Modernization and renewal of the MELA software (MENU)

Tuula Packalen, Reetta Lempinen, Daniel Melander
& the rest of Forest resources and planning (MESU)
Team* in Luke

MENU Workshop

Viikki 9.9.2019

*https://www.luke.fi/en/natural-resources/forest/forest-resources-and-forest-planning

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

The Finnish MELA system is an ICT application easily adapted to different end-user/data combinations.

NFI plots

VMI10 - maastotyöt
- 2008
- 2007
- 2006
- 2005
- 2004

Photo: Metla/Pekka Hyvönen

Stand/NFI sample plot and **tree** data

Regulation: forest level objective and constraints

Source: Siitonen et al. 1996

Stands

1
2
3
4
5
6
7
8
9
10

time

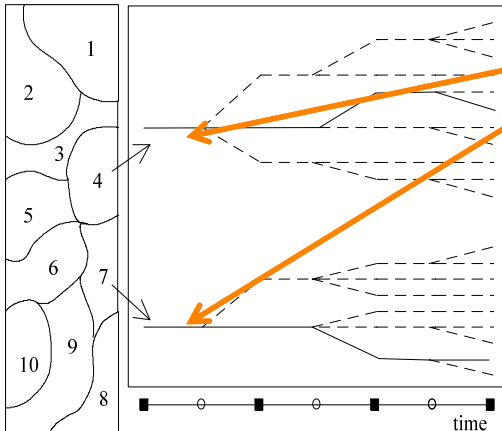Sum of stands, full forest-stand interaction

MELASIM Stand simulator
Including models for
- **automated** generation of options
- natural processes / state monitoring
- treatments and **economy**
- **thousands** of decision variables

User defines:
Management
Prices, costs
Goals for region/
enterprise

MELAOPT/J Optimisation
- Regional/enterprise-level optimum
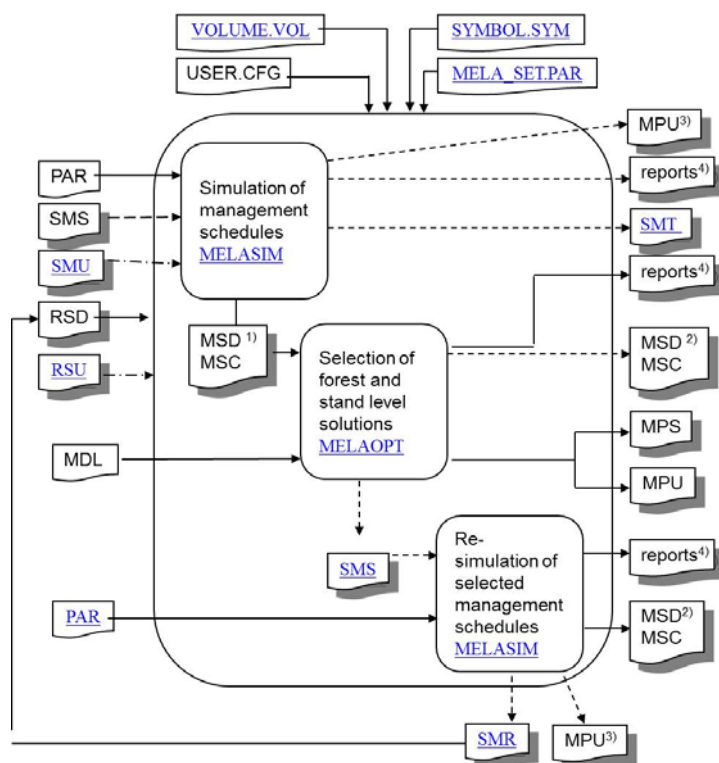
Regional/enterprise report

Stand level report
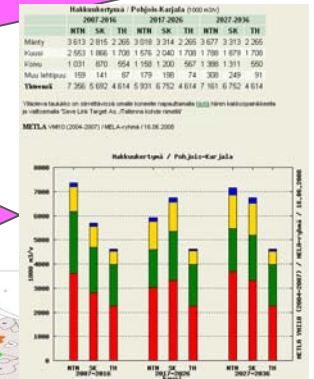
For example:

Haakana et al. 2017. 2017. Scan. J. For. Res. 32(2): 185-195.

Kärkkäinen et al. 2019. Forest Policy and Economics 103: 136-146.

