Profilage de compilation C++ avec crofiler

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2022-03-08

Contexte

- Mars 2020 : La bibliothèque de tracking Acts **migre sur Github** pour faciliter la collaboration hors CERN
  - Problème : **Crashes CI intermittents**, à endroit variable
  - Disparaissent quand on descend à -j1 ? Contournement !

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  - Problème : **Crashes CI intermittents**, à endroit variable
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- Mai 2020 : Coupable identifié = **consommation RAM**
  - 4 fichiers cpp nécessitent >6 Go + 2 fichiers >4 Go
  - Les temps de compilation se comptent en minutes
  - Reste à comprendre pourquoi…

Sources de données

- **Moniteur système :** Indique le fichier cpp, mais pas la raison
  - Moniteur spécialisé comme cmakeperf → Suivi en CI
- **Templight ?** Nécessite un clang patché, compliqué à utiliser
- Corrélation RAM/temps observée → **Analyse temporelle** !
  - **Rapport compilo ?** Juste des passes, peu intéressant
  - **Profileur ?** Indique le bout du compilo lent, pas la raison
  - Heureusement, clang ≥9 nous donne **-ftime-trace**

-ftime-trace

- Vient d'un dev Unity3D, actuellement spécifique à clang
- **Historique** de compilation avec données à grain fin
  - Valeur des **paramètres** (ex : types/fonctions traités)
  - Vue **hiérarchique** : on sait pourquoi le traitement est fait
- Sortie au format Chrome Trace Format
  - Diverses visus (chrome://tracing, Perfetto, Speedscope…)

Démo

Visualisation directe time-trace

Un processus pénible

- 1ère appli pour **suivre la conso RAM** de chaque .cpp
- 2e appli pour analyser le CSV, **repérer les .cpp lourds**
- Puis **pour chaque cpp identifié**
  - Trouver la ligne de commande de compil de CMake
  - Remplacer g++ par clang++
  - Ajouter l'option -ftime-trace
  - Attendre quelques minutes
  - Localiser le JSON généré (près du .o)
  - Visualiser le JSON

Un résultat perfectible

- Centré **séquence temporelle**, pas goulot d'étranglement
- Noms de fonctions **« manglés »** peu lisibles côté backend
- Métaprogrammation → **Noms de templates** du style


std::vector<std::variant<Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundLoc0>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundLoc1>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundLoc0, Acts::eBoundLoc1>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundPhi>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundLoc0, Acts::eBoundPhi>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundLoc1, Acts::eBoundPhi>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundTheta>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundLoc0, Acts::eBoundTheta>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundLoc1, Acts::eBoundTheta>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundPhi, Acts::eBoundTheta>, Acts::Measurement<Acts::Test::ExtendedMinimalSourceLink, Acts::eBoundLoc0, Acts::eBoundPhi, 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crofiler

- **Tout-en-1 :** Mesure build, analyse build, time-trace cpp, visu
- Visualisation **orientée profilage** (inspirée de perf report)
  - TUI interactive pour l'exploration
  - Sortie stdout résumée pour le reporting et le scripting
- **Simplification des noms d'entités C++**
  - Nécessite un AST, donc un parser, sans avoir le contexte
  - ~95 % de l'effort de développement à la louche…
  - Disponible hors de crofiler (outil CLI simpp)

Démo 1

Visualisation profil existant (build Acts + CKFTests)

Démo 2

Configuration de build, acquisition de données

Statut crofiler

- Actuellement, **en mode maintenance**
  - Suffisant pour moi + pas d'autres utilisateurs
  - Difficile de justifier de nouvelles fonctionnalités !
- Quelques idées si l'outil devenait plus populaire
  - Simplification de noms d'entités plus futée*
  - Export de fichiers compatibles Firefox Profiler
  - Corrélation d'activités (ex : même template, front/backend…)
  - Détection automatique des changements clang en CI

* Algo actuel = Parcours BFS de l'AST tronqué à une profondeur limite croissante.
Pas efficace (travail dupliqué) + résultat pas optimal (redondances, colonnes terminal inutilisées)

Ce qu’il faut retenir

- **Arrêtez de faire n’importe quoi à la compilation !**
  - Profilez l’exécution, réservez les templates aux cas graves
  - Méfiez-vous des bibliothèques « futées » comme Eigen
  - Surveillez la consommation CPU/RAM de vos builds
  - Le C++ *header-only* ne passe pas à l’échelle
- Si le mal est déjà fait, **profilez et optimisez la compilation**
  - Outils/méthodes moins matures que pour l’exécution
  - crofiler fait de son mieux pour aider…

Merci de votre attention !

https://github.com/HadrienG2/crofiler