SINTEF

OPM-OP

NORCE

OPM SUPPORT & MAINTENANCE

SUGGESTED STRUCTURE

January 2021

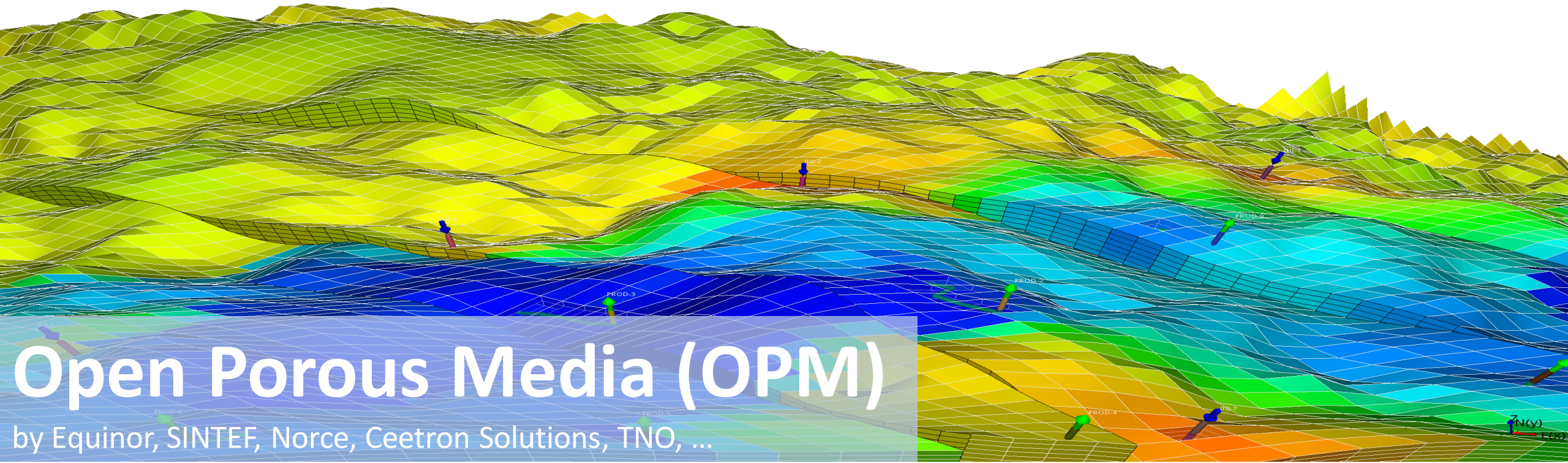
OPM Flow – an industry-standard simulator:

- ✓ Fully implicit black-oil simulator
- ✓ Modern open-source implementation
- ✓ Validated on several field models
- ✓ Verified to reproduce ECLIPSE on several real fields
  - As fast as or faster than ECL100
  - More robust on ensemble models

Work in progress to deploy in industry and to improve forecast mode, accelerate linear solvers, add new keywords, add more physics, etc.

Feature list:

- ✓ Live oil, live gas, hysteresis, end-point scaling, vaporization controls
- ✓ CO_2 storage option
- ✓ Equilibration initialization, threshold pressures
- ✓ Region-based properties (SATNUM, PVTNUM etc.)
- ✓ Multisegment wells, group control, etc.
- ✓ More than 400 ECLIPSE keywords: property editing, multipliers, runs in both history and prediction mode
- ✓ ECLIPSE binary output format
- ✓ Python bindings + command-line options
- ✓ CPR preconditioner + different default linear solvers
- ✓ Based on automatic differentiation, extensible



Open Porous Media (OPM)

by Equinor, SINTEF, Norce, Ceetron Solutions, TNO, …

Support organization

Support and maintenance will be supplied by a three-partner consortium, with SINTEF as coordinator.

A consortium agreement will regulate activities between the consortium partners

SINTEF

Independent non-profit research institute

- Largest for-contract research in Scandinavia
- More than 2000 employees

Computational Geosciences group:

- 18 researchers
- Performs a mixture of basic and applied research.
- Known for open-source software (MRST, OPM), multiscale methods, etc
- Expertise: numerical methods

OPM-OP

Small company established to provide support and development of OPM Flow

Key expertise in I/O and parallelization.

