Swiss TPH
Swiss Tropical and Public Health Institute
Schweizerisches Tropen- und Public Health-Institut
Institut Tropical et de Santé Publique Suisse

Associated Institute of the University of Basel

Health Systems Research and Dynamical Modelling
Dept. Epidemiology & Public Health

Malariacontrol.net

Melissa Penny & Michael Tarantino
BOINC Workshop 2012

Science Part

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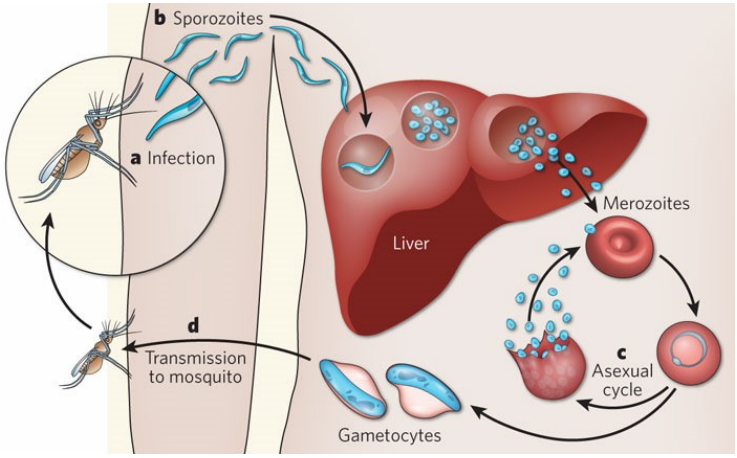
What is Malaria ?

- Mosquito-borne infectious diseases
- In 2010 (WHO. 2011, world malaria report) :
  - o half billion clinical episode/year
  - o 655 000 death/year



Interventions :

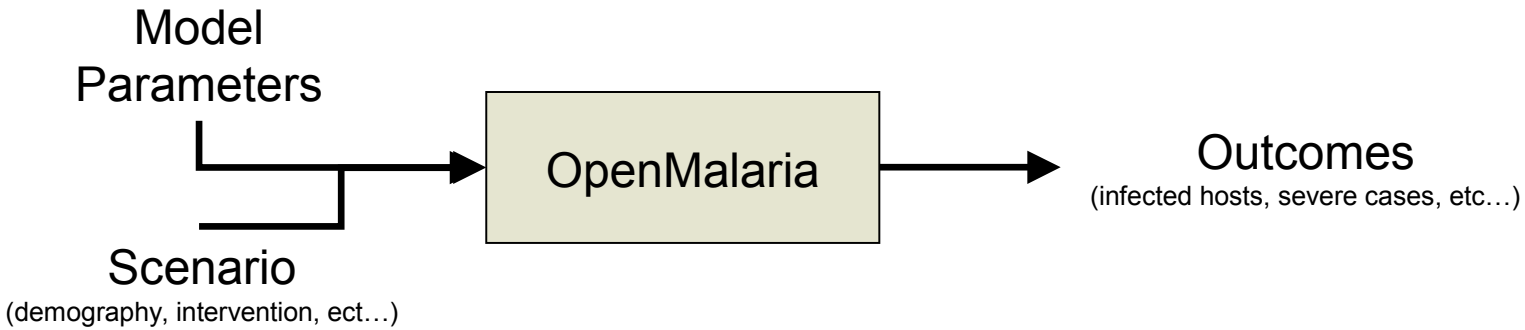
- Drugs
- Insecticide treated nets
- Outdoor or indoor spray

Modeling & Software

- Using mathematical models to simulate different component of malaria : Infection, Transmission, etc … (exist different models per component)

- Predicts impacts of interventions on infection, morbidity, mortality, health services use and costs

- Based on mathematical models developed a platform for stochastic simulations in C++ : **OpenMalaria**



What we're doing with BOINC ?

