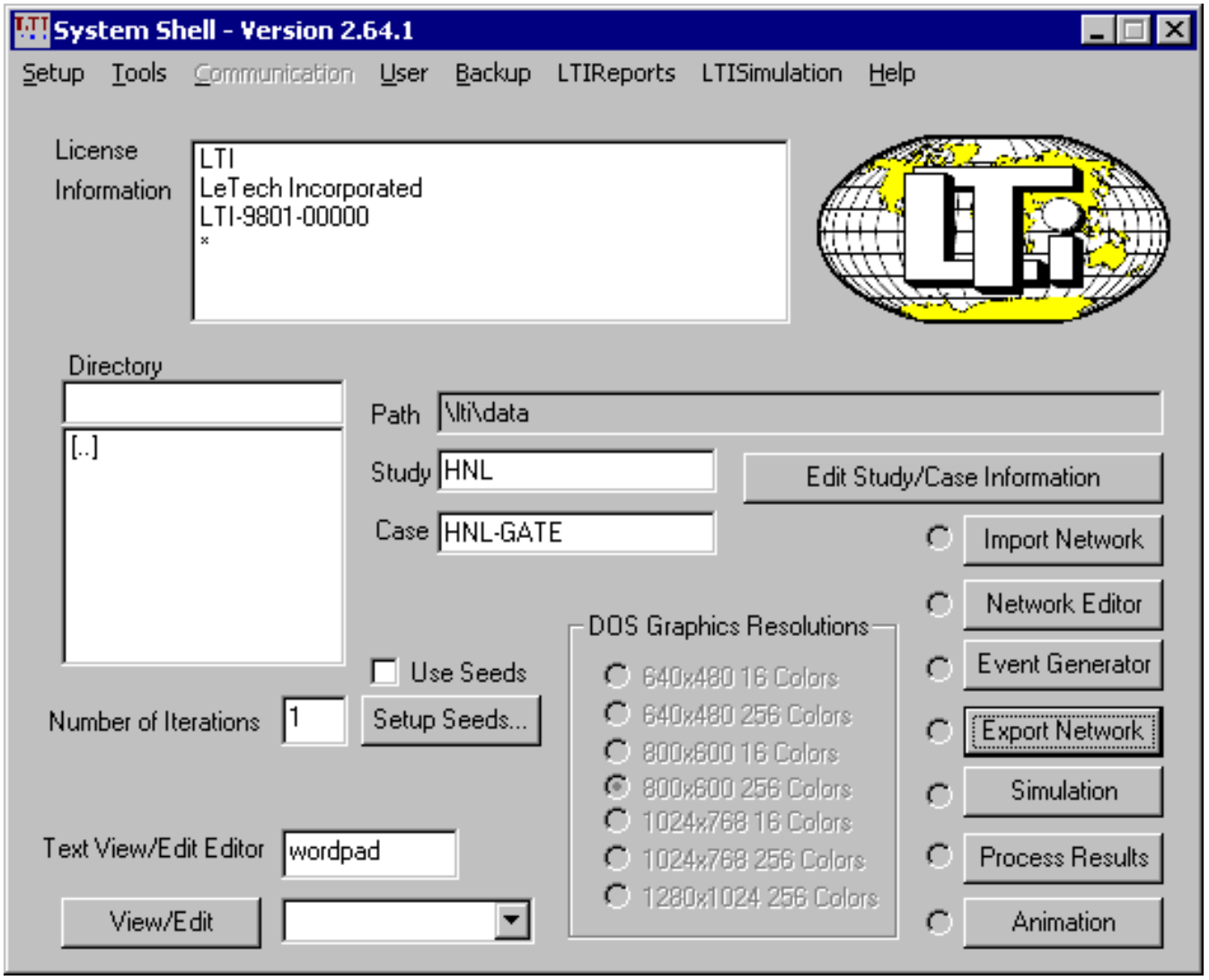
Reporting Features

- Text and graphical output
- Graphical point-n-click analysis
- Graphs and charts
- 24 hours data collection/analysis
- Reports:
  - General delays
  - Airlines delays
  - Gate statistics
  - Ground and airspace statistics
  - Sector delays and statistics
  - Deicing ops and delays
  - Departure queues delays
  - Flight statistics

