Microsoft

Latest and Greatest in Visual Studio for C++ Developers

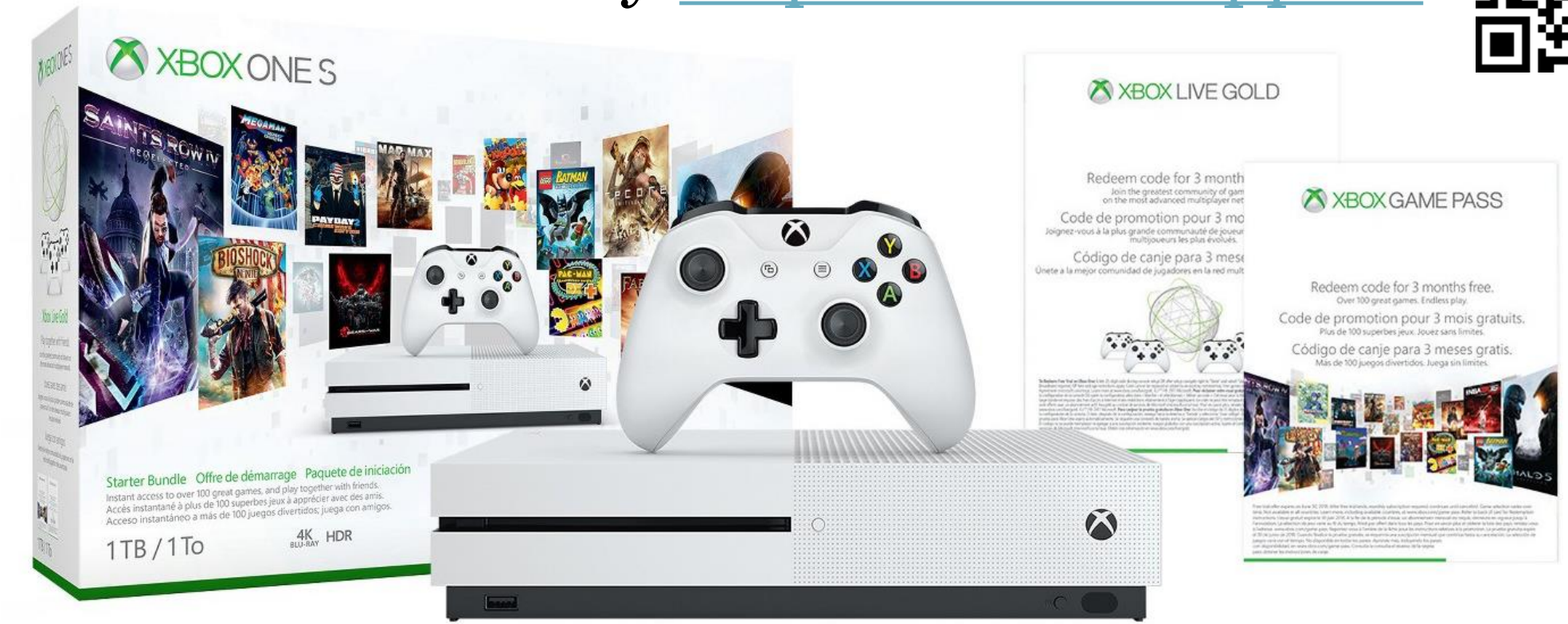
Steve Carroll @ScareAll

Marian Luparu @mluparu

https://aka.ms/cpp

@VisualC

Take our survey https://aka.ms/cppcon



You can win an Xbox One S - Starter Bundle

9/27 10:30 – 12:00 // *Breckenridge Hall*
Thoughts on a More Powerful and Simpler C++ (5 of N), *Herb Sutter*


Visit our booth
2nd floor, Mon - Fri

Mission of the C++ product team at Microsoft

Make the lives of all C++ developers on the planet better

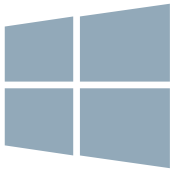
1. by participating in the creation of the **C++ Standards**

Our agenda today

2. by investing in the Microsoft Visual C++ (**MSVC**) Compiler & Libraries
3. by improving the **Visual Studio IDE**
4. by continuing to enhance the C++ extension for **Visual Studio Code**

Visual Studio Code





- Lightweight, keyboard focused
- Git integration
- Code Editing
  - IntelliSense, Code Browsing, Switch header/source, Code formatting (clang-format)
- Debugging
  - Core-dump debugging, launch, attach, breakpoints (incl. conditional and function), stepping, threads, call stack, watch, GDB and MI commands
- Easily run, build, test, and integrate external tasks

