NAADSM

NAADSM Architecture

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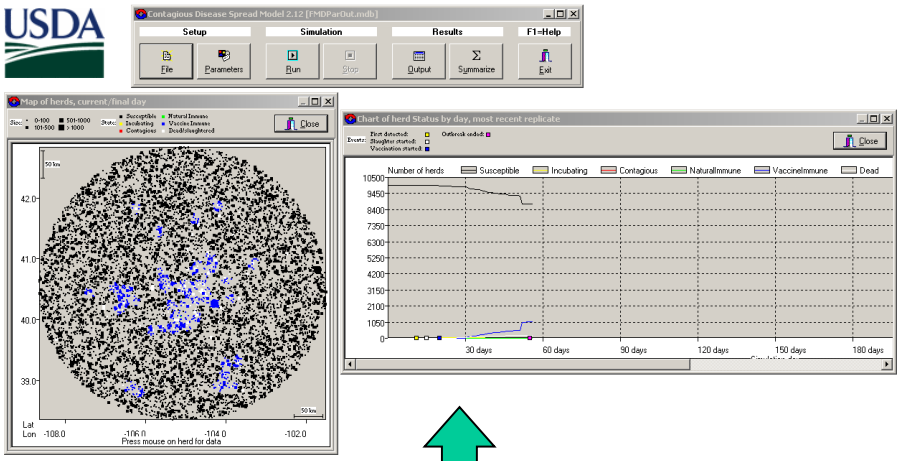
SpreadModel

- Dr. Mark Schoenbaum of the USDA developed a stochastic, herd-level simulation named SpreadModel.
- SpreadModel 2.0 added the ability to model heterogeneous populations.

The Canadians get involved



"We want this…"

"…on this"

(but with Canadian data)

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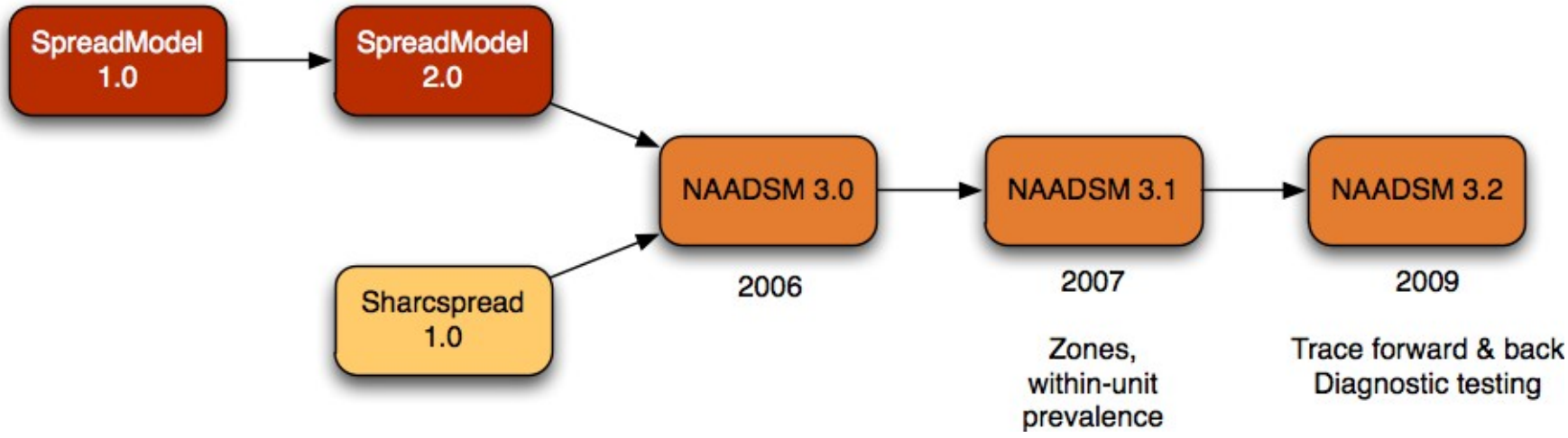
NAADSM

- The simulation engine written for SHARCNet merged with SpreadModel's GUI to become NAADSM.