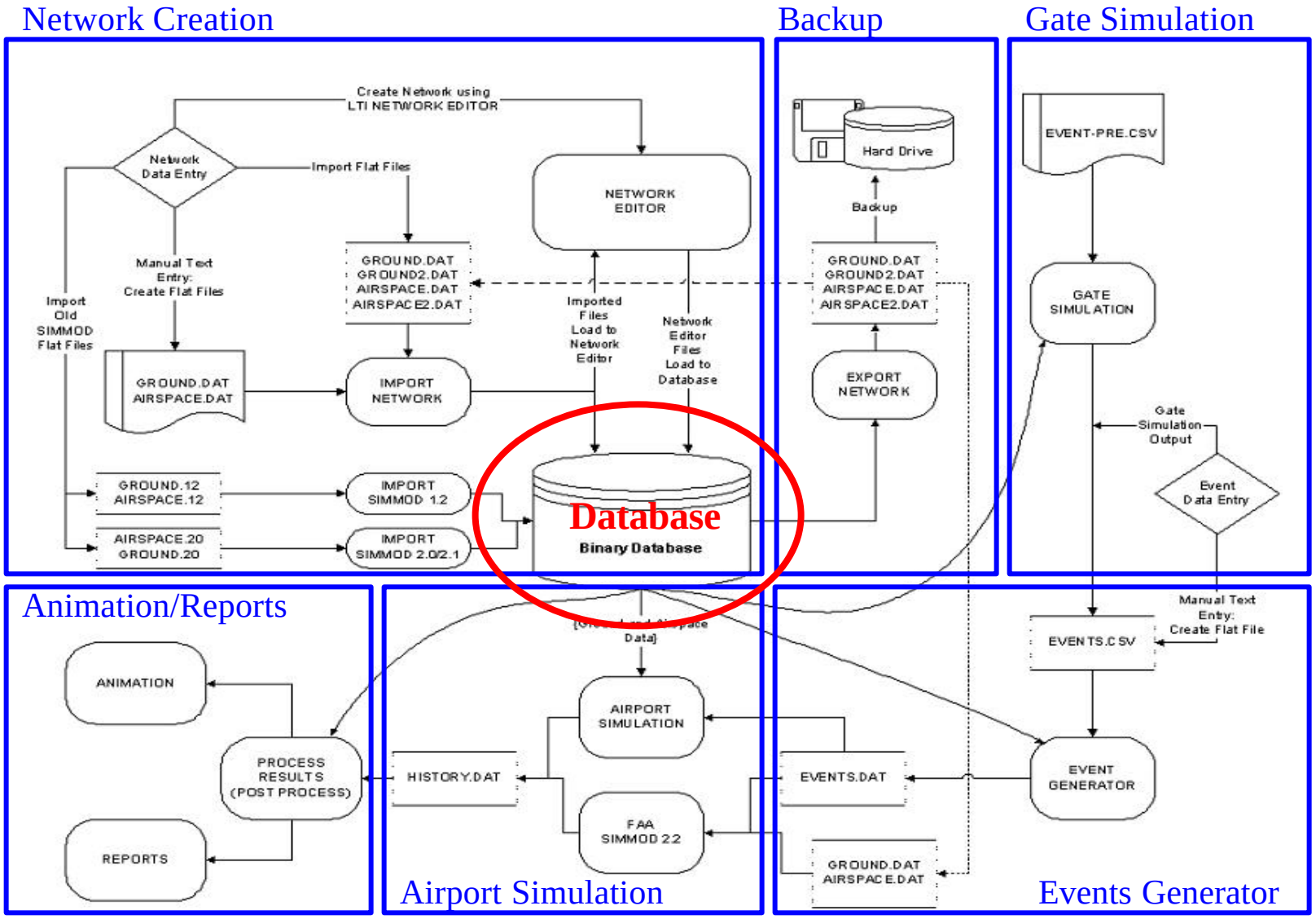
Backup Features

- Daily or temporary backup onto network drive or floppy drive
- Data transfer or delivery
- Use for full regenerating of study and its cases