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- Running simulation experiments :

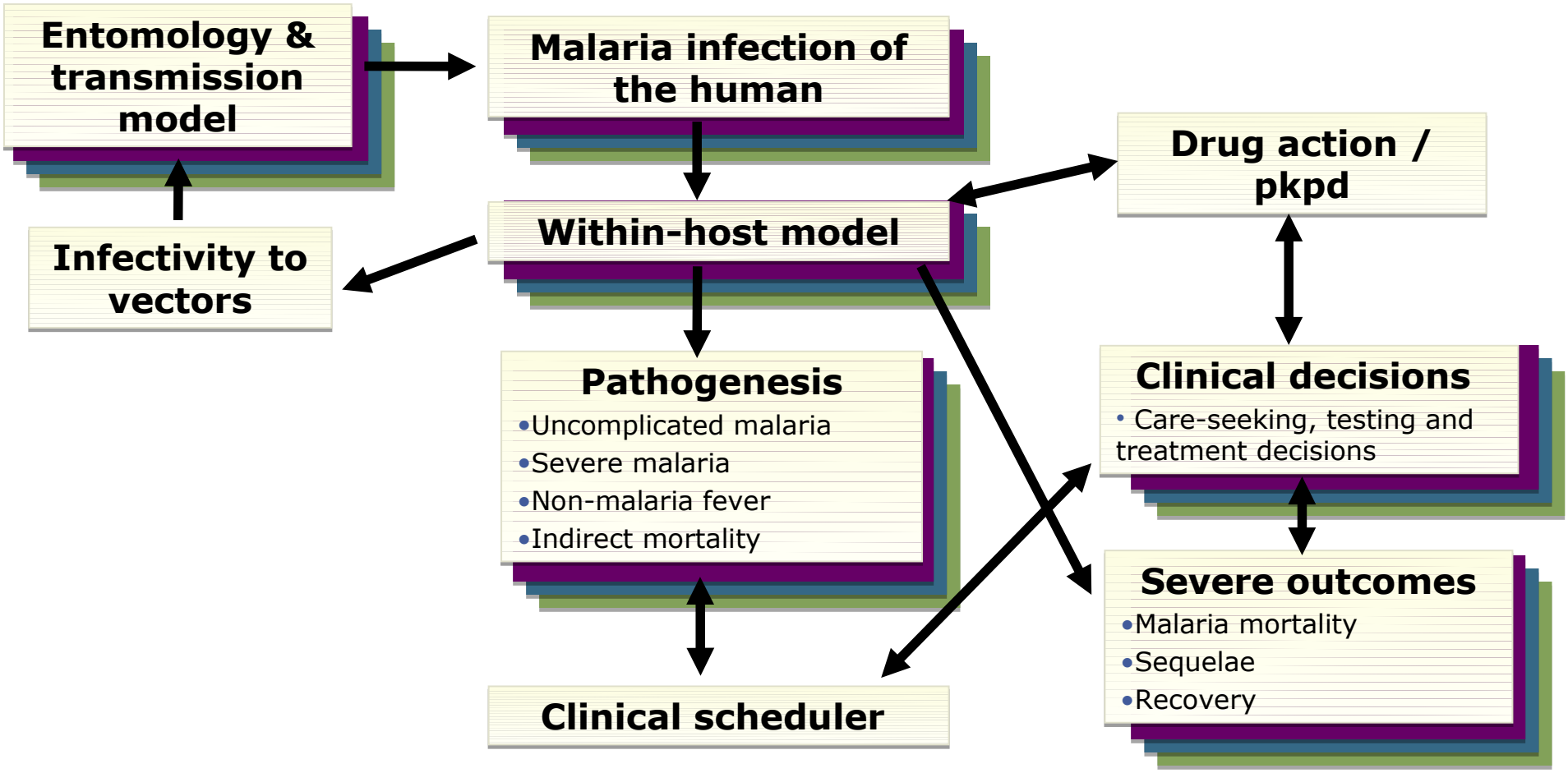
  e.g. Insecticide treated net lifespan, Vaccine cost effectiveness