Building blocks

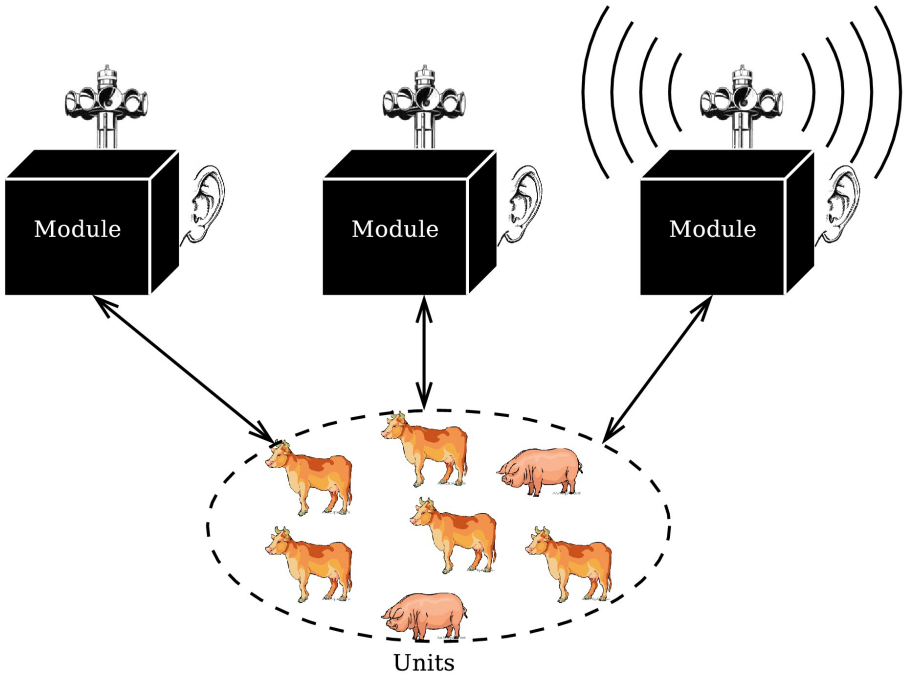
- Many different, largely independent modules make up “the model”.

Building blocks

- A module may
  - encapsulate knowledge (*e.g.*, how long the incubating period lasts)
  - simulate a biological process (*e.g.*, disease spread by airborne virus)
  - simulate one rule in a response policy (*e.g.*, “when an infected unit is detected, establish a control zone around it”)
  - monitor, count, bookkeep.

