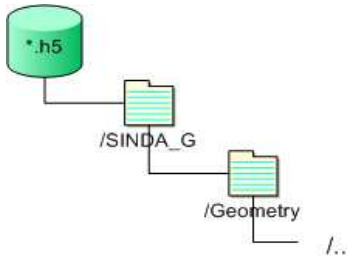
SINDA/G®
by Network Analysis, Inc.

HDF5 and STEP/NRF Database for SINDA/G

October 22st, 2003

Ron Behee
Network Analysis Inc



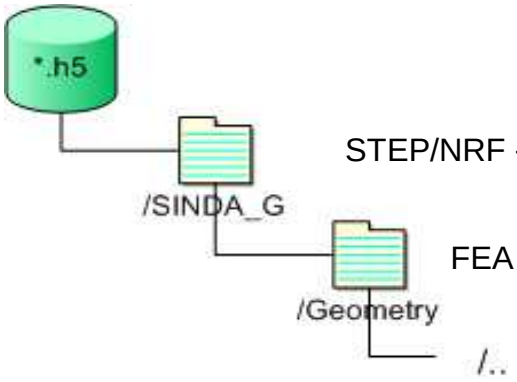
SINDA/G®
by Network Analysis, Inc.

Why NAI Chose HDF5

- Widely used for scientific data
- Proposed database for STEP/NRF
- Public domain from NCSA
- Good user documentation
- Efficient, flexible and compact binary storage format
- Cross platform compatible
- API's based on C, Fortran and Java

Why NAI is Implementing a SINDA/G Database based on HDF5 and STEP/NRF

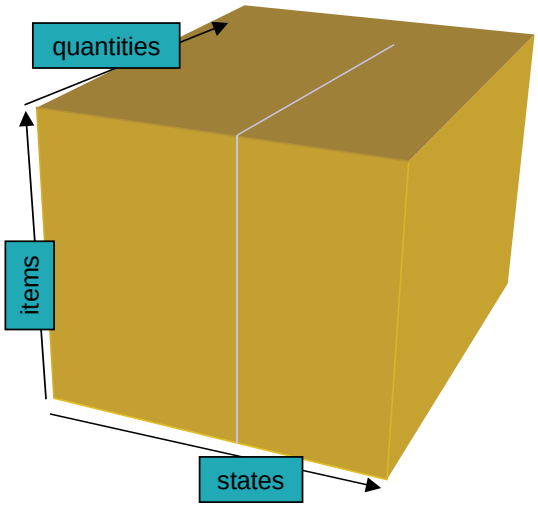
- Simplifies interface to multiple FE systems
- Needed for “Next Generation” SINDA/G that is currently being designed
- Provides powerful post processing capability



STEP/NRF - Network thermal model and results

FEA and Shape data (geometric)

STEP/NRF – Proposed by ESA



?

Can AP209 STEP FE data be stored in this data model, or will we need to create our own structure?