- Mathematical modelling :

  e.g. Probabilistic sensitivity analysis, Models Parameterization

Both can create substantial computational loads

Many model variants



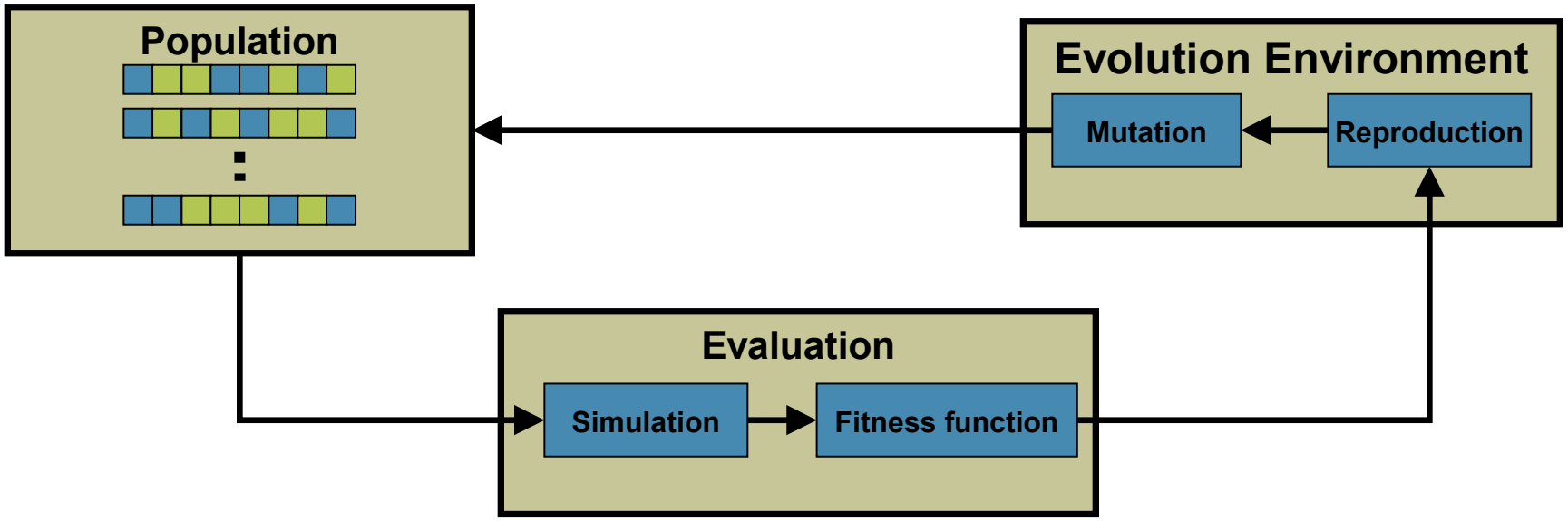
Input parameters differs :