9/26 15:15 – 15:45 // *Steamboat (403)*
What's new in Visual Studio Code for C++ development, *Rong Lu*

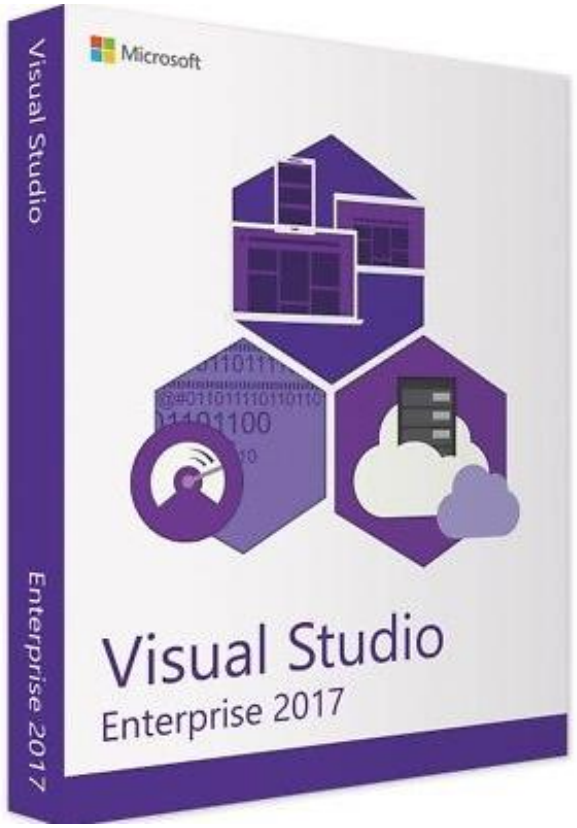
Learn more at https://aka.ms/cpp/code

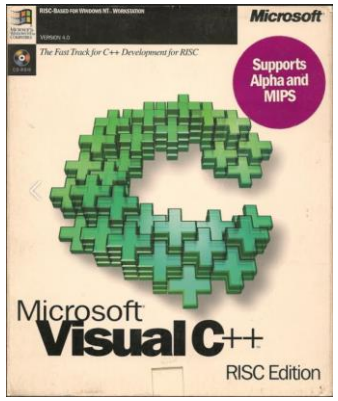
Visual Studio

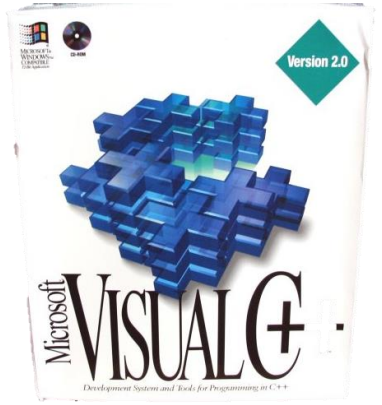
2018

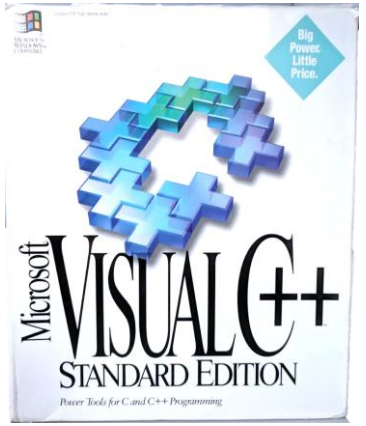
2017

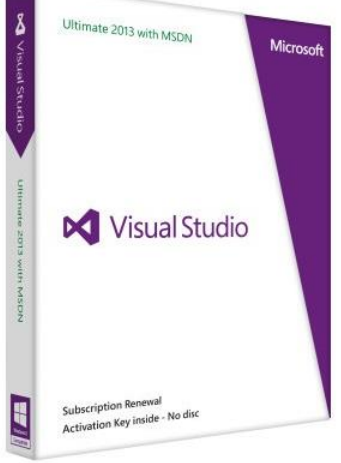
Coming soon	-	Version 15.9 – *Preview 2 out now*
14-Aug-18	-	Version 15.8
7-May-18	-	Version 15.7
5-Mar-18	-	Version 15.6
4-Dec-17	-	Version 15.5
9-Oct-17	-	Version 15.4
14-Aug-17	-	Version 15.3
10-May-17	-	Version 15.2
5-Apr-17	-	Version 15.1
7-Mar-17	-	**Visual Studio 2017**