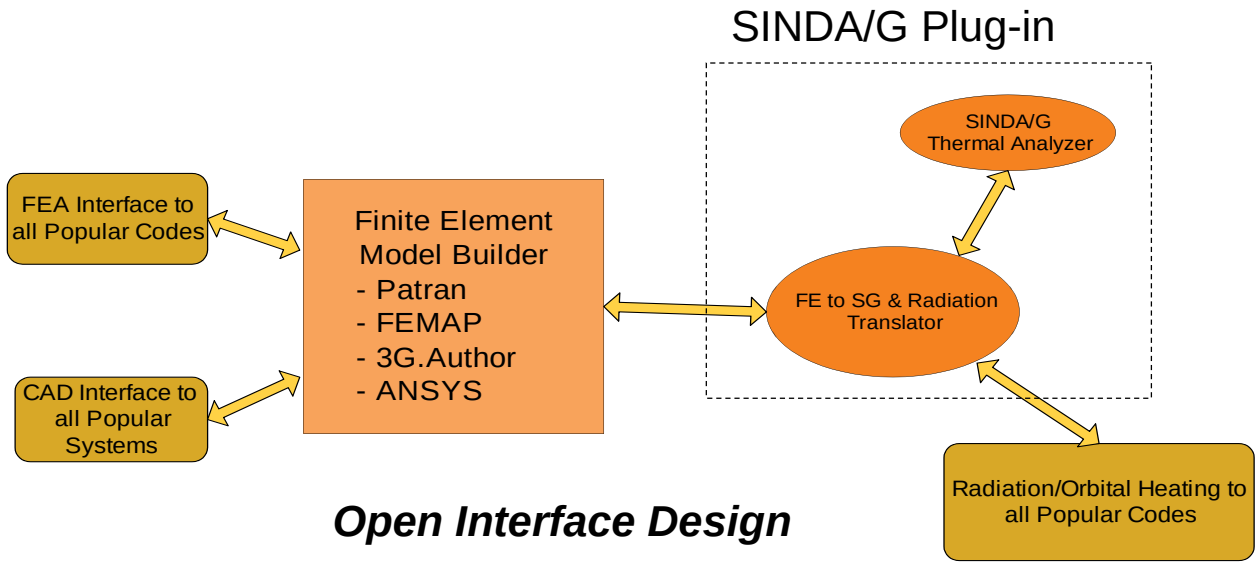
Central NRF data structure is the ‘data cube’

- each element of the cube is a scalar, vector or tensor property for a specific (item, quantity, state)
- state quantity is normally time or frequency

SINDA/DB Schema

- FEA data structures
  - Element, Node, Property, Load
  - Shapes
  - Materials-specific Coordinate Systems
  - Coating for Radiation Loads
  - Fluid for Convection Loads
  - Function dependant values
- SINDA Model/Sub-model hierarchy
- Results
  - SINDA/G Results
  - Ability to import results from other sources (i.e. test or computed data from another code

Need for Finite Element Database

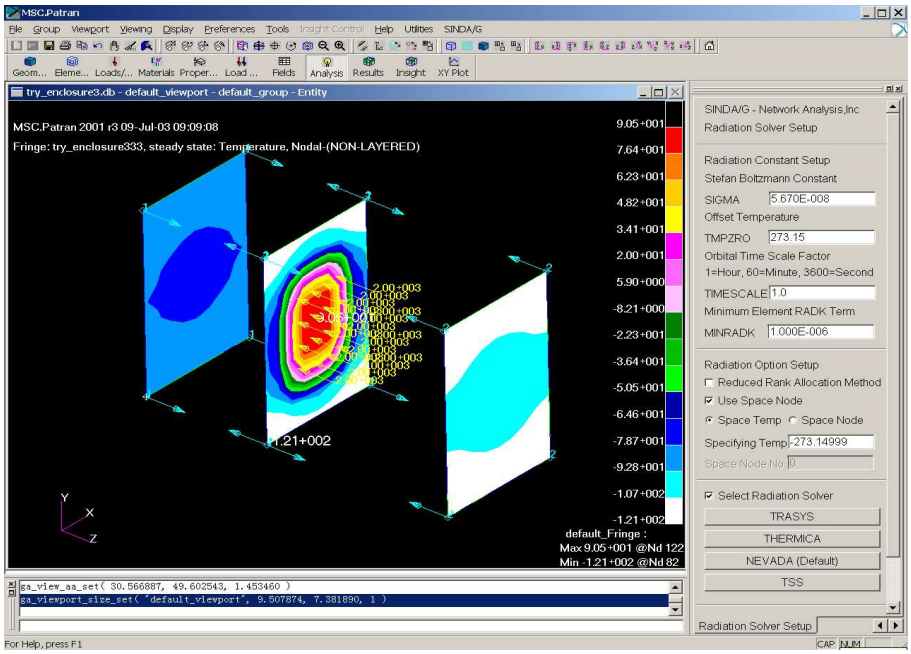


Open Interface Design

SINDA/G®
by Network Analysis, Inc.