→ Model variants need to be parameterized using fitting runs to match reality

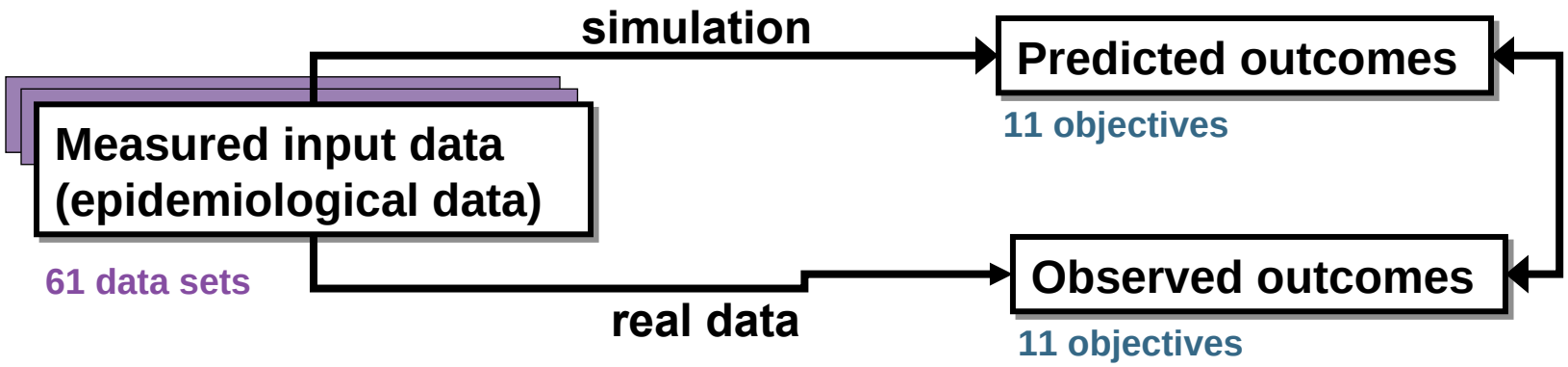
Search algorithm

- Run simulations with different combination of parameters values

- Use heuristic to approach optimum solution : Evolutionary Algorithm (EA)

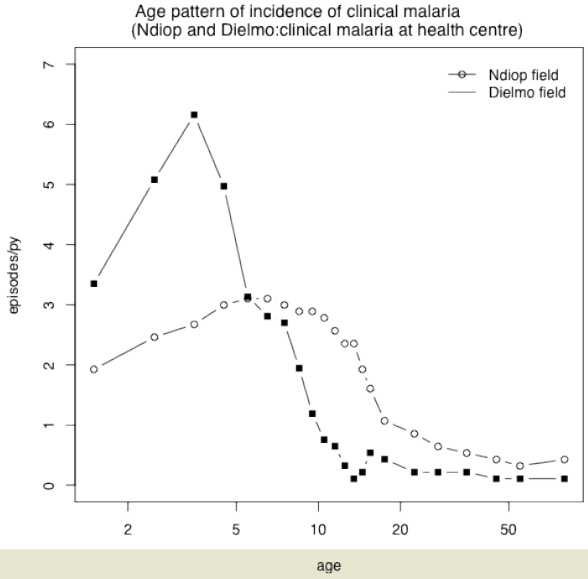


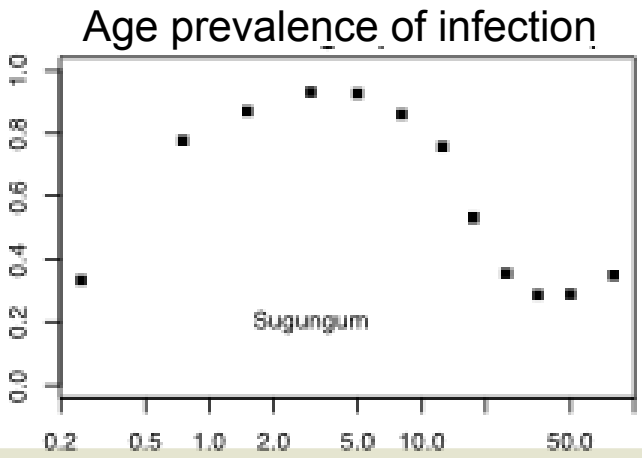
How do we determine a good individual?

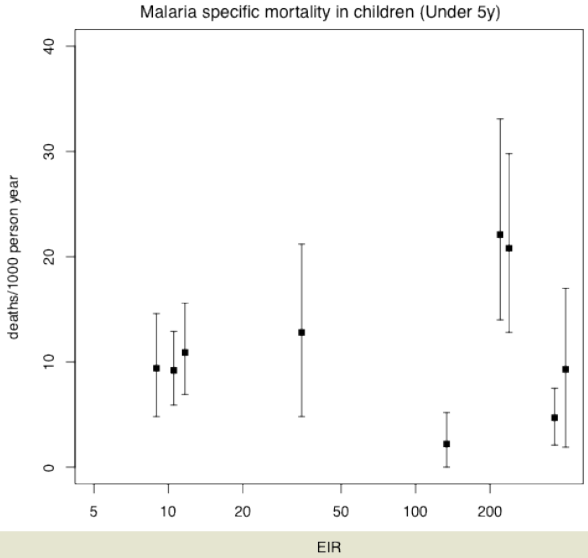


Objectives :