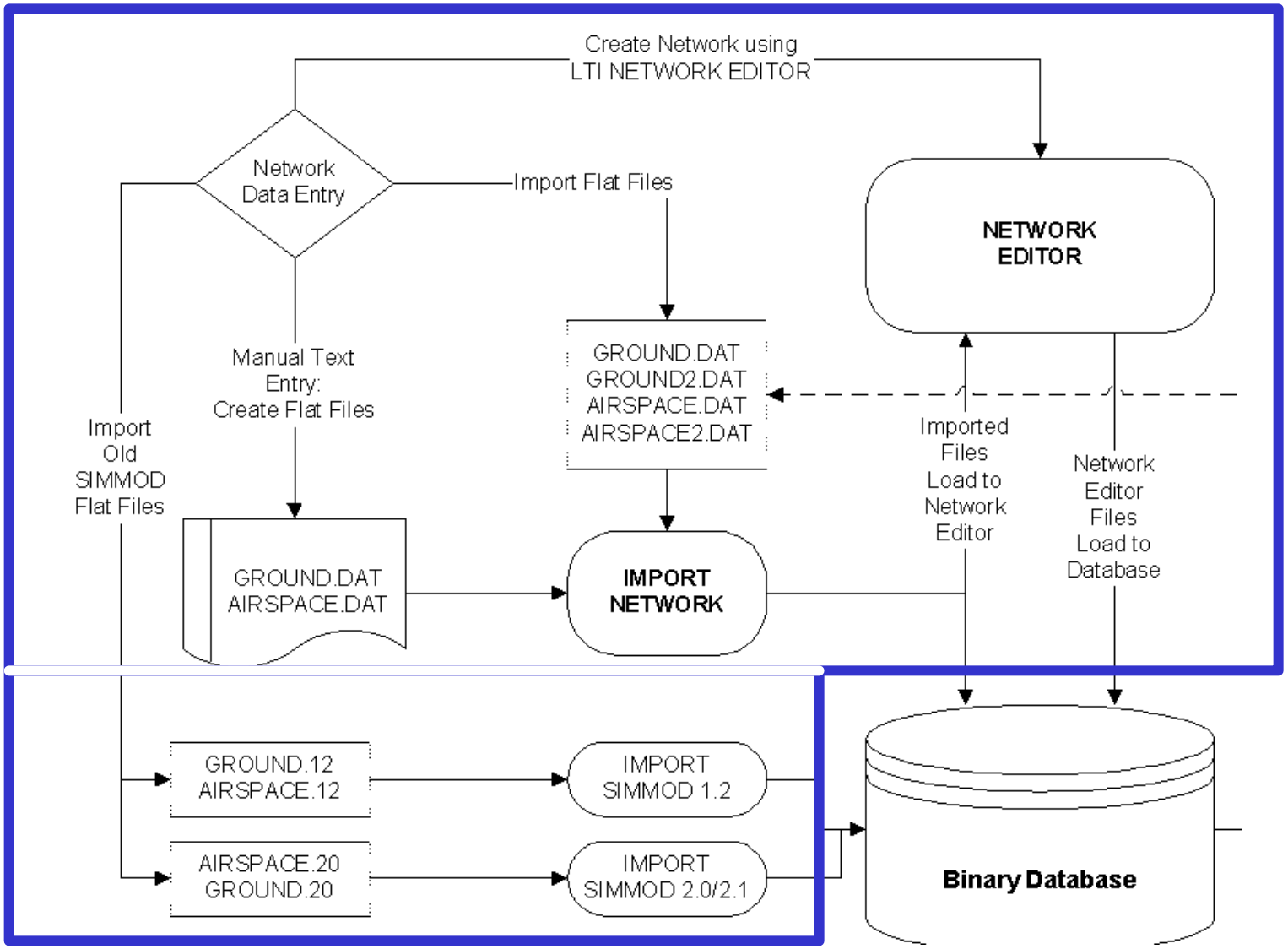
System Shell



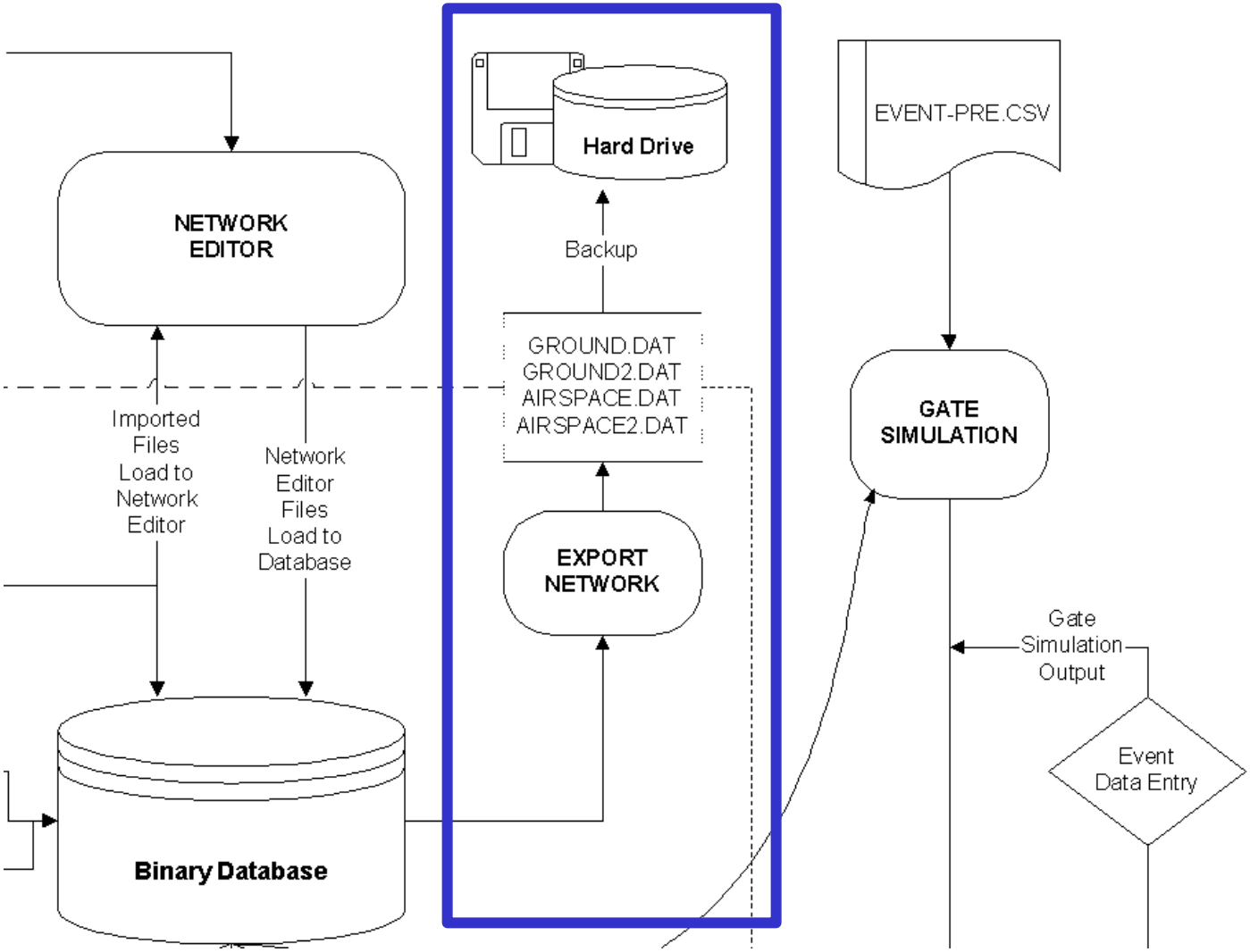
System Flow


Network Creation
Backup
Gate Simulation
Create Network using LTI NETWORK EDITOR
Network Data Entry
Import Flat Files
NETWORK EDITOR
Manual Text Entry: Create Flat Files
Import Old SIMMOD Flat Files
GROUND.DAT GROUND2.DAT AIRSPACE.DAT AIRSPACE2.DAT
Imported Files Load to Network Editor
Network Editor Files Load to Database
GROUND.DAT AIRSPACE.DAT
IMPORT NETWORK
GROUND.12 AIRSPACE.12
AIRSPACE.20 GROUND.20
IMPORT SIMMOD 1.2
IMPORT SIMMOD 2.0/2.1
Database
Binary Database
Hard Drive
Backup
GROUND.DAT GROUND2.DAT AIRSPACE.DAT AIRSPACE2.DAT
EXPORT NETWORK
EVENT-PRE.CSV
GATE SIMULATION
Gate Simulation Output
Event Data Entry
Animation/Reports
ANIMATION
PROCESS RESULTS (POST PROCESS)
REPORTS
Data)
AIRPORT SIMULATION
HISTORY.DAT
FAA SIMMOD 2.2
Airport Simulation
EVENTS.CSV
Manual Text Entry: Create Flat File
EVENTS.DAT
EVENT GENERATOR
GROUND.DAT AIRSPACE.DAT
Events Generator