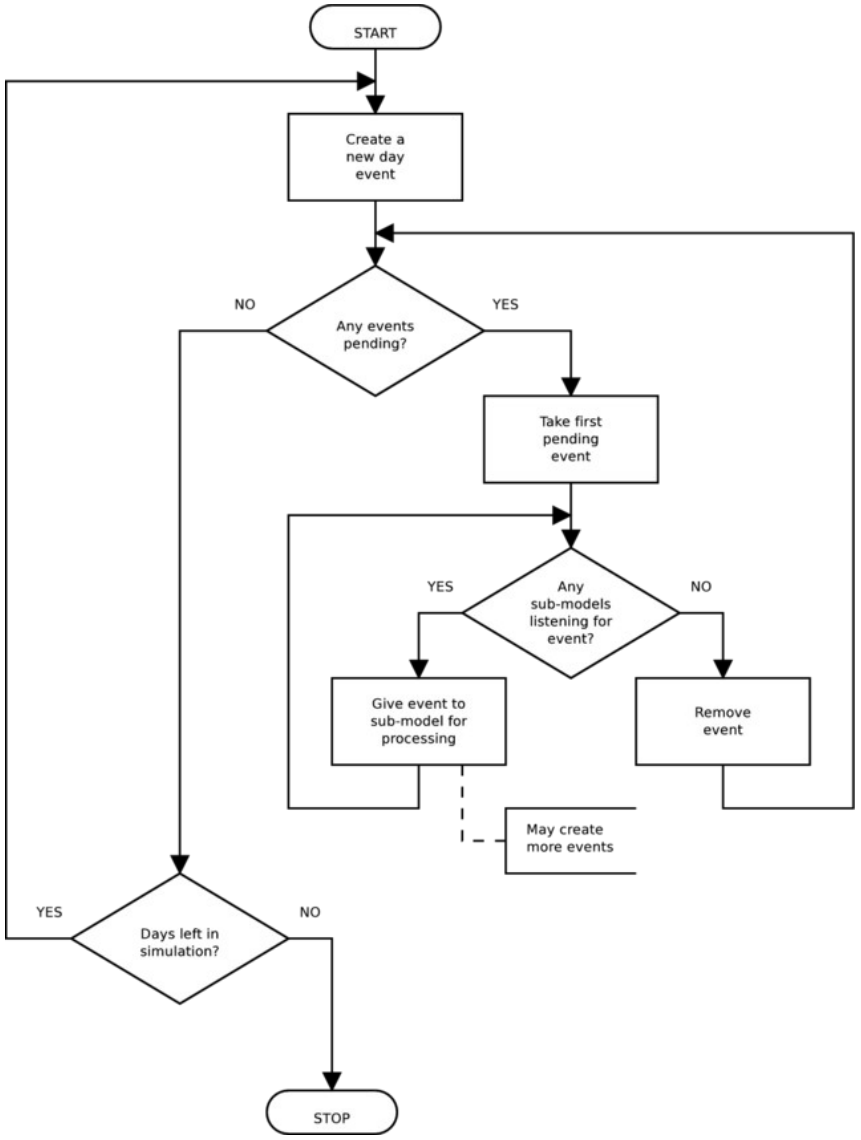
Publish/Subscribe

- Sometimes modules need to know about each others' actions.
- Use an event system where modules announce any interesting actions they take.
  - “Observer / Publish-Subscribe” pattern



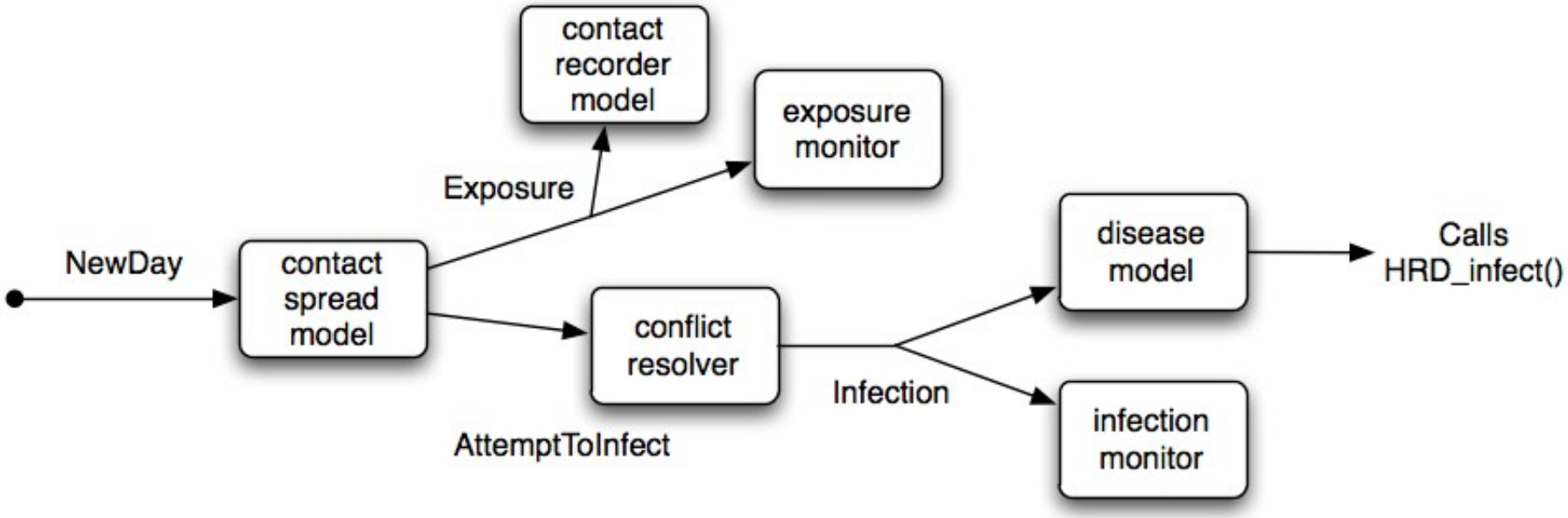
Event loop

- Sometimes modules need to know about each others' actions.
- Use an event system where modules announce any interesting actions they take.
  - “Observer / Publish-Subscribe” pattern