E.g. Age-prevalence, incidence of disease, age pattern of hospitalization







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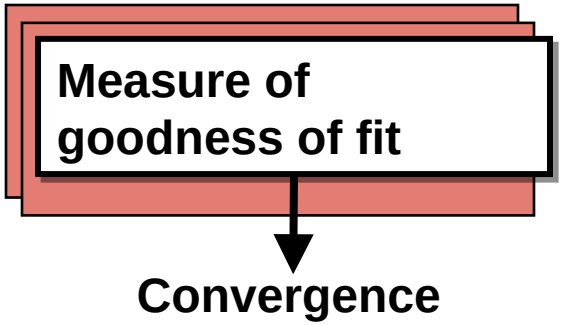
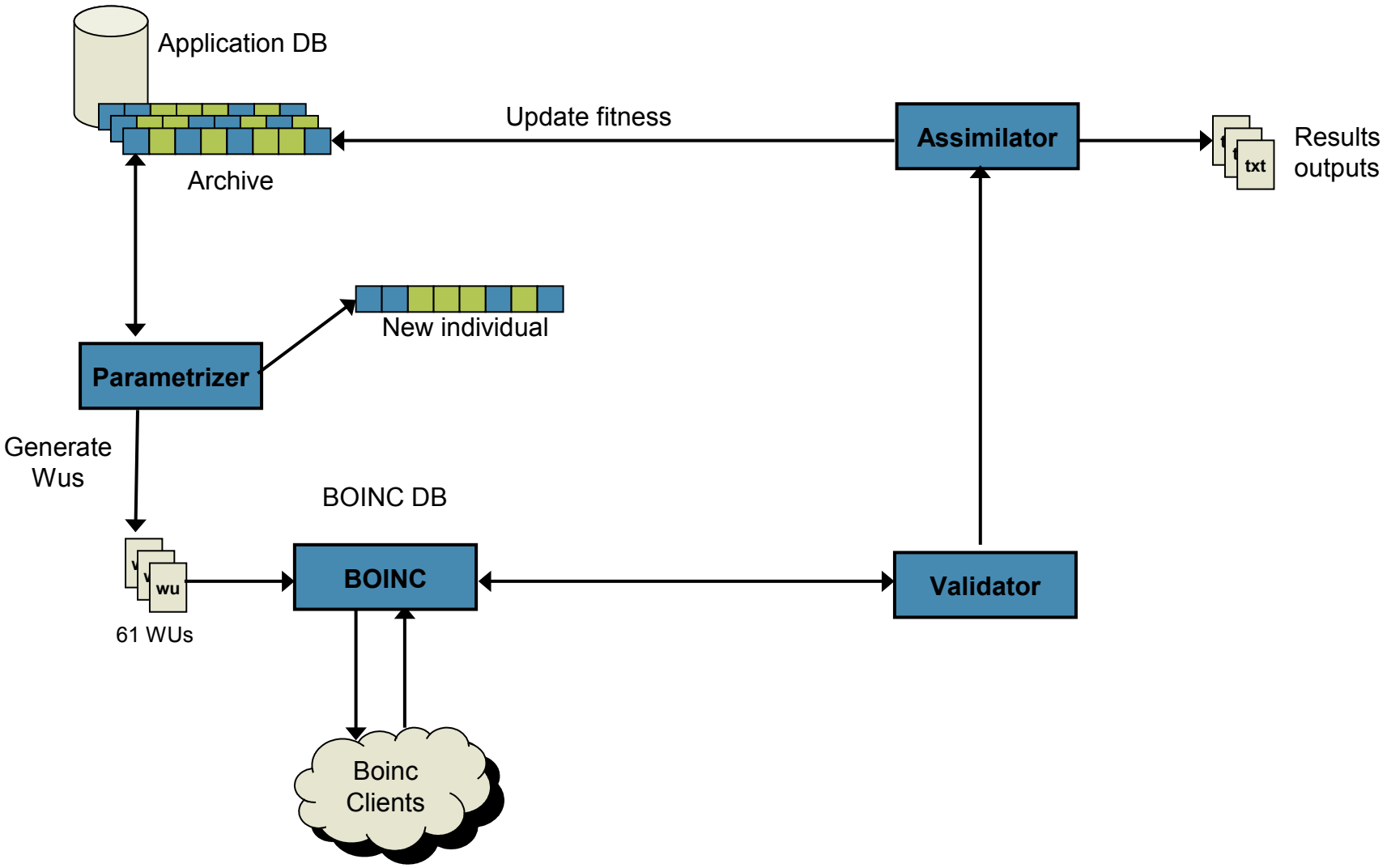