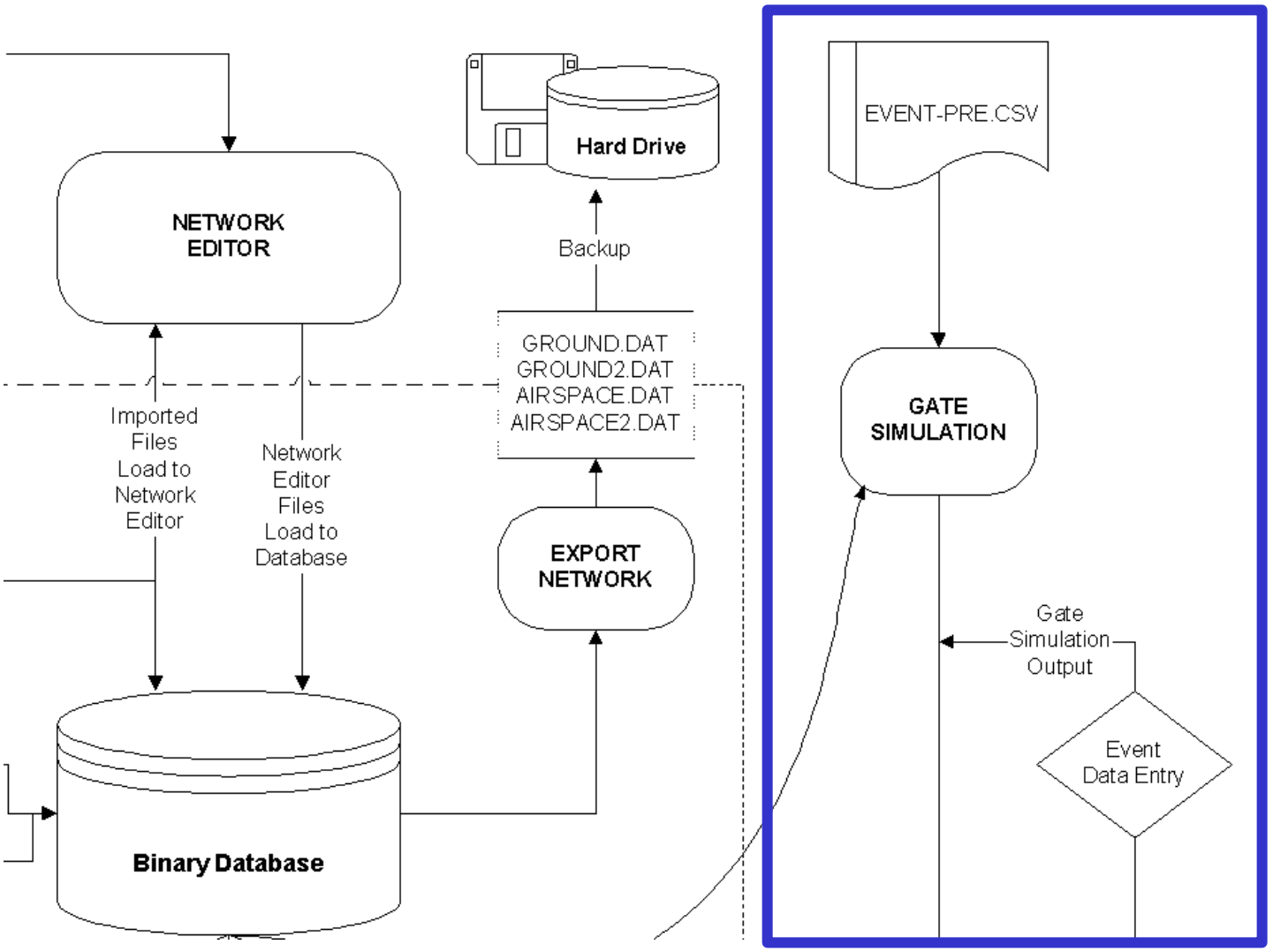
System Flow - Network Creation



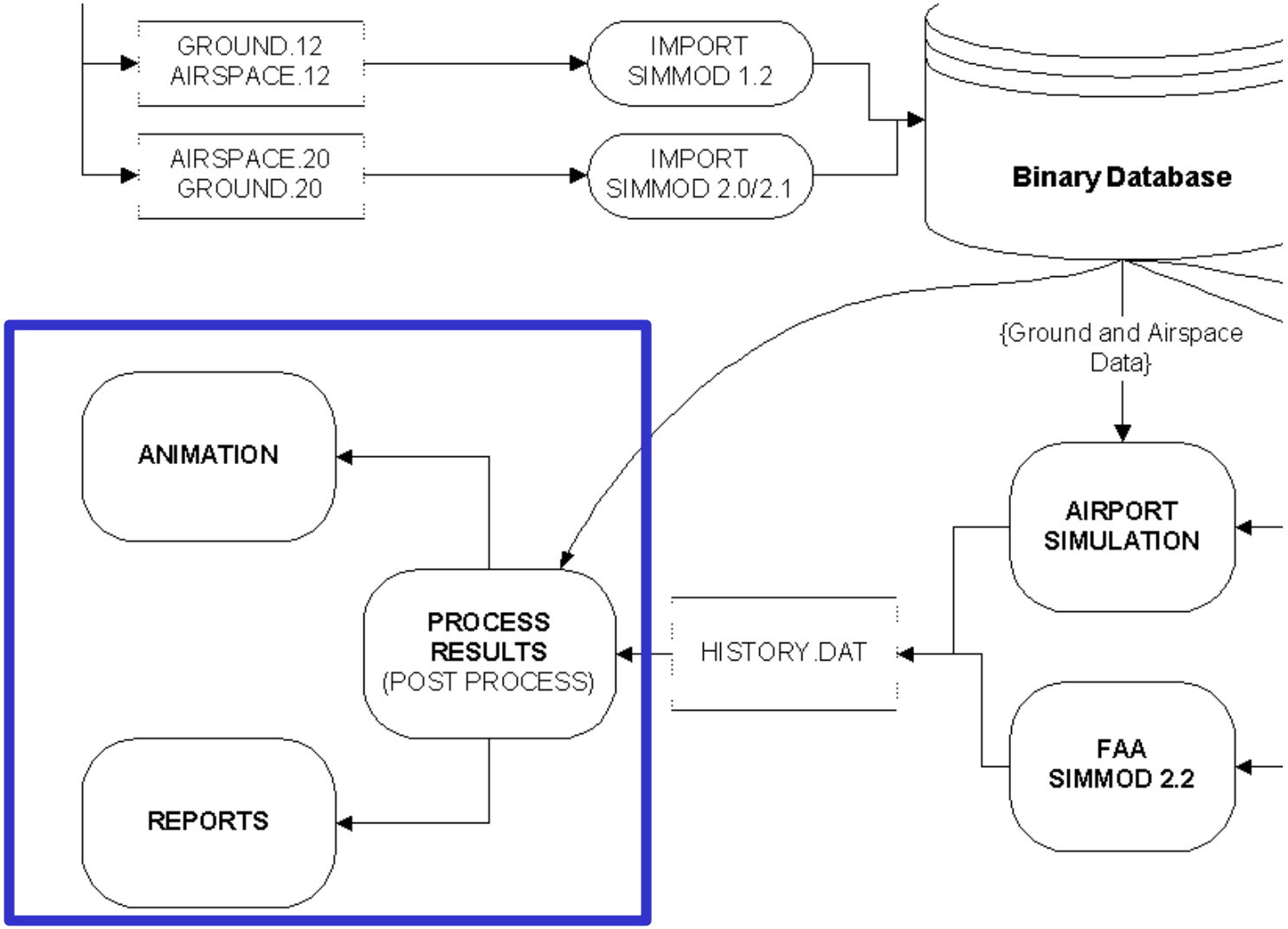
System Flow - Backup



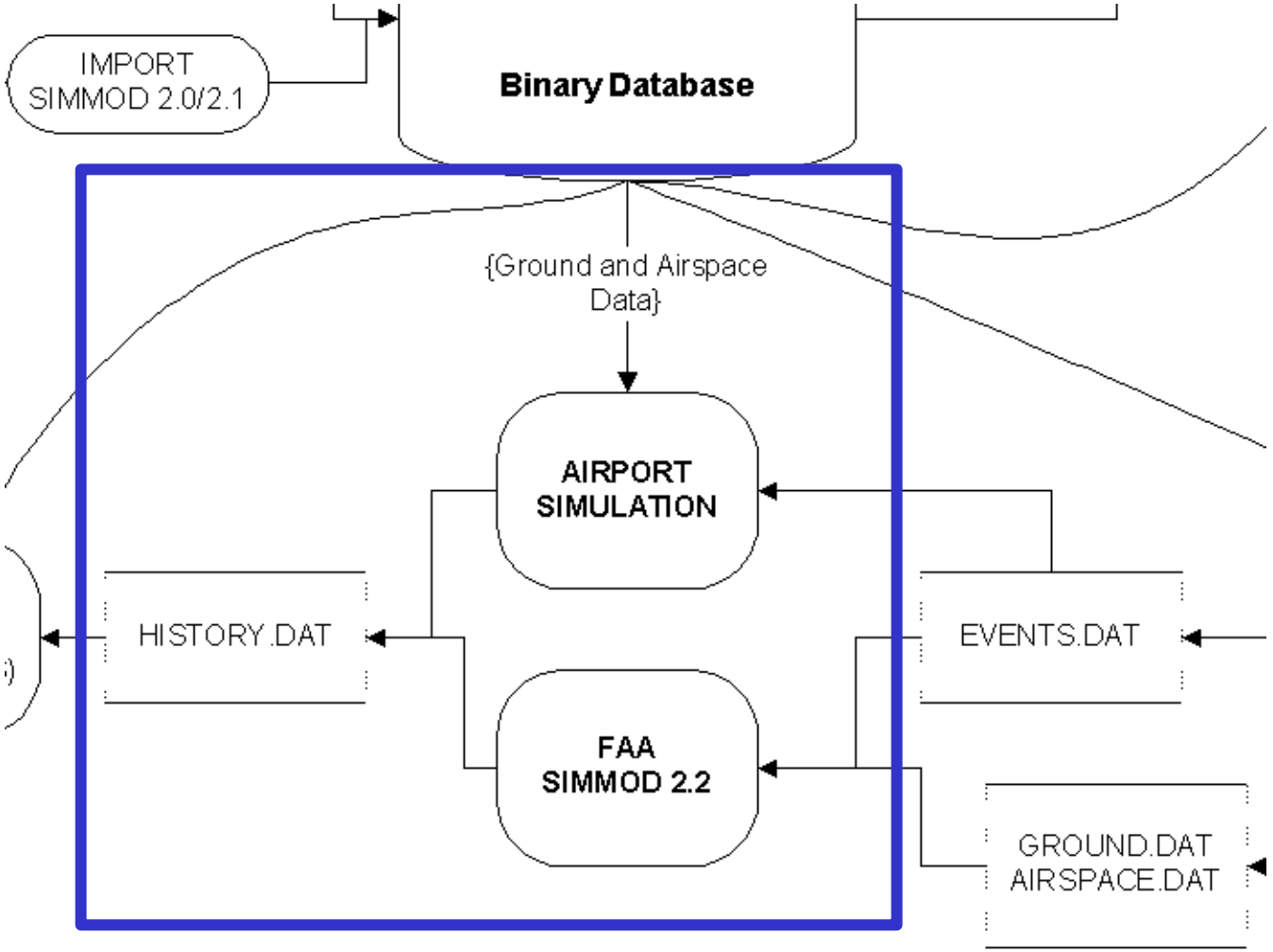
