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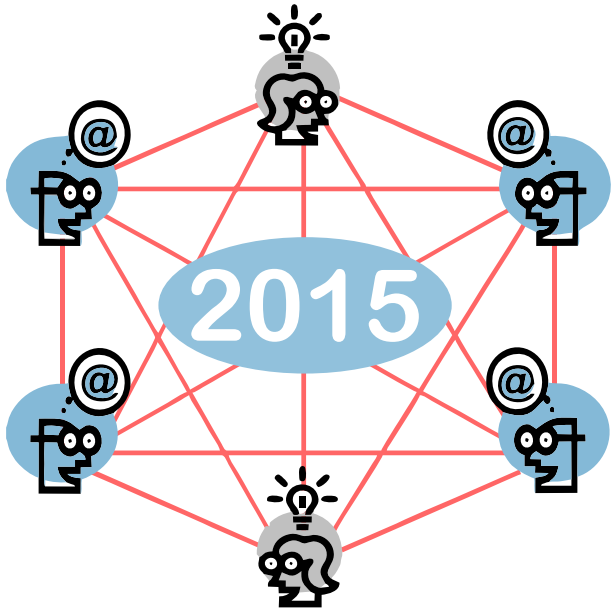


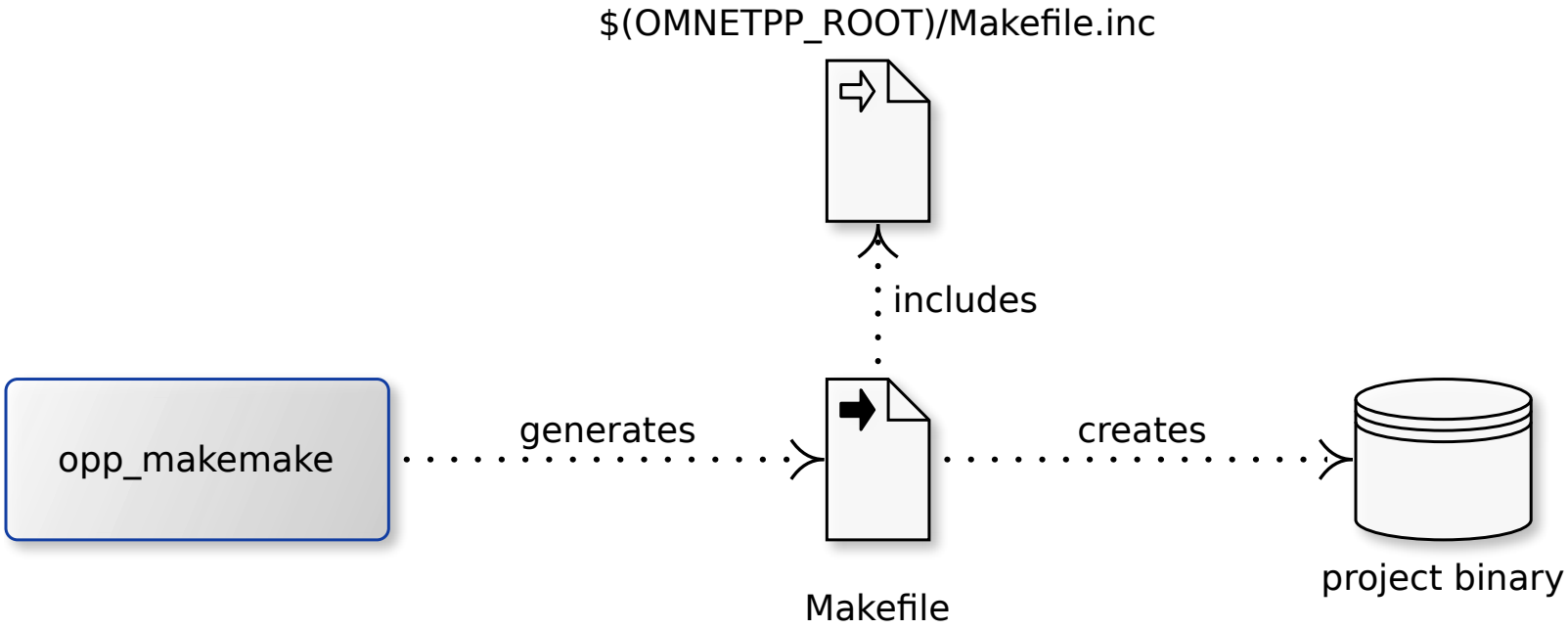
Regain Control of Growing Dependencies in OMNeT++ Simulations