Weighted linear sum :

Minimize $$G(\theta) = -\sum_i w_i \sum_j \mathcal{L}_{ij}(\boldsymbol{\theta})$$

- Log likelihoods / Residual sums of squares
- Weights with equal contribution from each objective

BOINC Integration



Evaluation

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Current evaluation :

→ Single objective function by weighting linear sum

Drawbacks:

- Uniform spread of weights does not necessarily produce a uniform spread of points on the Pareto front.

- „Non-convex" parts of the Pareto front cannot be obtained.

Future work :

change/update evaluation algorithm using :

Dynamic weighted algorithm

or

Pareto based algorithm (NPGA,NSGA,etc …)

or

Criterion based algorithm (VEGA, etc…)

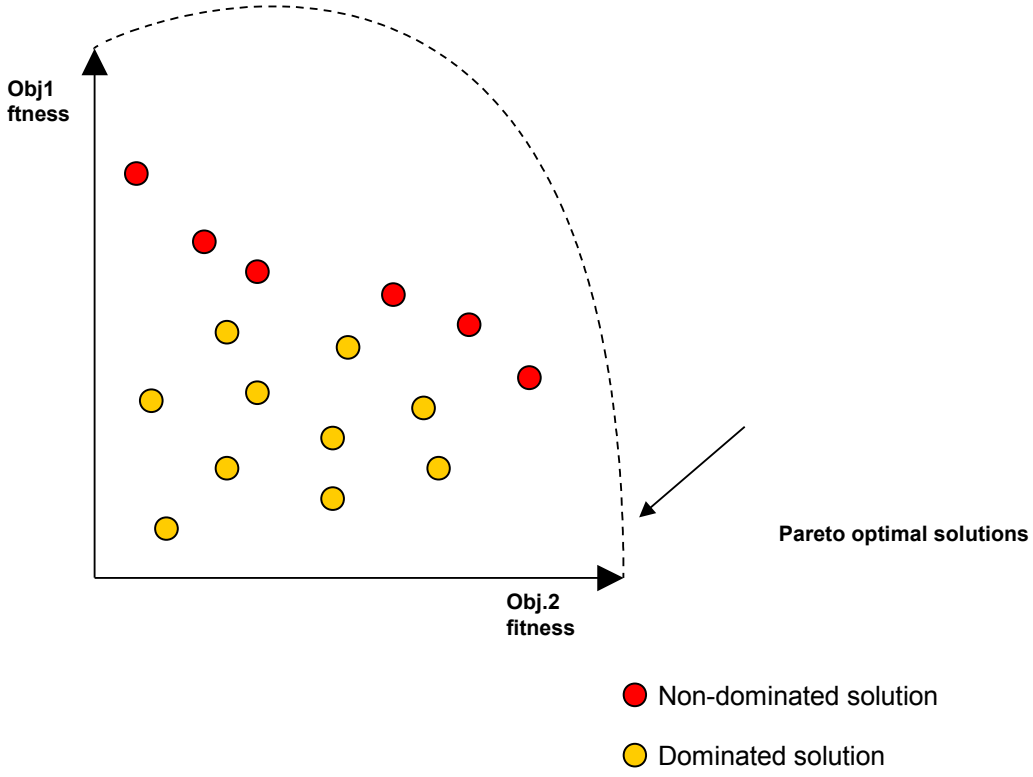
→ Need investigation

Pareto Front

- All objectives are equally important

-Looking for non-dominated solutions

- Goal is to find solutions which approach pareto optimal solution
and choose among the best one depending on preferences