Boreal **green bioeconomy**

9.9.2019

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

MELA is a user driven decision support tool – not a single utility function

MELA2016 File systems

MELA2016 strengths (+) and challenges (-)

+ Knowledgebase kept up-to-date
+ Continuous validation with the NFI-MELA runs
+ Computational efficiency
+ A full user control
+ Thousands of output variables
+ Flexible data and output interface
+ Hundreds of references in different scale and disciplines
- Proprietary software (however parameters in open text files)
- Model functions "hard coded" (manually)
- Spatio-temporality by iterations only
- JLP, not J

Boreal **green bioeconomy**

9.9.2019

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

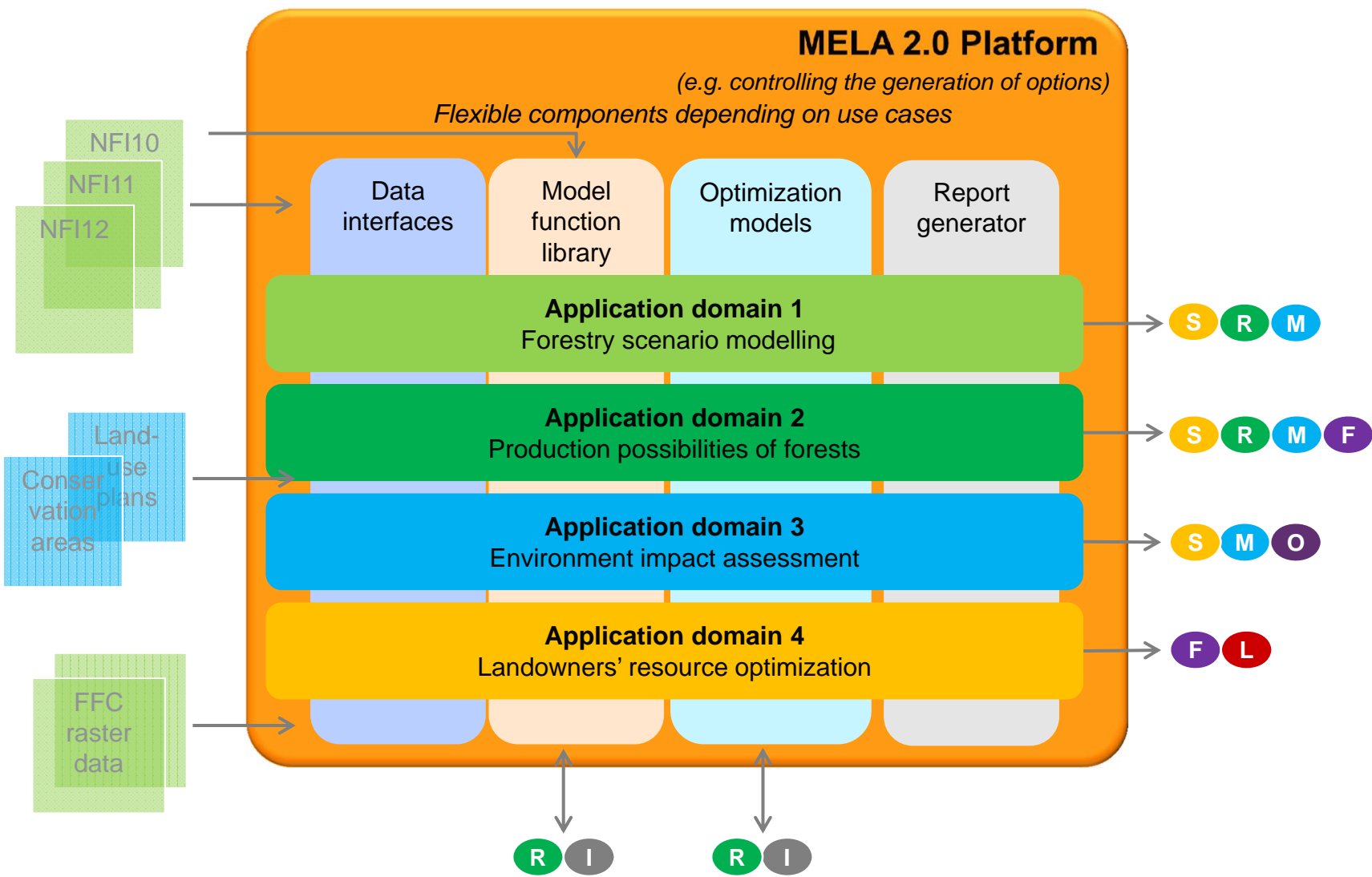# Freestyle forestry and digital transformation motivate MELA2.0