Raphael Riebl · 3. September 2015

What can you expect?

- Status quo of OMNeT++ build process
- Why it can become insufficient
- Some basics about CMake
- How to combine OMNeT++ and CMake

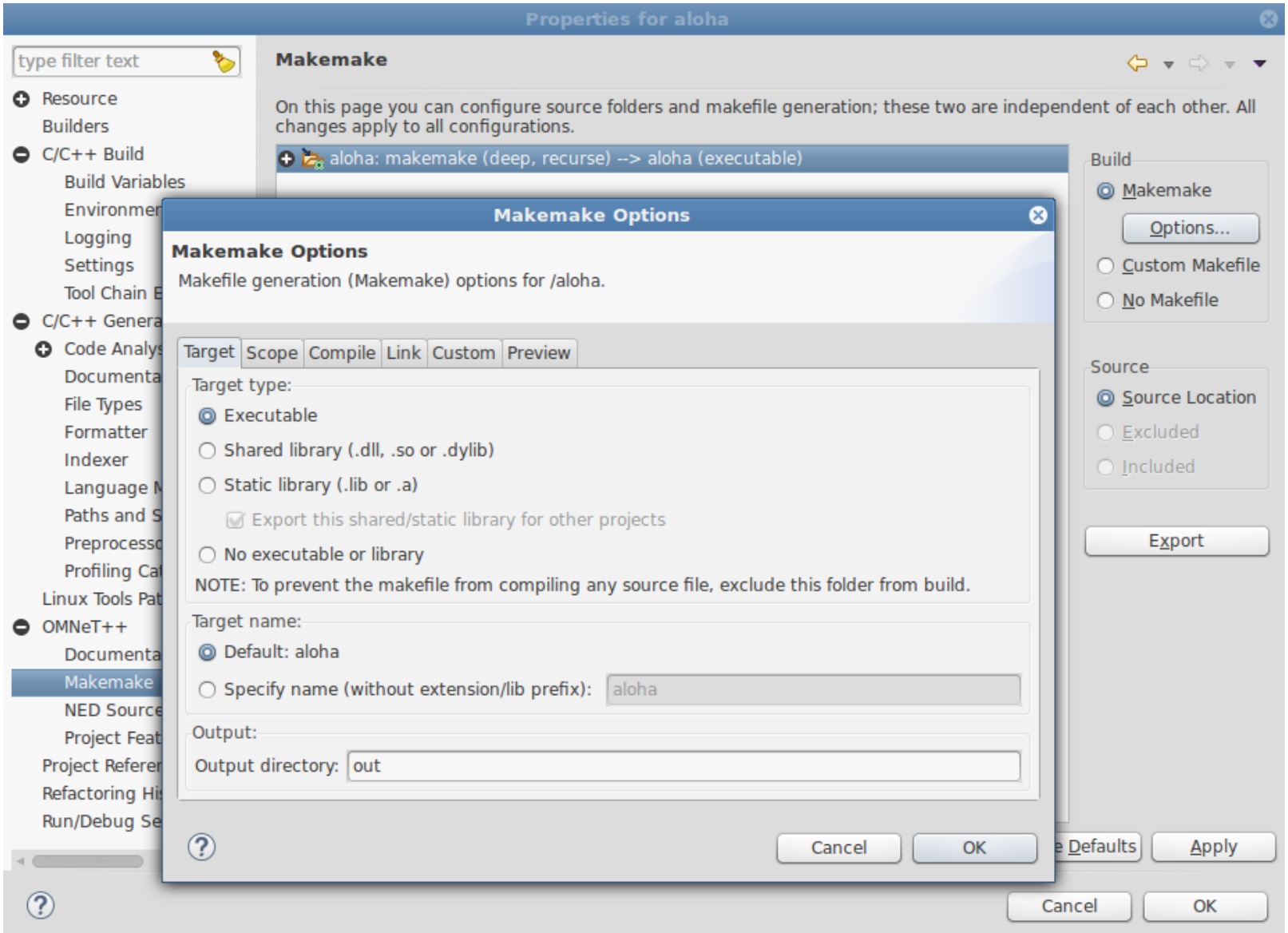
Current build process for OMNeT++ projects