SINDA/G for Patran

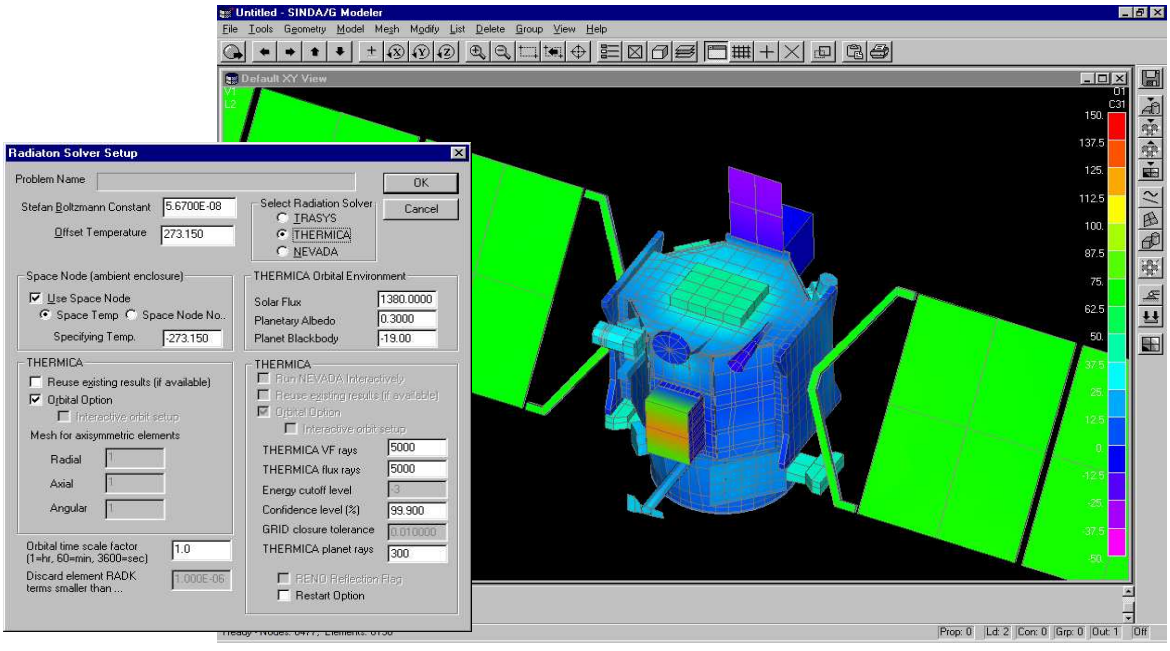
Model is independent of the radiation code



SINDA/G®
by Network Analysis, Inc.