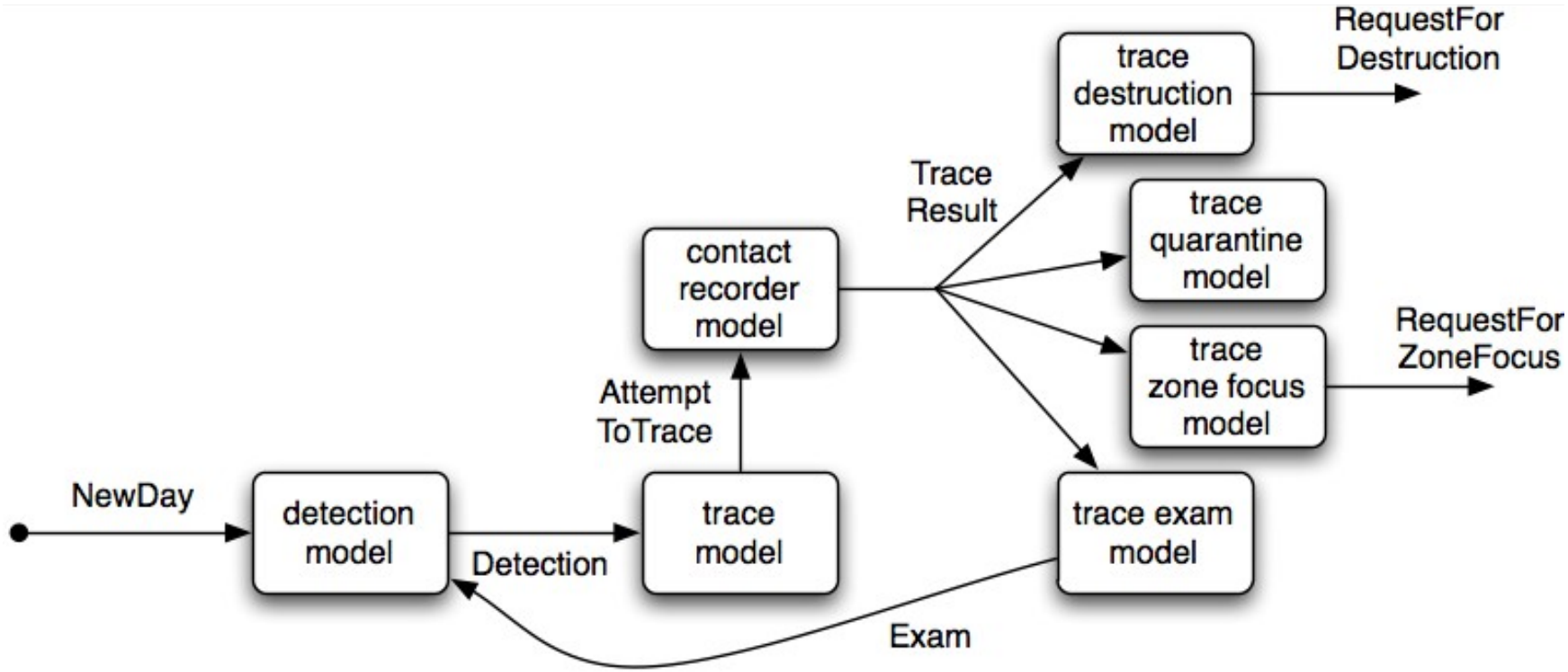
Events example 1

- Creating a new infection by direct contact.