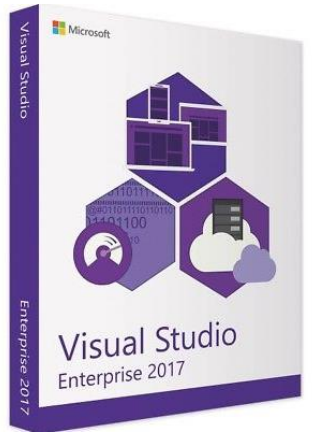


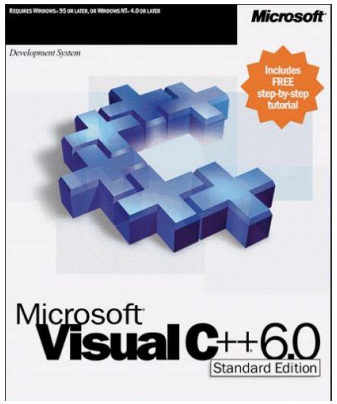

Microsoft
The Fast Track for C++ Development for RISC
Supports Alpha and MIPS
Microsoft
Visual C++
RISC Edition


Version 2.0
Microsoft
VISUAL C++

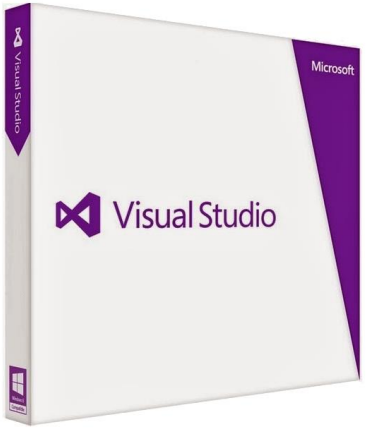

Big Power. Little Price.
Microsoft
VISUAL C++
STANDARD EDITION
Power Tools for C and C++ Programming

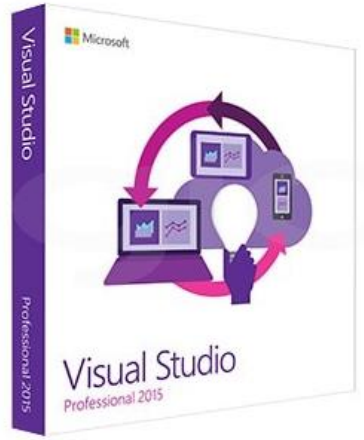

Ultimate 2013 with MSDN
Microsoft
Visual Studio
Subscription Renewal
Activation Key inside - No disc

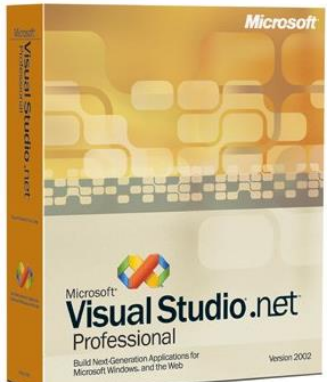

Microsoft
Visual Studio
Enterprise 2017
Visual Studio
Enterprise 2017

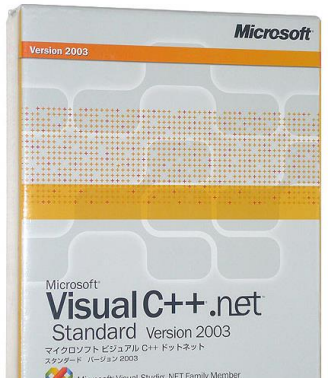

Microsoft
Development System
Includes FREE step-by-step tutorial
Microsoft
Visual C++6.0
Standard Edition