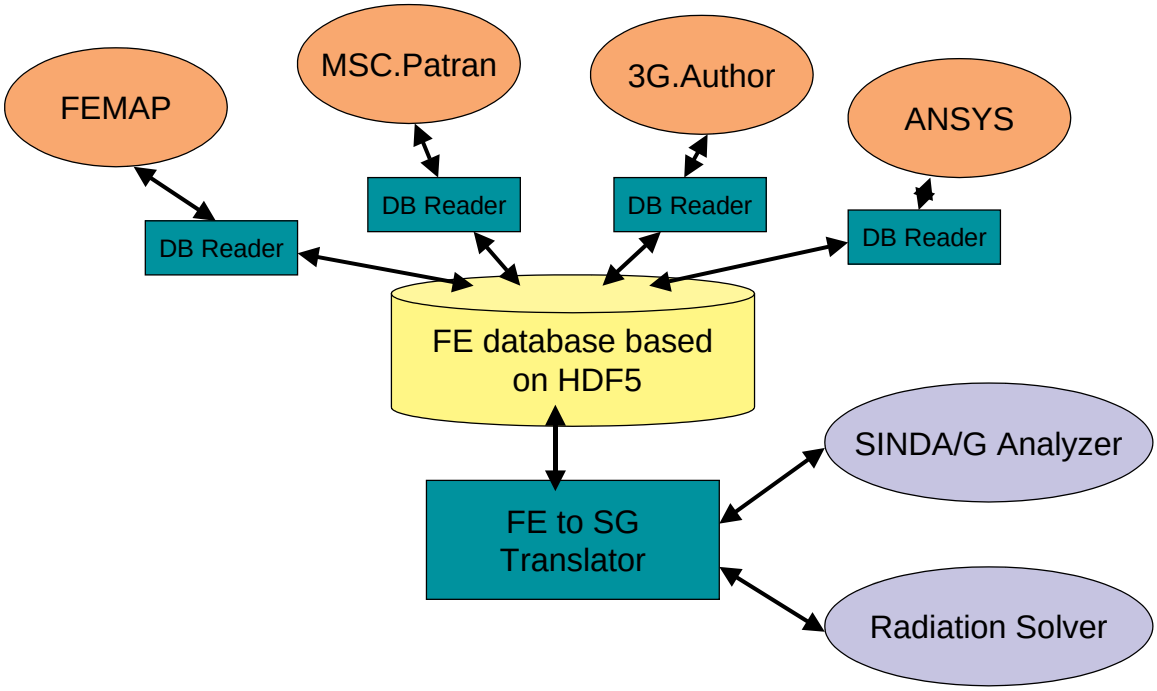
SINDA/G for FEMAP

Model is independent of the radiation code



SINDA/G® by Network Analysis, Inc.

Use of HDF5 File for FE Model Builder Interface



SINDA/G® by Network Analysis, Inc.

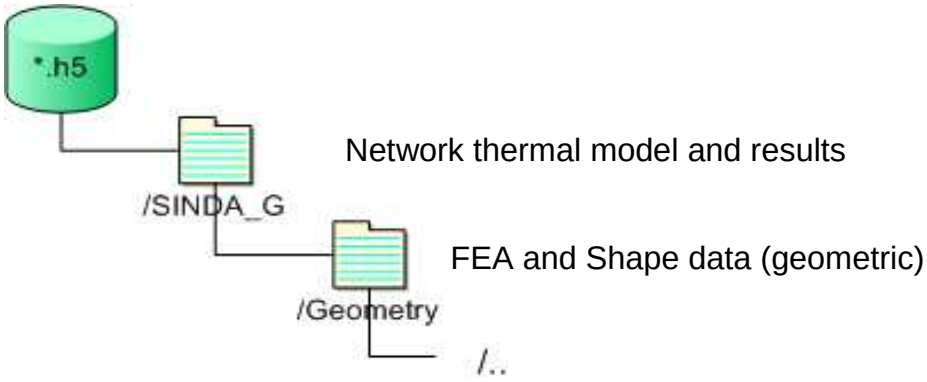
SINDA/G FE Database Implementation

- Using existing HDF5 libraries
- Languages
  - C/C++
  - Fortran 95
- ANSYS, FEMAP & Patran file readers
- Planned release by 2004 Q1

SINDA/G® by Network Analysis, Inc.