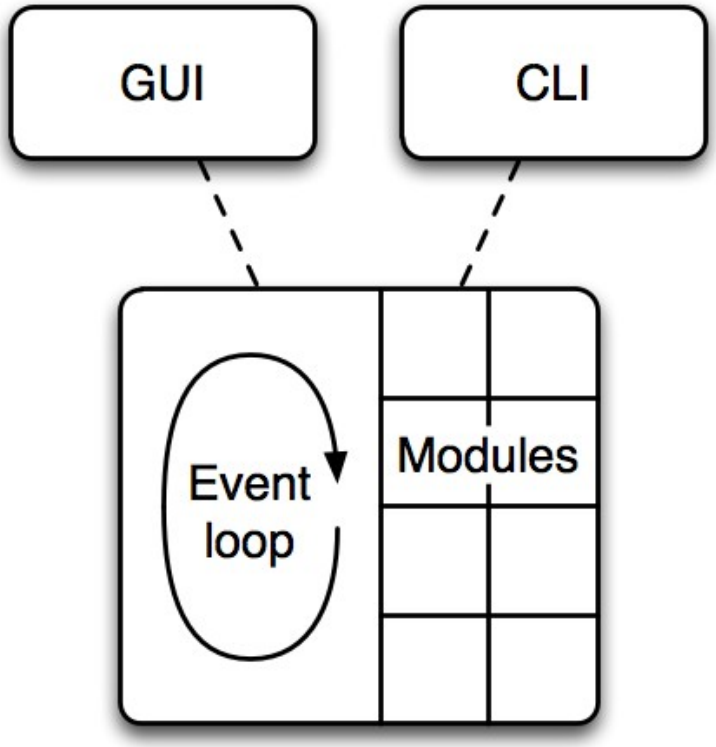
Events example 2

- Tracing.



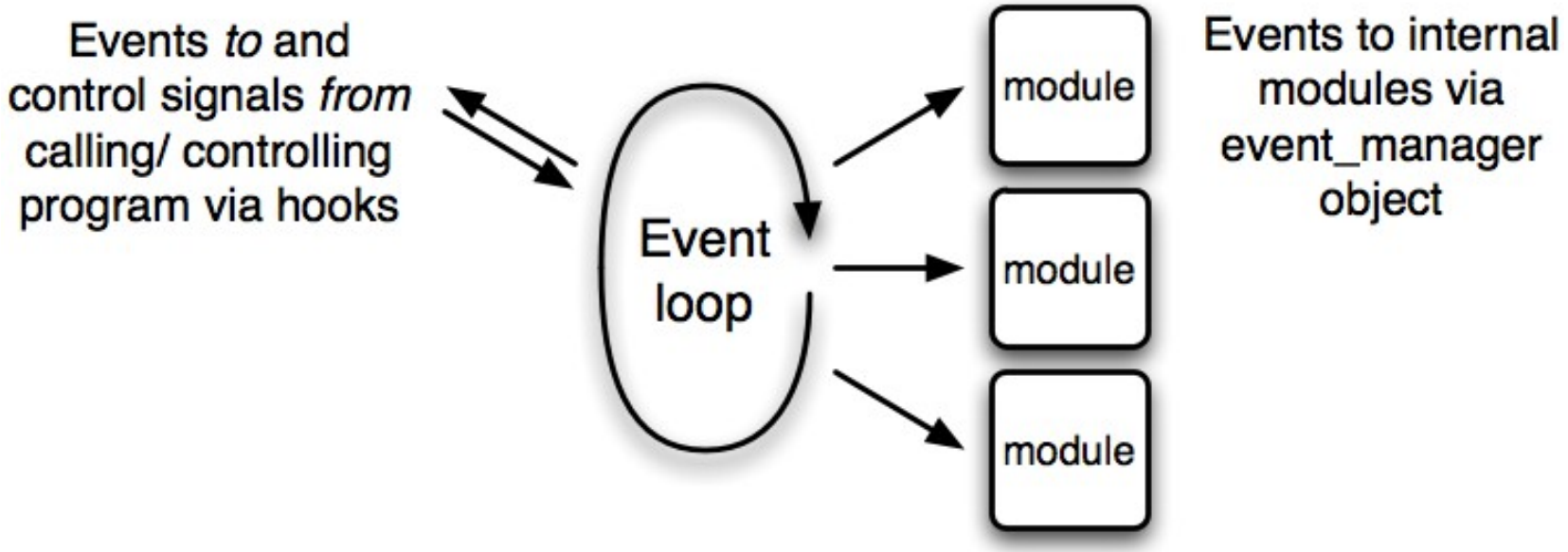
Windows, Unix, same code

- Whether you are using the Windows application the command-line version in Unix, the same code is inside.