Invocation

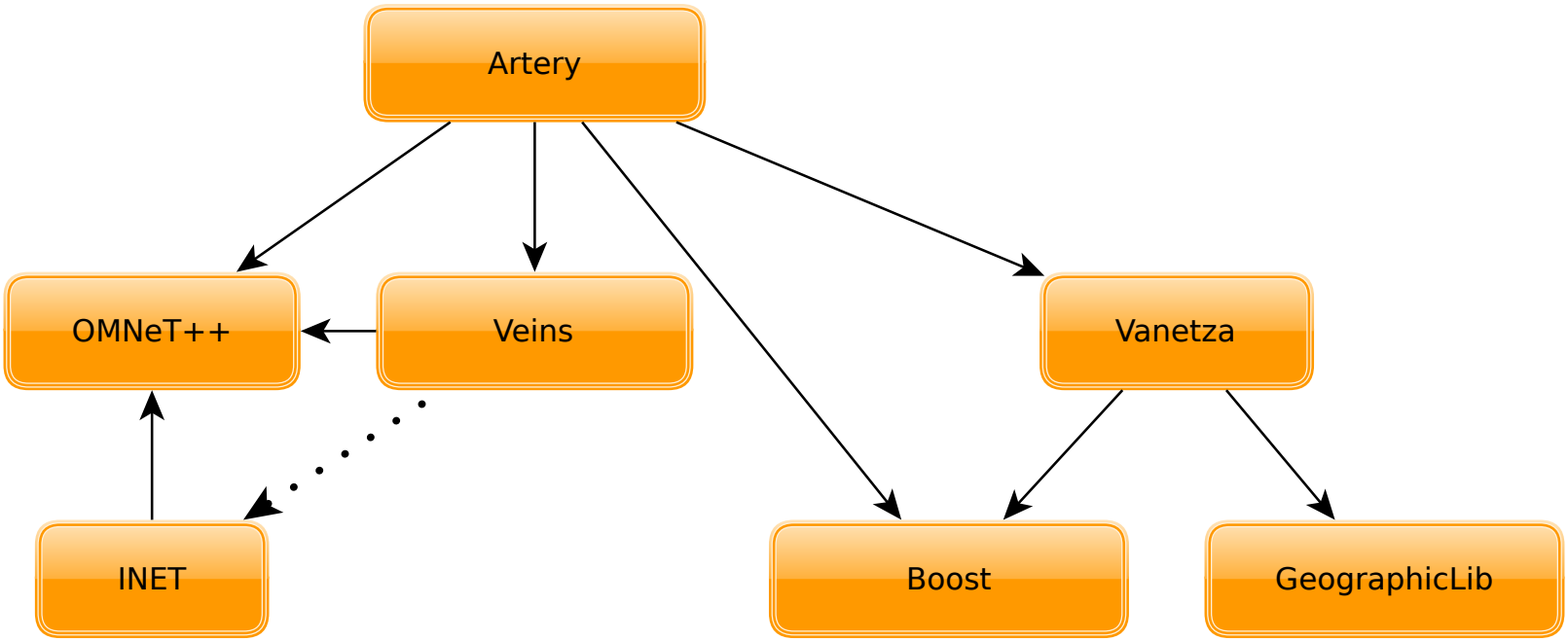
- From IDE, see configuration stored in *.oppbuildspec*
- From custom Makefile or build script