The situation

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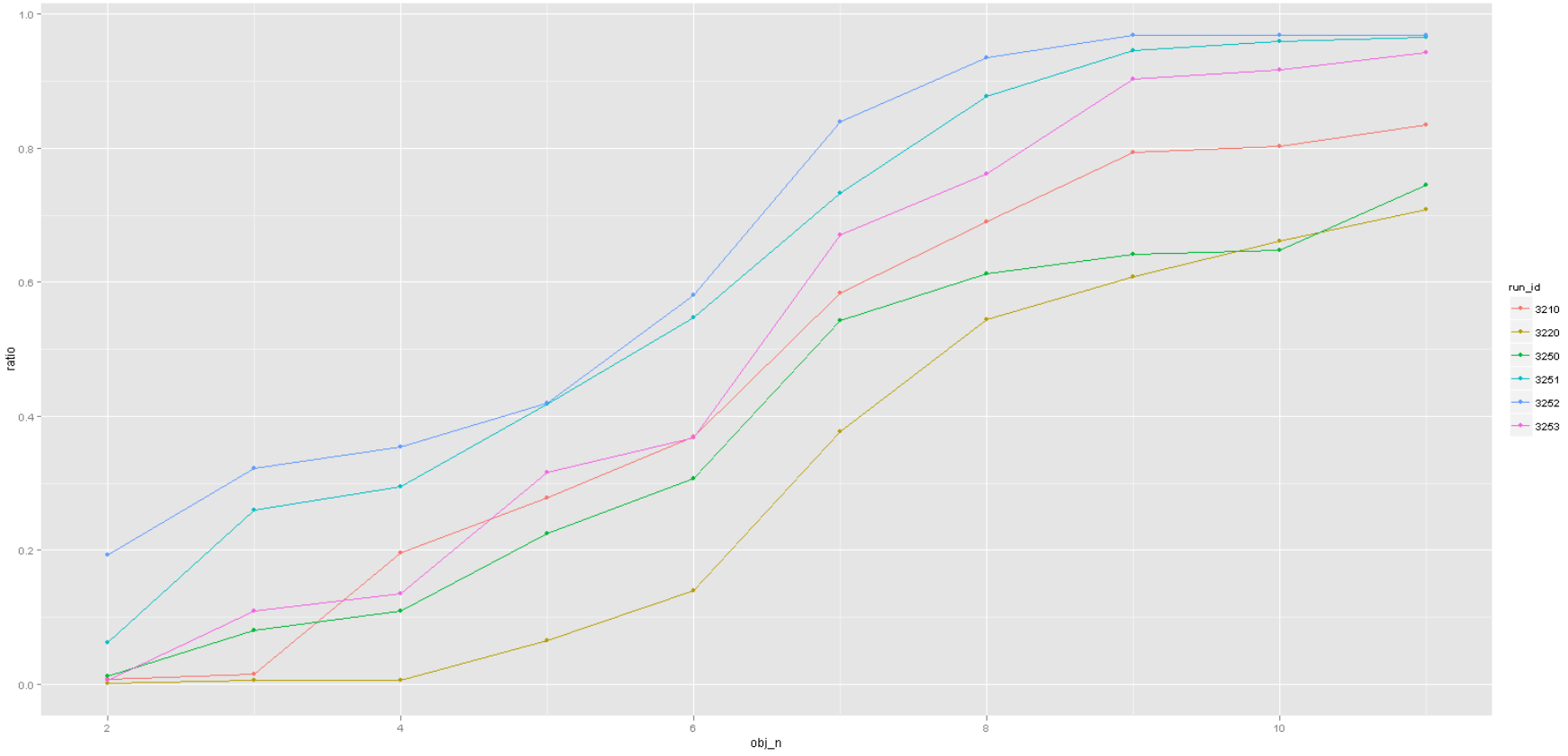
Too many non-dominated solutions



The situation

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Too many non-dominated solutions

?BOINC questions/features requests?

Cut long tails of waiting time: best practices?

-We already use reliable host mechanism

FLOPS varried according to model combination within the same batch of wu …

More user-friendly error browser

Thank you
&
Questions ?