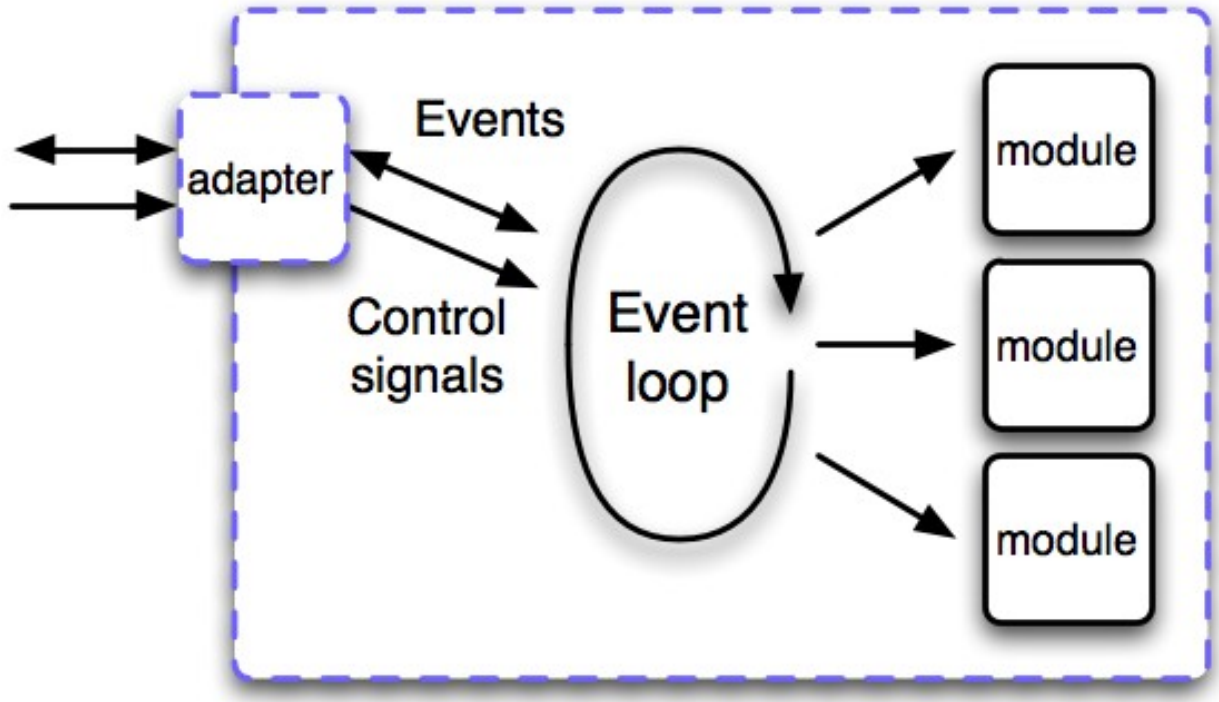
Events to GUI

- Communication with the GUI is via hook functions.



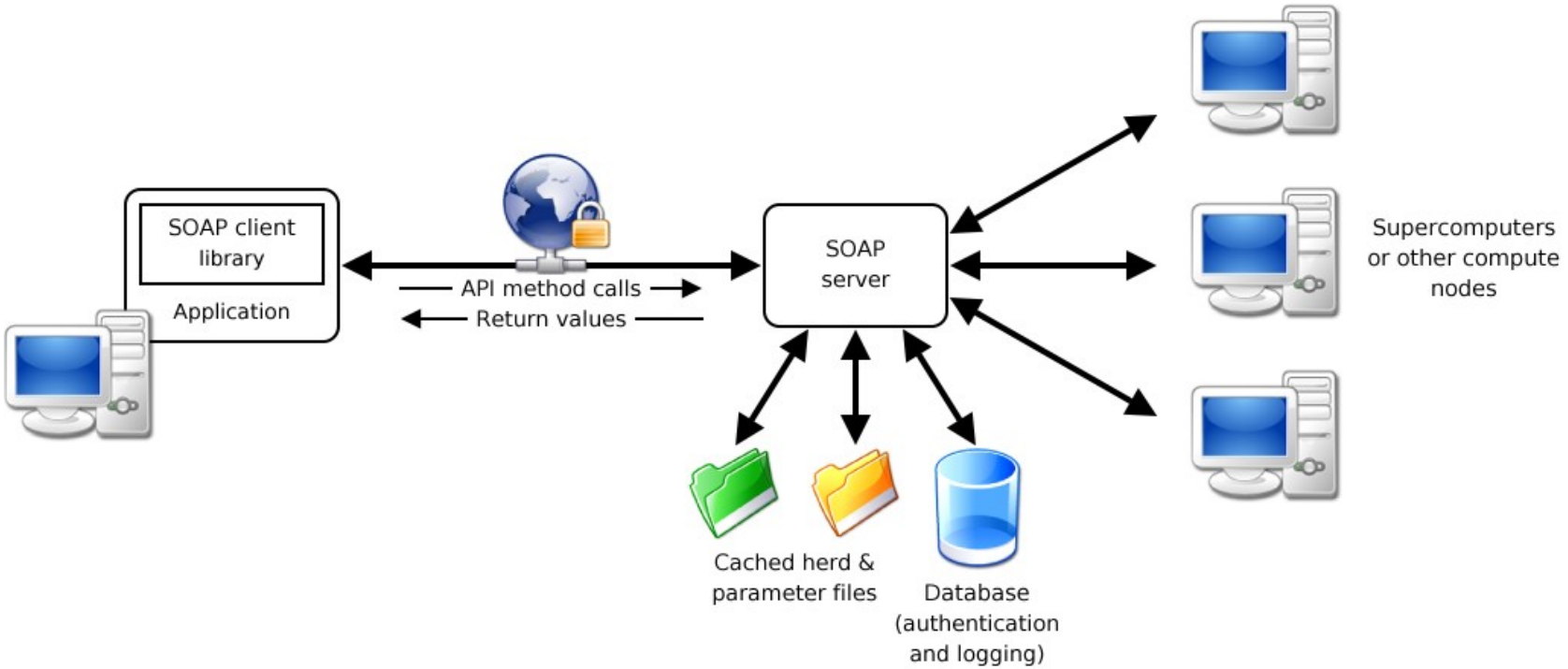
Events to/from other models?