Broad reservoir engineering experience

NORCE

Independent non-profit research institute

- Owned by a consortium of Norwegian universities
- 1000 research/technical staff

Computational Geosciences & Modeling group:

- 17 PhD researchers from applied mathematics, physics and computer science
- Research focus: IOR, CCS, renewable energy
- Co-lead for OPM software

Structure

Assisting a company in commercial use of OPM requires two types of work

1. Support and maintenance
   - Consists of user support, development support, maintenance
   - The consortium will balance between support and maintenance

2. Feature development
   - New functionality, expand existing features
   - Tasks in this category are initiated by the client and consortium in cooperation

Support and maintenance: user support

Ticket system:

- Reporting channels: web, email, chat
- Comprehensive ticket system with access control and sharing of smaller files.
- Criticality levels: Critical, Normal, Low Priority.
- Response time: within end of next working day (CET time zone) for Critical tickets

Bug fixes and minor enhancements:

- Effort to fix is estimated.
- Less than two workdays (or Critical ticket): work commences as soon as possible
- Less than two work weeks: work will be started when and if prioritized by Client
- More than two work weeks: will be considered a feature development effort

Support and maintenance: user support

Types of tickets:
We will be contacted when the user has a problem running OPM Flow. The real source of the problem can be for example:

- Bug in OPM Flow
- Missing feature - exists in Eclipse or another commercial simulator
- Missing feature - the user would really like a completely new feature
- Slow performance, tuning is needed
- User error 1: Bug in workflow involving OPM Flow
- User error 2: Incorrect input to OPM Flow
- Infrastructure problem in Client installation

Client representative will have access to all Client's tickets, and able to modify them, including criticality levels.

Support and maintenance: user support

Releases and installation:

- Regular releases provided to the community twice per year
- Interim bugfix releases can be provided up to 2 times between each regular release (can be requested by Client or consortium)
- Releases can additionally be provided to Client as binary distributions and/or containers according to Client's preferences

Documentation:

- Open web-based knowledge portal with reference documentation, FAQs, tutorials, and knowledge articles.
- A new Technical Description manual for Flow will be created, and continuously updated.
- For each release, the Reference and Technical Description manuals are updated, and release notes created.

Support and maintenance: maintenance

These are ongoing efforts to enhance OPM Flow and reduce the future support burden. For example:

- Refactoring simulator subsystems
- Continuously work on reducing technical debt
- Making OPM Flow run well on publicly available benchmark cases
- Creating new test cases to improve test coverage or accuracy
- Improving the testing infrastructure
- Improving the build system or packaging

The consortium will initiate such actions within the resources available.

- Clients will be notified of any major work being undertaken.
- *Maintenance work will have lower priority than user support*.

Support and maintenance: developer & community support

Community infrastructure will be maintained by the consortium

- OPM GitHub account
- Jenkins continuous integration (CI) system
- Performance benchmarking
- OPM website and mailing list

Roadmap/ongoing efforts

- Make a publicly available development roadmap
- Actively update with known development efforts
- Encourage third parties to contribute information

Code reviews and Quality Assurance (QA)

- We will assess all code contributions to OPM Flow
- Small changes may be reviewed and merged continuously
- Larger changes will be reviewed and merged if prioritized

Feature development category

For new features and major bug fixes (> two weeks estimated effort)

Work only started if requested and prioritized by Client

- Consortium will provide cost estimate
- Invoiced separately from support & maintenance work

Progressive test cases will be created as needed by consortium

- May require cooperation of Client
- Test cases will be open and considered for inclusion in regular automated testing