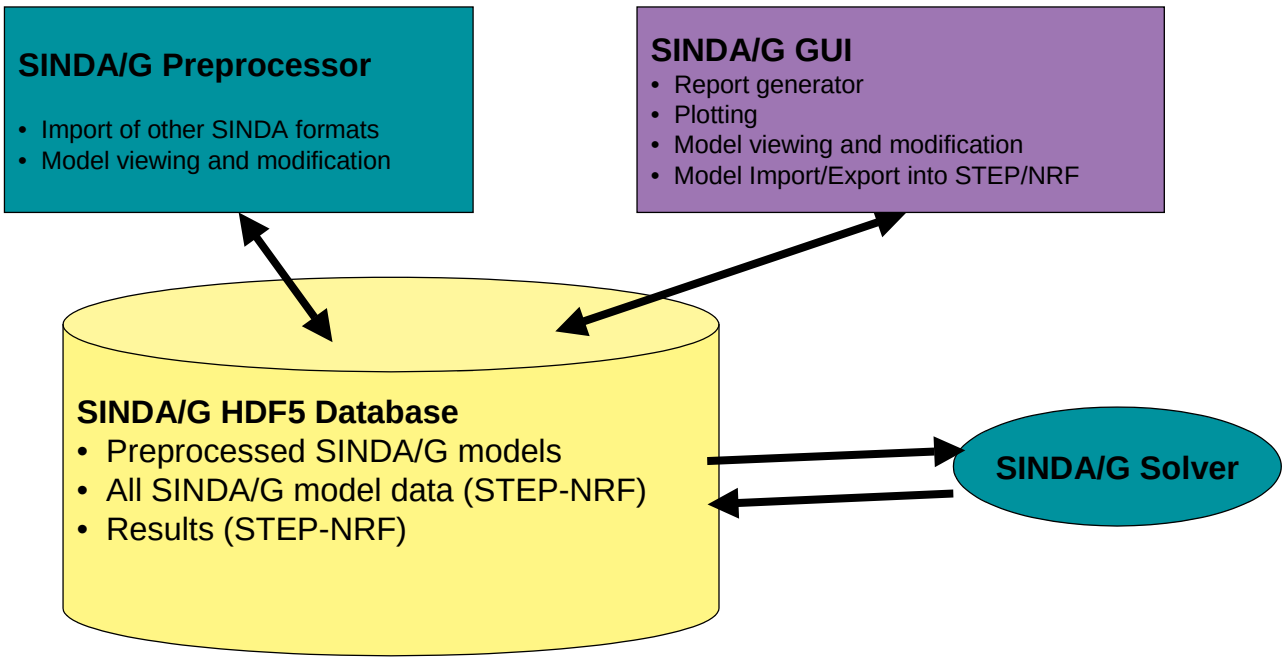
Why NAI is Implementing a SINDA/G Database based on HDF5 and STEP/NRF

- Simplifies interface to multiple FE systems
- Needed for “Next Generation” SINDA/G that is currently being designed
- Provides powerful post processing capability



SINDA/G® by Network Analysis, Inc.

SINDA/G use of HDF5 Database



SINDA/G® by Network Analysis, Inc.

Items Needed to be Stored in Database

- Preprocessed SINDA models.
- SINDA/G Model in STEP/NRF format to facilitate model exchange.
  - Data Blocks
  - Operation Blocks
- SINDA/G Results (time dependent)
  - Temperatures, conductor values, heat flows capacitance values
  - Results from radiation codes – fluxes, REF, VF
  - Test results or results from other codes

SINDA/G® by Network Analysis, Inc.

SINDA/G Data Objects

- Network Objects
  - Node
  - Conductor
  - Source
  - Constants
  - Arrays
- Operation Objects
  - Main
  - Execution
  - Variable 1
  - Variable 2
  - Subroutine
  - Output

F & M statements in Operations Blocks that difficult to store in a non-proprietary manner

Possible Solutions

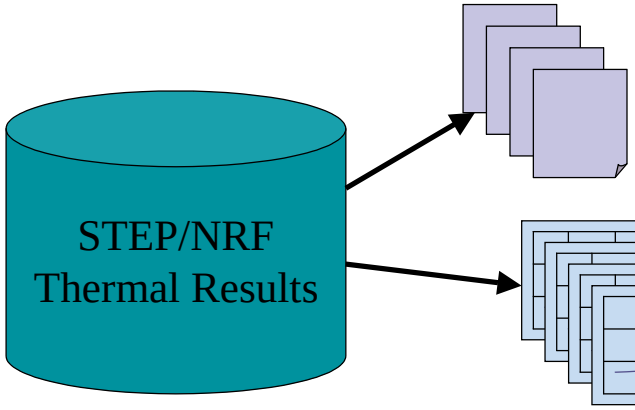
- Use option codes in the data blocks to minimize function and subroutine calls
- Develop a common language that encompasses all features of the various SINDA's and ESATAN. Encourage developers to implement this in future releases.
- Translate all Fortran into a pseudo language that can be translated back to various codes using their unique function and subroutine names.

SINDA/G® by Network Analysis, Inc.

Post Processing of STEP/NRF data

Want to change the way people look at thermal data from SINDA.

- Don’t decide before the run what you want printed out.
- Plots and tables are attached to the database and automatically updated after the run.



- Plotting
- Tables
- Data reduction