- Plan to expose the event system so that NAADSM becomes “pluggable” with other systems.



Access to supercomputers

- A web service presents a simple API for launching simulations and retrieving results on SHARCNet.



Shareable data format

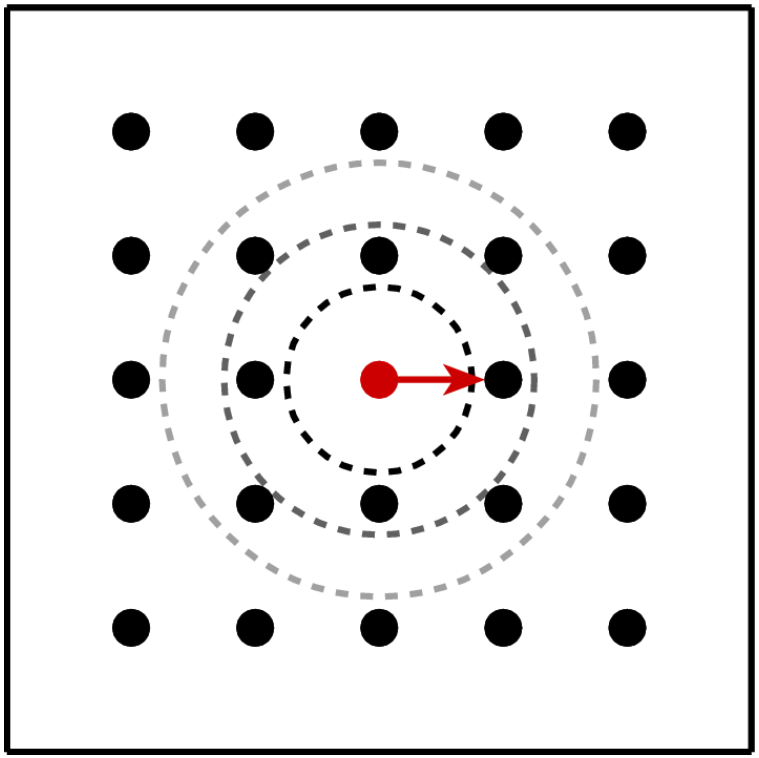
- Premises locations and simulation parameters are exported from the Windows application in XML format.
- Could also be created by other applications.

Underlying libraries

- Make heavy use of open-source and public domain code
  - GLib (data structures)
  - GNU Scientific Library
  - SPRNG (random numbers)
  - R-Tree (spatial index)
  - General Polygon Clipper (zone shapes)
  - PROJ.4 (map projection)
  - Expat and SCEW (XML processing)

What consumes time?

- Any operation that requires a spatial search.



What consumes memory?

- Number of premises.
- Contact rate: all exposures that can potentially be traced must be stored, at least for a while.
  - For example, the EU directive on FMD calls for traces to go 21 days back.

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