opp_makemake usage from IDE



Inconvenient for complex setups

Example: Artery dependencies



Fork at github: `https://github.com/riebl/artery`

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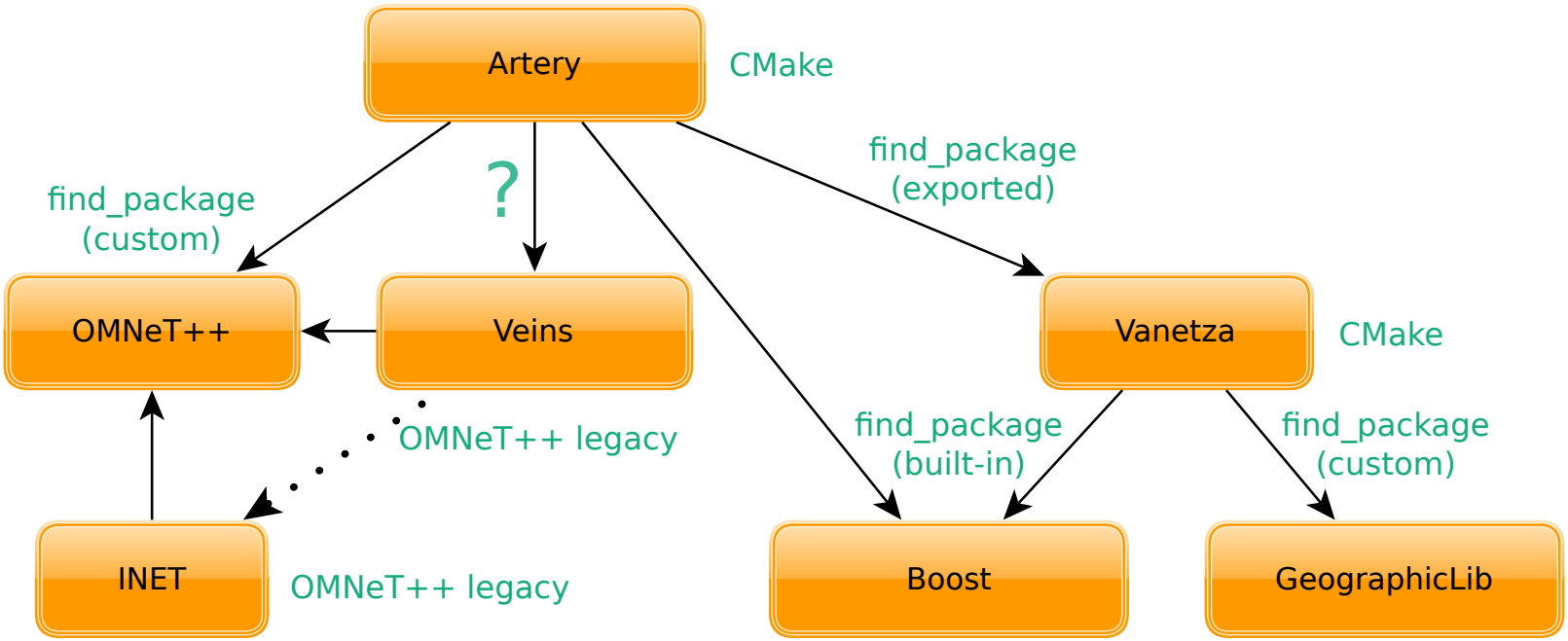

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Why CMake?