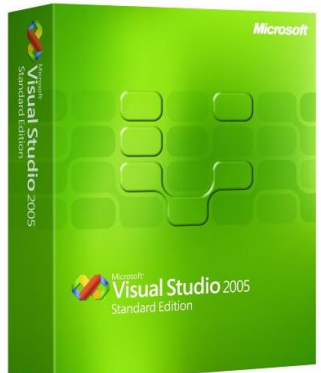

Microsoft
Version 5.0
Microsoft
Visual C++
Professional Edition

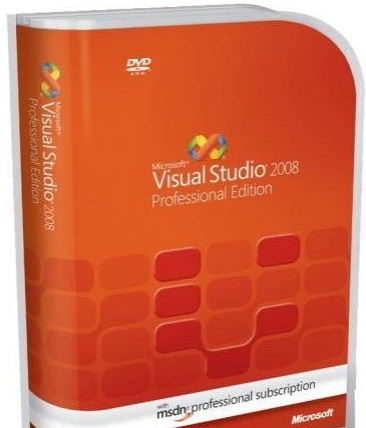

Visual Studio
Microsoft
Visual Studio

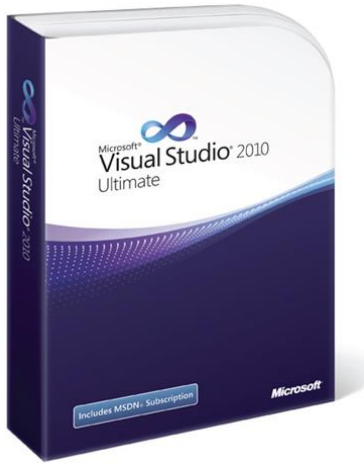

Microsoft
Visual Studio
Professional 2015
Visual Studio
Professional 2015


Microsoft
Visual Studio .net
Microsoft
Visual Studio .net
Professional
Build Next-Generation Applications for Microsoft Windows, and the Web
Version 2002


Microsoft
Version 2003
Microsoft
Visual C++.net
Standard Version 2003


Microsoft
Visual Studio 2005
Standard Edition
Microsoft
Visual Studio 2005
Standard Edition


Visual Studio 2008
Professional Edition
Microsoft
Visual Studio 2008
Professional Edition
with msdn professional subscription
Microsoft


Microsoft
Visual Studio 2010
Ultimate
Includes MSDN Subscription
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Microsoft
Supports Alpha and MIPS
Microsoft Visual C++
RISC Edition
Version 2.0
Microsoft VISUAL C++
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Microsoft
Visual Studio
Enterprise 2017
Microsoft
Includes FREE step-by-step tutorial
Microsoft Visual C++ 6.0
Standard Edition
Microsoft
Microsoft Visual C++
Professional Edition
VISUAL C++
25
YEARS
Visual Studio
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Visual Studio
Professional 2015
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Visual Studio
Professional 2015
Microsoft
Visual Studio .net
Professional
Microsoft
Version 2003
Microsoft Visual C++ .net
Standard Version 2003
Microsoft
Visual Studio 2005
Standard Edition
Visual Studio 2008
Professional Edition
msdn professional subscription
Microsoft
Visual Studio 2010
Ultimate
Includes MSDN Subscription
Microsoft

Visual Studio

One IDE for any developer, any app, any platform

Freedom to **target any platform** from one single IDE

ARM/mBed, Android, Cygwin, iOS, Linux, MinGW, UWP, Windows

Easy to get started

Keep your CMake/make/Ninja, No import/conversion to VS solutions, Easy C++ library acquisition

Rich and familiar C++ **code editing and debugging** experiences

IntelliSense, Refactoring, Conditional breakpoints, Debug visualization

Continue to use **your C++ tools** of choice, all **integrated** in the IDE

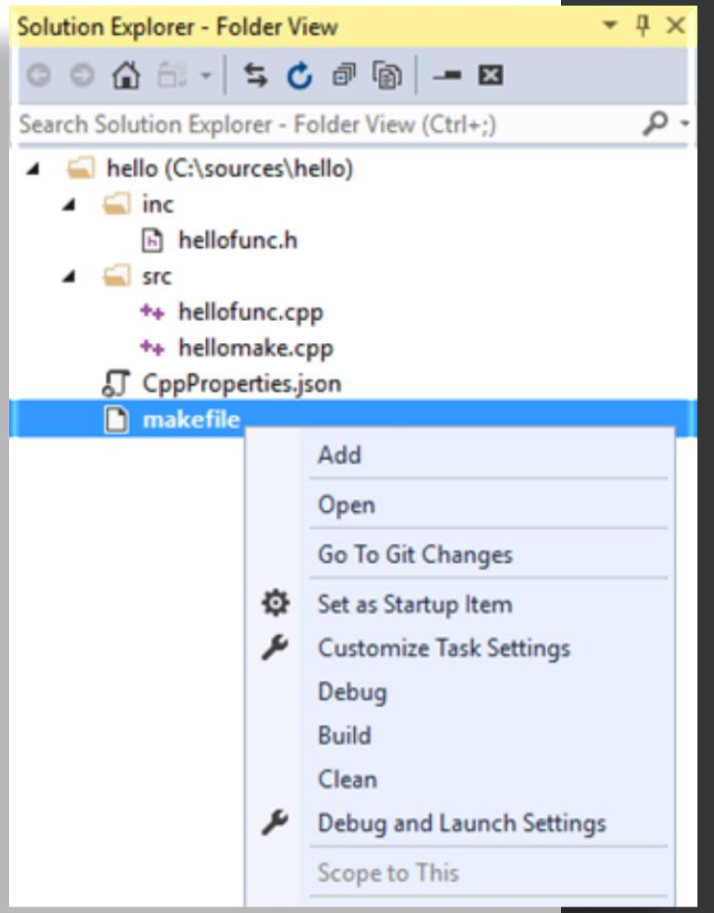
Clang/LLVM, GCC, Clang-format, Google Test, Boost.Test