Major new features may require completely separate projects

- Depends on amount of work involved, novelty and research required

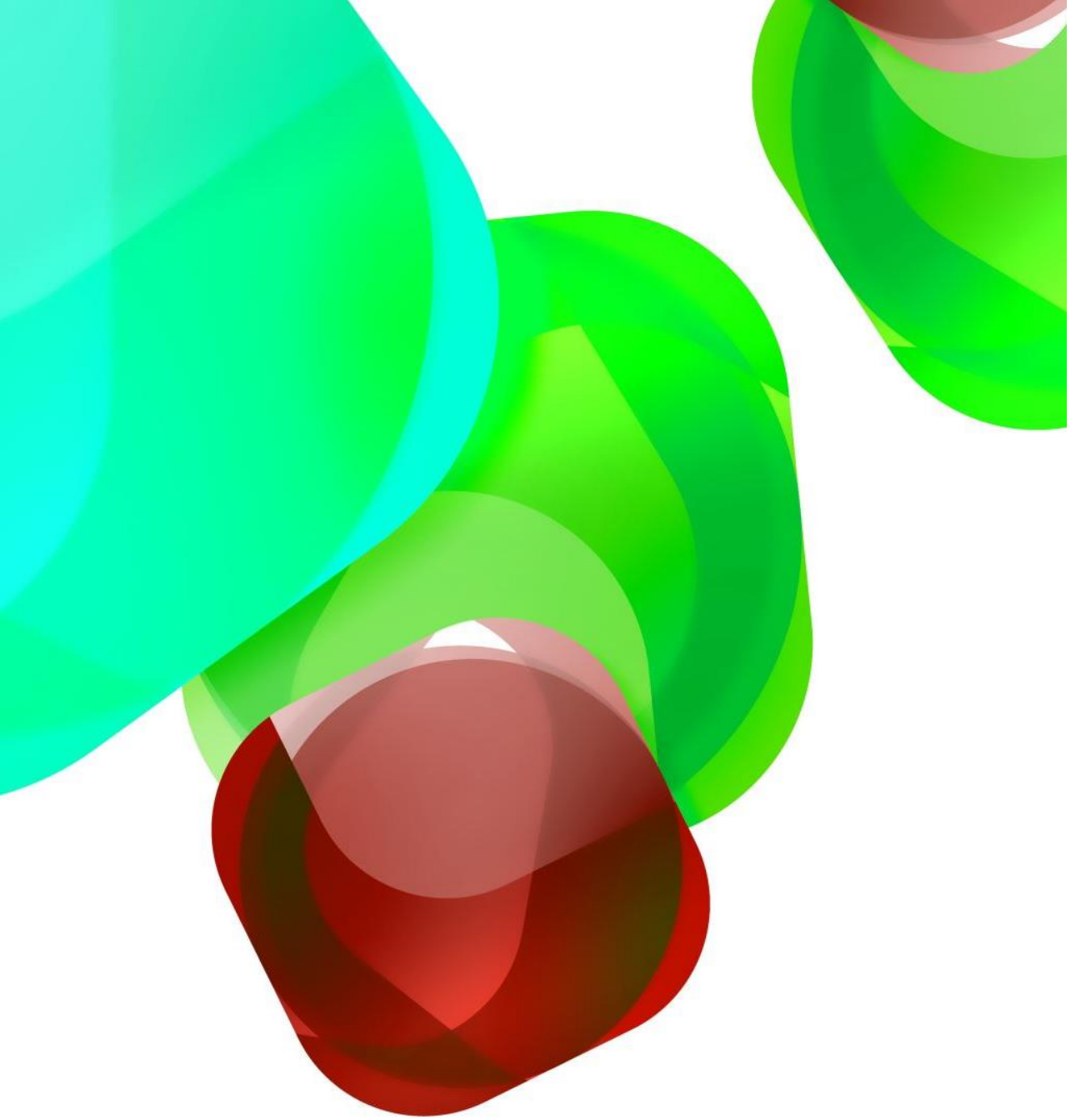
Communication

Continuous: There will be continuous communication with users reporting bugs.

Status updates: We will have frequent, short status updates to discuss ongoing work and Client priorities.

Bi-annual meetings: Walk-through of new release. Discuss directions for future development.

Support evaluation: Once a year we will have a meeting to evaluate the support experience



Quality assurance

Quality assurance will be done for all work in the project. The consortium will have a designated QA responsible person.

- Ticket closure must be approved by user or Client representative
- Tutorials, knowledge articles, and documentation will be reviewed and require approval by QA responsible
- Code modifications will be reviewed and go through automated testing
- Releases will follow a standardized and rigorous procedure

Procedures and practices will be documented and regularly reviewed and revised to meet best practices. The project management follows ISO-certified procedures