- CMake is widely used for C/C++ projects
- Convenient user-interface for configuring builds (*ccmake*, *cmake-gui*)
- Working dependency handling
  - internal: correct build order within project
  - external: library and include directory locations (*find_package*)
- More accessible syntax compared to Makefiles
- Previous experience available ☺

CMake fundamentals

A CMake project consists of at least one *CMakeLists.txt*

- Defines executables and libraries to build
- Defines dependencies between these build targets and other libraries

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Building a CMake project spans three phases

1. **Configuring** a build directory (with local CMake cache)
   Set custom compiler flags, determine location of external dependencies, select build type…
2. **Generating** files for a native build tool based on previous configuration
   GNU Makefiles, Ninja, Eclipse or Visual Studio projects etc.
3. **Building** with actual native build tool

Steps towards OMNeT++/CMake

1. Enhance *find_package* for OMNeT++
   - Directory with include headers
   - Import OMNeT++ libraries (debug and release)
   - Extract compiler flags from *Makefile.inc*
   - OMNeT++ message compiler

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3. Support OMNeT++ specific features, i.e. NED folders
   - Additional CMake target property *NED_FOLDERS*
   - Targets inherit all NED folders of their dependencies automatically
   - Property value can be used for *opp_run* invocation

find_package(OmnetPP)

Implemented through *FindOmnetPP.cmake* located in CMake's module path
Basically, OMNeT++ can be treated like any other C/C++ library

- Additional location hint by looking up *omnetpp* binary in PATH
- Extract information from *Makefile.inc* with regular expressions
- Dedicated libraries with debug symbols are available