Demo

One IDE for any developer, any app, any platform

Open folder experience

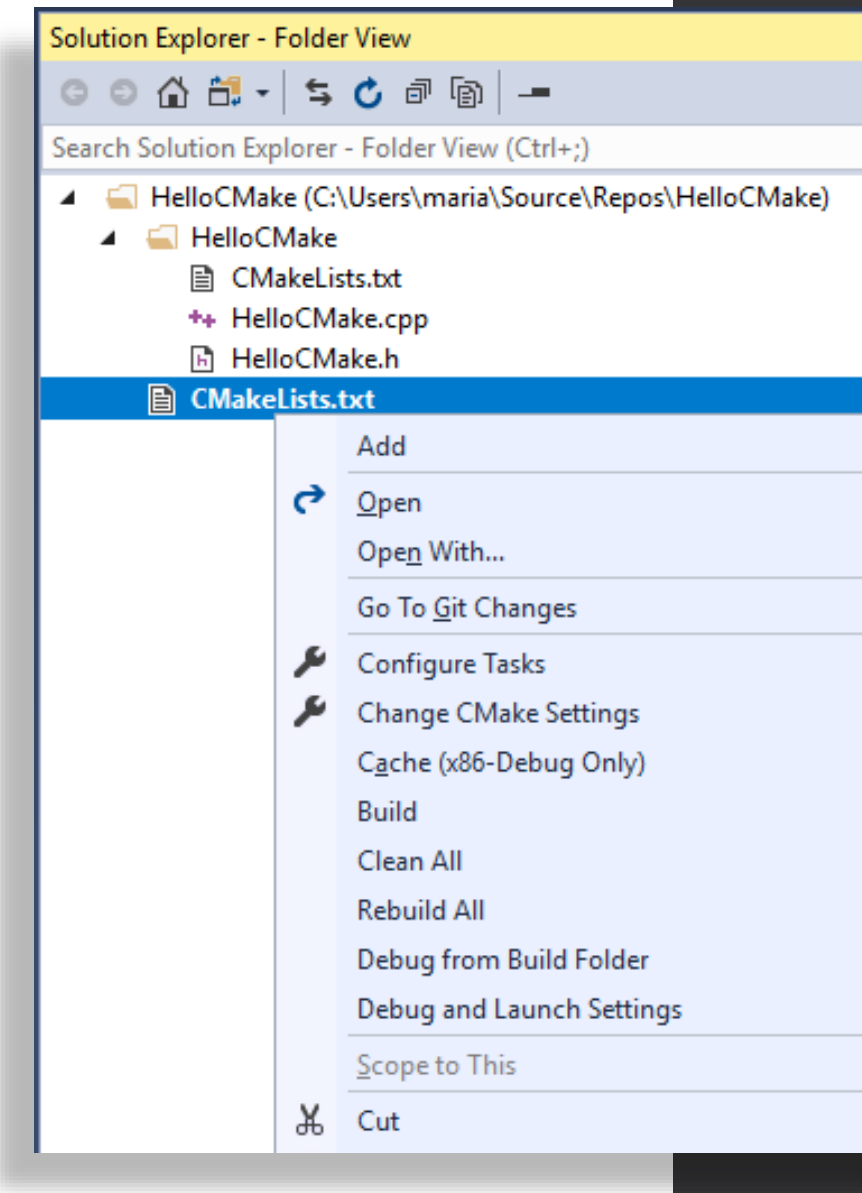
- **Optimized for non-MSBuild projects**
  - E.g. any projects using CMake, make, or other C++ build systems
  - Target Windows, MinGW, Cygwin, Linux, or mBed
- **Easy to get started**
  - devenv.exe <folder>
  - **File > Open > Folder**… (or Ctrl+Alt+Shift+O)
  - Missing #include lightbulbs, IntelliSense heuristics
- **Enables familiar VS experience** for any project types
  - C++ IntelliSense & code navigation & refactoring
  - External build systems integration
  - C++ debugging
- Learn more at https://aka.ms/openfolder/cpp



9/26 18:45 – 20:00 // *Breckenridge Hall*
Cross-platform C++ development is challenging - let tools help!
Marc Goodner, Will Buik