New challenges

- More complex decision making

- More diverse users

- More frequent updates

New potential

+ Computational intelligence

+ Open source

+ Modern ICT solutions

Boreal green bioeconomy

9.9.2019

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

Goals for MELA2.0

1. **Data interface:** new data sources
2. **Model function library:** supporting co-development and social coding
3. **Optimisation:** supporting risk and uncertainty management
4. **Research community interface:** open and transparent
5. **Interfaces to external systems:** scalable
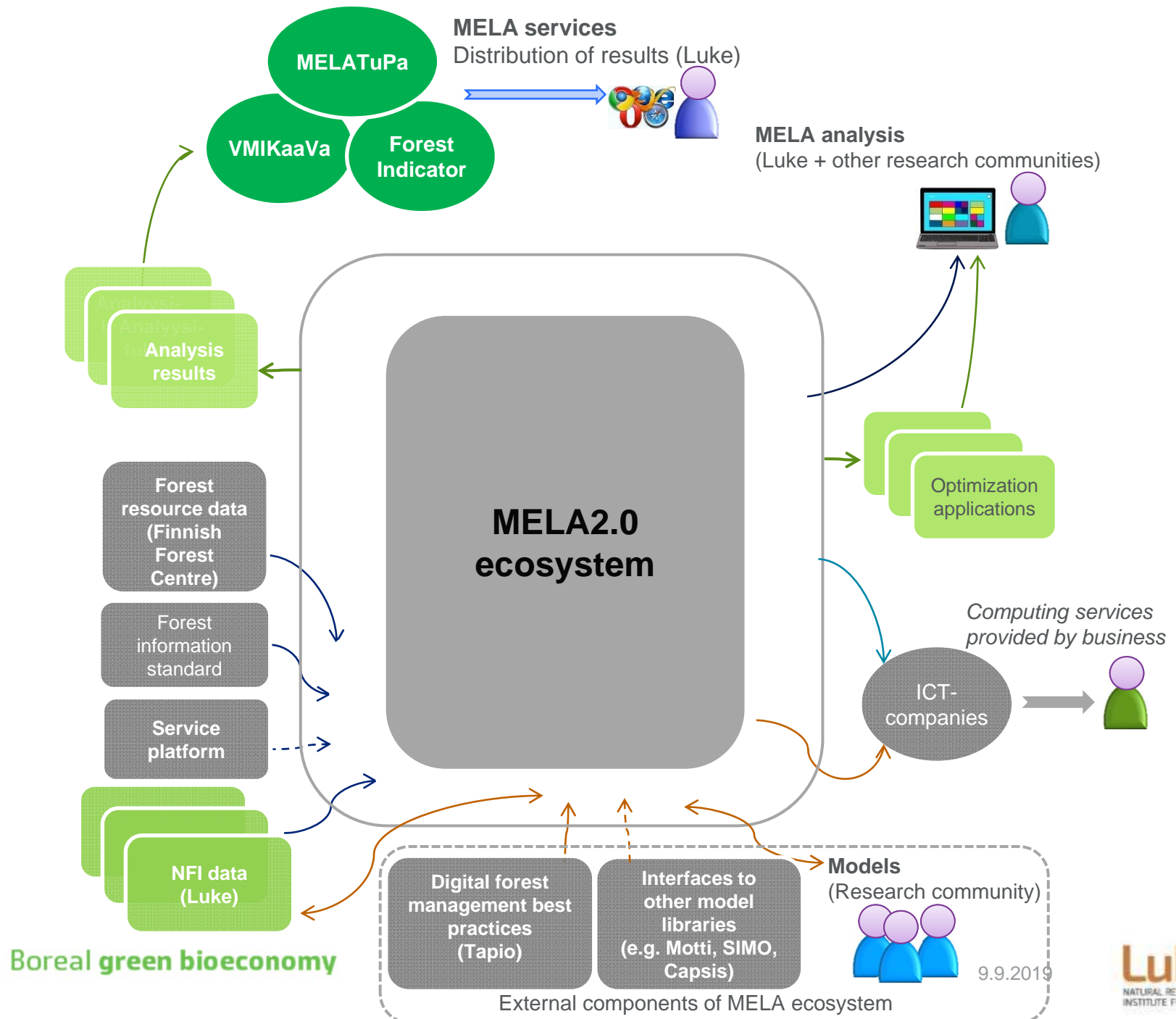6. **Software ecosystem:** modern, transparent, scalable, user friendly & easier to maintain

Boreal **green bioeconomy**

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

MELA 2.0 Platform

(e.g. controlling the generation of options)
Flexible components depending on use cases

