Clang tools Format, lint, analyze C/C++

CONCEPTS

Each tool reads its own YAML file from the nearest parent directory: .clang-format, .clang-tidy, .clangd.

CMake, Meson
↓ writes
compile_commands.json
↓ -p build
clang-tidy, clangd
↓ report
warnings + fixes

One compile database feeds the analysis tools

CLANG-FORMAT

clang-format *<file>*
Print the formatted file to stdout

clang-format -i *<a.cpp> <b.h>*
Format files in place

clang-format --style=google -i *<file>*
Use a preset style

clang-format --dry-run --Werror *<file>*
Fail if a file is not formatted

STYLE FILES

clang-format --style=llvm --dump-config
Print every option of a preset

.clang-format

```
BasedOnStyle: LLVM
IndentWidth: 4
ColumnLimit: 100
---
Language: Proto
DisableFormat: true
```

// clang-format off
Stop formatting until ... on

FORMAT ONLY CHANGES

git clang-format
Format lines changed vs HEAD

git clang-format *<branch>*
Format all changes since <branch>

git clang-format --diff
Print the diff, change nothing

CLANG-TIDY

clang-tidy -p *<build> <file>*
Lint with flags from compile_commands

clang-tidy *<file>* **--** *<compiler flags>*
Lint without a compile database

clang-tidy --checks='-*,bugprone-*' *<file>*
Pick checks by glob

clang-tidy --fix -p *<build> <file>*
Apply the fixes

clang-tidy --list-checks --checks='*'
List every available check

clang-tidy --dump-config
Print the effective config

clang-tidy --warnings-as-errors='*' *<file>*
Fail CI on any finding

run-clang-tidy -p *<build>* **-j 8**
Lint the whole database in parallel

CHECK GROUPS

Prefix	Looks for
`bugprone-`	Likely bugs
`modernize-`	Newer idioms
`performance-`	Wasted copies
`readability-`	Clarity
`cppcoreguidelines-`	Guidelines
`clang-analyzer-`	Analyzer

CONFIGURE AND SILENCE TIDY

.clang-tidy

```
Checks: '-*,bugprone-
*,performance-*'
WarningsAsErrors: 'bugprone-*'
HeaderFilterRegex: 'src/.*'
CheckOptions:
  <check>.<Option>: <value>
```

// NOLINT
Silence findings on this line

// NOLINT(*<check>***)**
Silence one check on this line

// NOLINTNEXTLINE(*<check>***)**
Silence the next line

CLANGD

clangd is the C/C++ language server most editors use. It finds compile_commands.json in a parent dir or its build/ subdir.

.clangd

```
CompileFlags:
  CompilationDatabase: build
  Add: [-Wall]
  Remove: [-fno-*]
Diagnostics:
  UnusedIncludes: Strict
  ClangTidy:
    Add: [bugprone-*]
```

CLANG-ONLY WARNINGS

clang -Weverything *<file>*
Every warning clang knows

clang -fsyntax-only *<file>*
Check code, produce no output

SANITIZERS AND COVERAGE

clang -fsanitize=memory -g *<file>*
MemorySanitizer: uninitialized reads

clang -fprofile-instr-generate -fcoverage-mapping *<file>*
Source-based coverage build

STATIC ANALYZER

clang --analyze *<file>*
Analyze one file

scan-build make
Analyze a whole build

scan-build -o *<dir>* **-V make**
HTML report, open in browser

COMPILE-TIME INSIGHT

clang -ftime-trace -c *<file>*
Write a Chrome trace of the compile

TOOLCHAIN CHOICES

CC=clang CXX=clang++ cmake -B build
Build a CMake project with clang