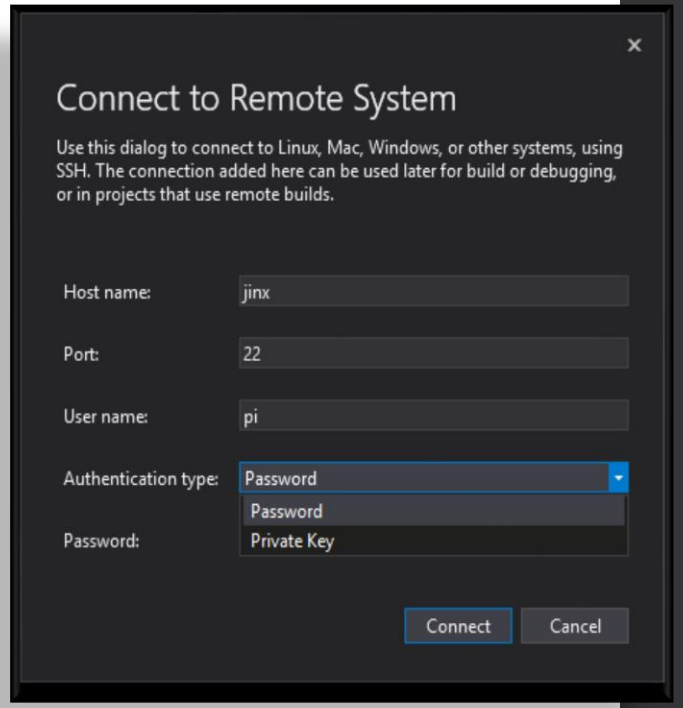
CMake support

- Based on **Open Folder** experience
  - No pre-configuration step on the command line
- CMake, as a **first-class project system** in Visual Studio
  - CMake auto-configuration
  - Explore, build, debug, & install CMake targets
  - Build with Ninja, MSBuild, or make
- **Familiar** edit-build-debug inner-loop experience
  - C++ IntelliSense, code browsing, and refactoring
  - Discover, run, and debug tests in Test Explorer
  - Disk view or CMake targets view (equiv. Solution View)
  - Code analysis integration, single file compilations
- **Target** Windows, Linux, MinGW or Cygwin
  - From a single codebase, from a single instance of the IDE
  - Multi-platform IntelliSense and purple squiggles
- Learn more at https://aka.ms/cmake



Linux targeting

- Use Visual Studio to **target any Linux distro**
  - Remote VMs, Containers
  - IoT (e.g. Raspberry PI, Beaglebone)
  - local Windows Subsystem for Linux distros
  - Cross-compile
- IntelliSense can run in **GCC compat mode** and can **parse remote Linux headers**
- **Build remotely** via MSBuild or CMake (with makefile or Ninja generators)
- **Debug local or remote targets** via gdb and/or gdbserver
  - Natvis visualizers & Python pretty-printer type visualizers supported
  - Launch or attach remotely to running processes
- Learn more at https://aka.ms/vslinux