System Flow – Gate Simulation



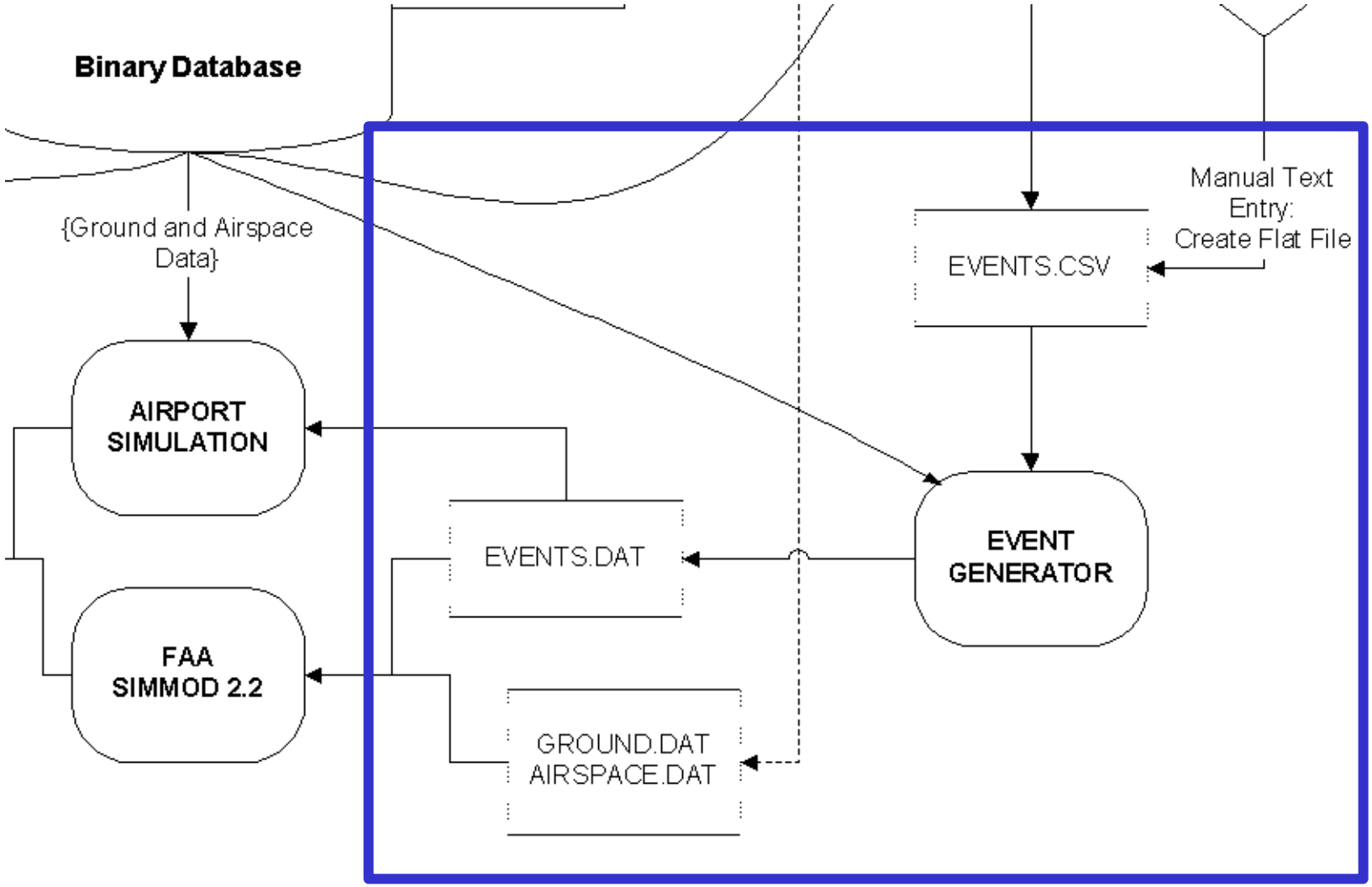
System Flow – Animation/Reports



System Flow – Airport Simulation



System Flow – Events Generator



Current and Future Developments

- Current
  - Demo/training features
  - CAD objects layout design
  - Report analysis enhanced features
  - 3-D graphics

- Future
  - Terminal Simulation
  - …

Final

- Our primary goals:
  - Provide the most efficient, productive, reliable, and peace-of-mind systems and tools
  - Keeping up the latest technology in hardware and software

http://www.letech.com