Integrating OMNeT++ legacy projects

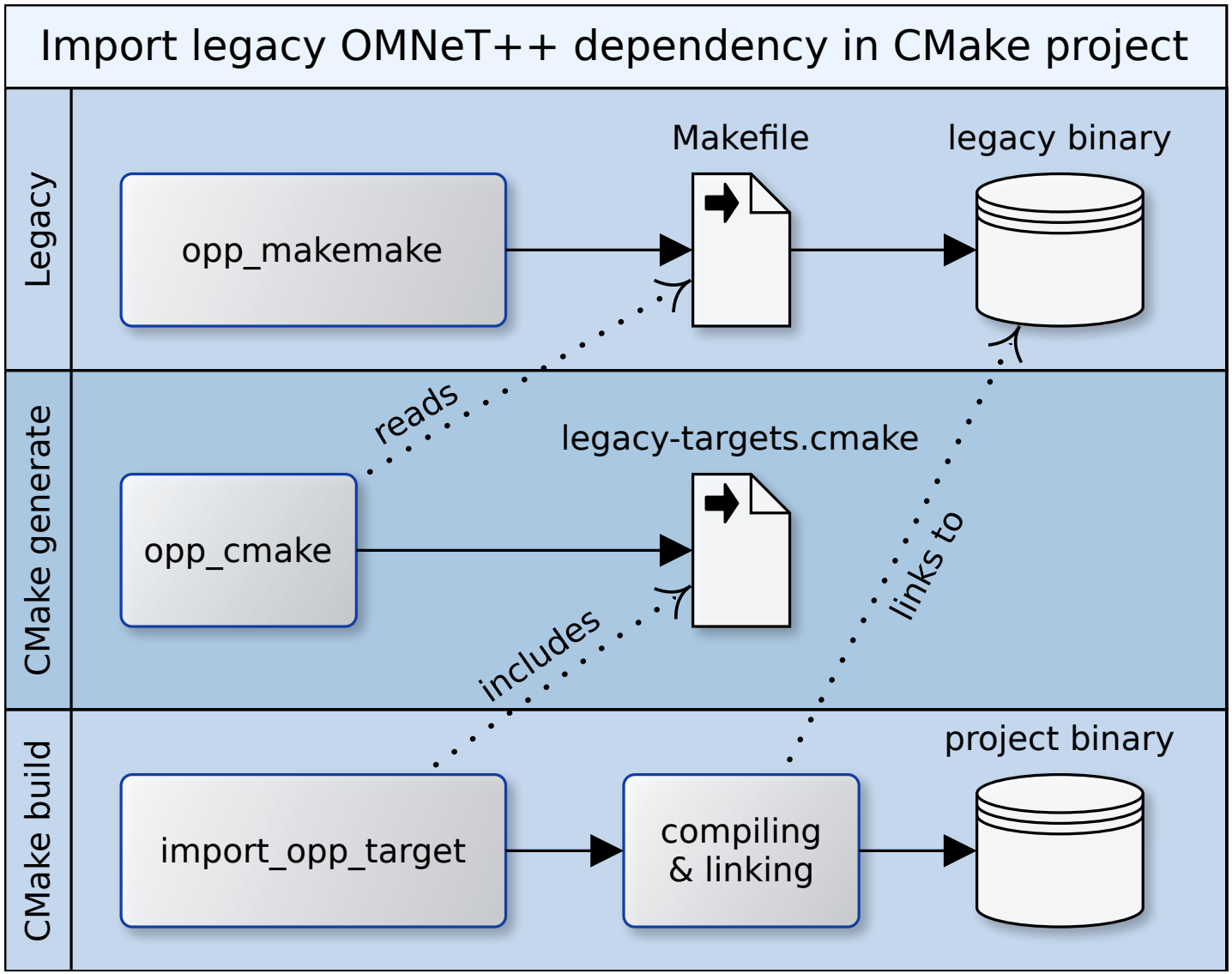
Exploit Makefile generated by opp_makemake, e.g. inet/src/Makefile (INET 3.0)

```
# OMNeT++/OMNEST Makefile for libINET
#
# This file was generated with the command:
#  opp_makemake -f --deep --make-so -o INET -O out -pINET
 ↪   --no-deep-includes -Xinet/applications/voipstream
 ↪   -Xinet/linklayer/ext -Xinet/transportlayer/tcp_lwip
 ↪   -Xinet/transportlayer/tcp_nsc -I../src -DWITH_TCP_COMMON
 ↪   -DWITH_TCP_INET -DWITH_IPv4 -DWITH_IPv6 -DWITH_xMIPv6
 ↪   -DWITH_GENERIC -DWITH_FLOOD -DWITH_UDP -DWITH_RTP -DWITH_SCTP
 ↪   -DWITH_DHCP -DWITH_ETHERNET -DWITH_PPP -DWITH_MPLS -DWITH_OSPFv2
 ↪   -DWITH_BGPv4 -DWITH_PIM -DWITH_RIP -DWITH_POWER -DWITH_RADIO
 ↪   -DWITH_AODV -DWITH_MANET -DWITH_IEEE80211 -DWITH_APSKRADIO
 ↪   -DWITH_IDEALWIRELESS -DWITH_TUN -DWITH_BMAC -DWITH_LMAC
 ↪   -DWITH_IEEE802154 -DWITH_CSMA
# ...
```

1. Parse *opp_makemake* line with a helper script *opp_cmake*
2. Create a CMake file with *IMPORTED* CMake targets of legacy project

Integrating OMNeT++ legacy projects

Overview of involved tools during build phases



An OMNeT++ example project using CMake

```
project(YourProject)
cmake_minimum_required(VERSION 3.0)
set(CMAKE_MODULE_PATH ${PROJECT_SOURCE_DIR}/cmake)

find_package(OmnetPP 4.6 REQUIRED)
# definition of add_opp_run and import_opp_target macros omitted

find_path(INET_DIR NAMES src/inet/package.ned DOC "INET root
 ↪  directory")
import_opp_target(inet ${INET_DIR}/src/Makefile)

set(SOURCES src/a.cc src/b.cc)
add_library(project_library SHARED ${SOURCES})
set_property(TARGET project_library PROPERTY NED_FOLDERS src)
target_link_libraries(project_library opp_interface inet)

add_opp_run(run_project omnetpp.ini project_library)
```

What's next?

Presented CMake macros, scripts and example project are available at
`https://github.com/riebl/artery/releases/tag/opp-summit2015`

- Proof-of-Concept is working for Artery
- Might it be valuable (reusable) for your simulation?
- Feedback is welcome as are suggestions for improvement!