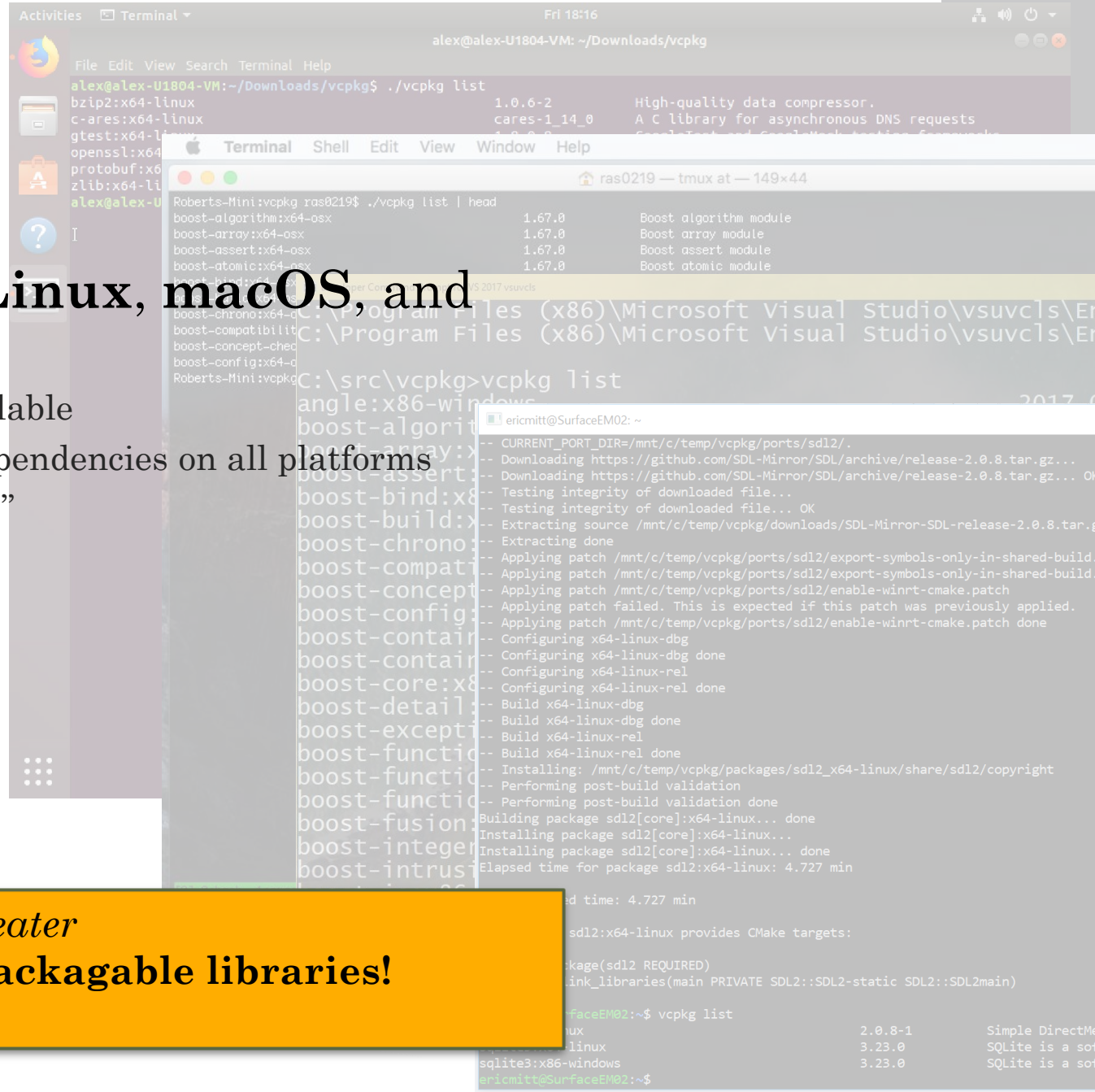
Vcpkg

C++ library acquisition for **Linux**, **macOS**, and **Windows**

- 470+ cross-platform libraries already available
- A single consistent way to acquire C++ dependencies on all platforms
- As simple as “vcpkg install [library_name]”

```
vcpkg install boost sdl zlib gtest
```

- Learn more at https://aka.ms/vcpkg



9/26 15:15 – 15:45 // *Copper Mountain Theater*
Don’t package your libraries, write packagable libraries!
Robert Schumacher

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Free for individual usage and small teams

Microsoft C++ compiler & libraries (MSVC)

Best compiler toolset to target Windows. Learn more at https://aka.ms/msvc

Conforming to **C++ standards** is our #1 priority

"Are you there yet?"

Improved **diagnostics & code analysis**

/analyze and CppCoreCheck

Member initialization order, Template dependent name diagnostics, Special member function errors, /diagnostics:caret, /external to isolate your code from external libraries

Improved **code generation & optimization**

New SSA optimizer, inliner improvements, expanded loop optimizer (unswitching and unrolling), SLP vectorizer, scalar replacement to sink stores out of loops

Built-in security tools

Compile-time checks (e.g. /sdl, /analyze), Test-time checks (e.g. /RTC, GFlags, CRT debug heap), Runtime protection (e.g. /guard:cf, /GS, /Qspectre)

C++ standards conformance

With version 15.7,

Visual Studio 2017 achieves

C++ standards conformance

- *supporting all C++11/14/17 compiler features,*
- *and including two-phase name lookup and expression SFINAE,*
- *and the most complete C++17 library implementation*

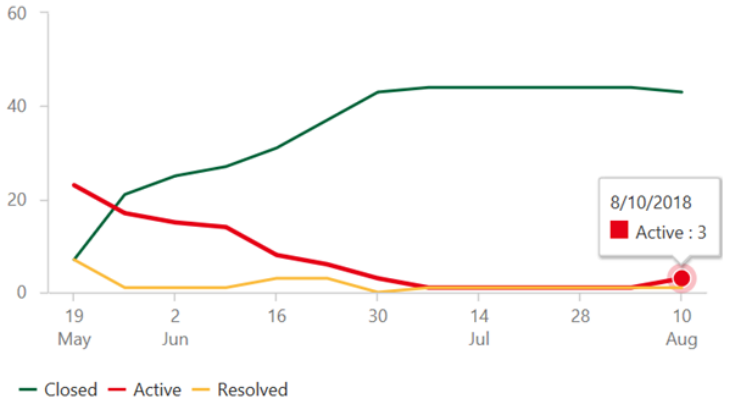
- Can MSVC build Hana?
- Can MSVC build ranges-v3?
- But does MSVC's preprocessor support variadic macro arguments now?