NFI10
NFI11
NFI12

| Data interfaces | Model function library | Optimization models | Report generator |

Application domain 1
Forestry scenario modelling — S R M

Application domain 2
Production possibilities of forests — S R M F

Application domain 3
Environment impact assessment — S M O

Application domain 4
Landowners' resource optimization — F L

Land-use plans
Conservation areas

FFC raster data
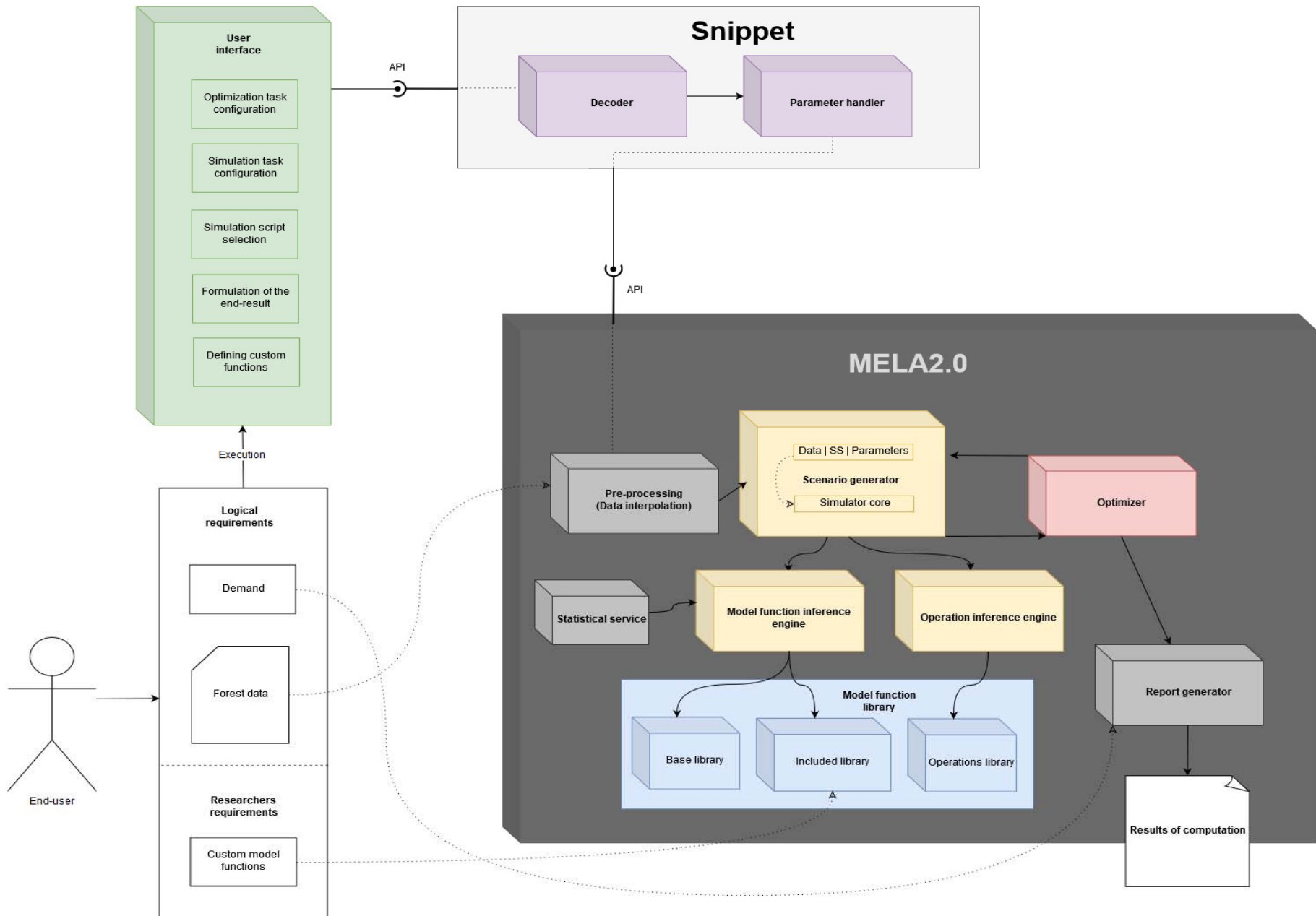
R I   R I

Users of the information

S *Summary Reports (Luke)*
R *Research communities*
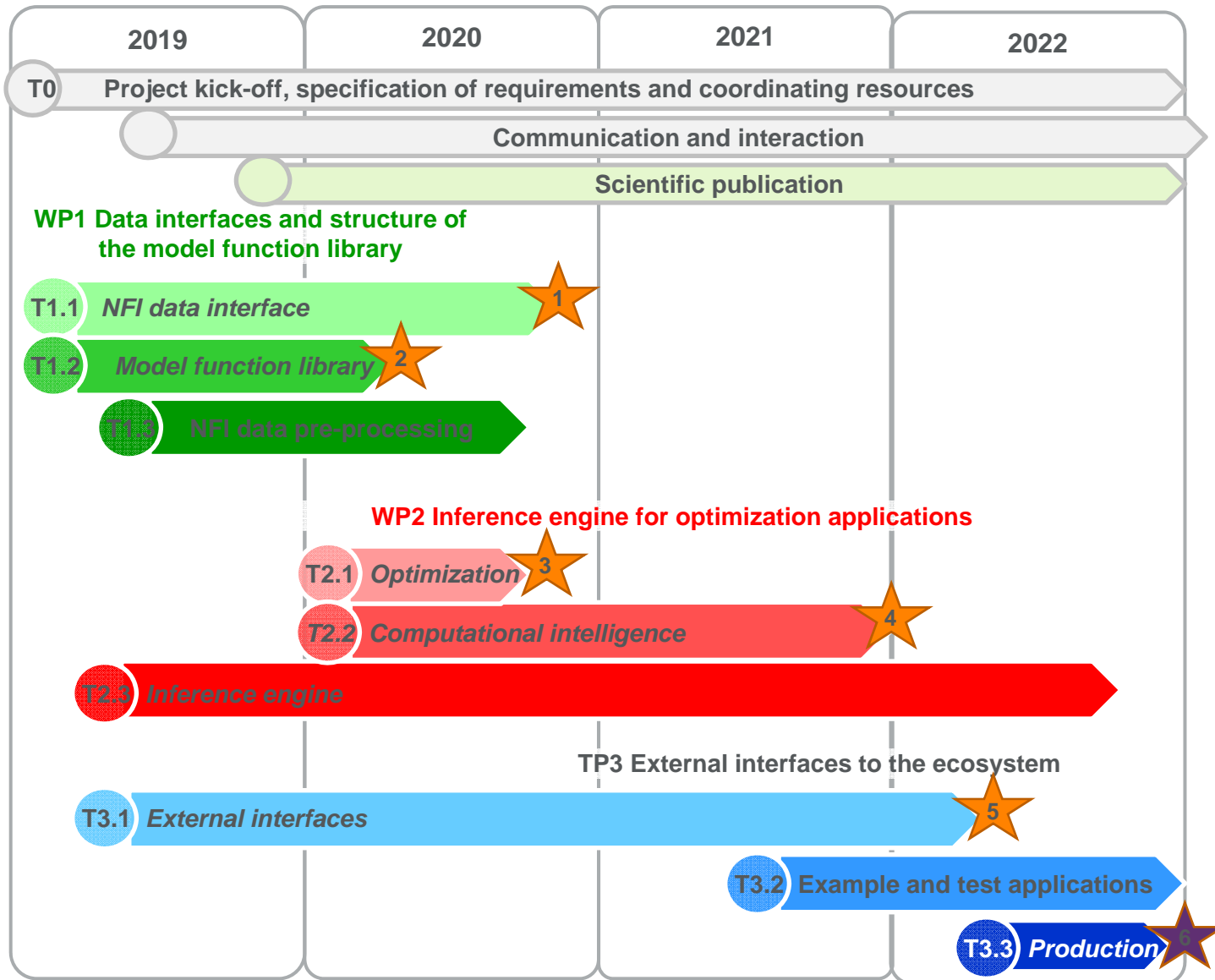**M** *Ministry, officials*
F *Forest industry*
I *ICT-companies*
L *Landowners*
O *Other stakeholders*

Boreal **green bioeconomy**

9.9.2019

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

MELATuPa

VMIKaaVa

Forest Indicator

MELA services
Distribution of results (Luke)

MELA analysis
(Luke + other research communities)

Analysis results

MELA2.0 ecosystem

Optimization applications

Forest resource data (Finnish Forest Centre)

Forest information standard

Service platform

Computing services provided by business

ICT-companies

NFI data (Luke)

Boreal **green bioeconomy**

Digital forest management best practices (Tapio)

Interfaces to other model libraries (e.g. Motti, SIMO, Capsis)

Models
(Research community)

9.9.2019

External components of MELA ecosystem

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

Thank you!

Luke

NATURAL RESOURCES
INSTITUTE FINLAND