For more details, visit https://aka.ms/msvcconformance

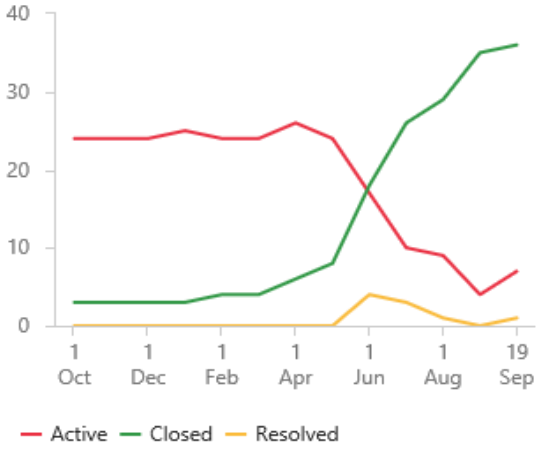
C++ standards conformance

- **Preprocessor** overhaul available in version 15.8
  - Traditional preprocessor still the default
  - Behind /experimental:preprocessor
- **Boost.Hana** builds clean starting with version 15.8
  - Available since 15.7 in vcpkg with workarounds
- **ranges-v3** will be available in version 15.9
  - 30+ alias template bug fixes
  - Available under /permissive-
- **/permissive-**
  - To guarantee portability of your code

Compiler Bugs (from Boost.Hana)

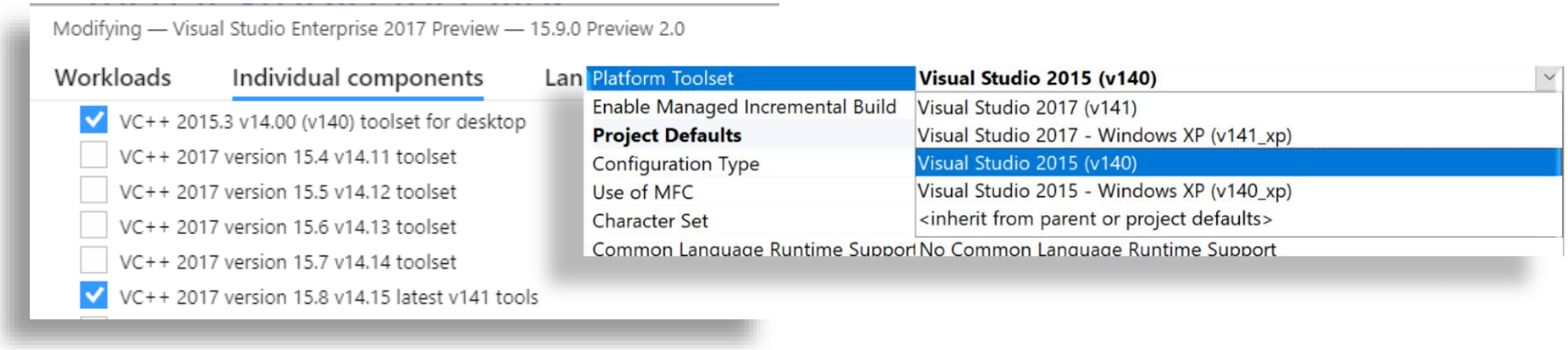


Compiler Bugs (from range-v3)



Pain-free upgrades

- Install Visual Studio 2015 toolset with Visual Studio 2017 (without needing the VS2015 IDE)
- **Side-by-side** minor Visual Studio 2017 toolsets (15.4, 15.5, 15.6)



- Compiler Switches – "pay for play" /permissive-, **/std:c++14 (default)**, /std:c++17, /std:c++latest
- **Binary compatibility** between the VS2015 and VS2017 runtimes
  - i.e. reuse prebuilt VS2015 library binaries in VS 2017 projects
- Vcpkg for getting the latest version of **open source libraries**

Porting and Upgrading Guide: https://aka.ms/cpp/upgrade

C++ conformance – state of the world

- Continuous testing on OSS projects on GitHub + latest compiler bits

No	Source	No	Source	No	Source	No	Source	No	Source	No	Source
1	CoreCLR	13	Cocos2dx	25	Blender	37	Irrlicht	49	Python3	61	EASTL
2	Chakra	14	OSQuery	26	Dolphin	38	LAME	50	PHP7	62	Folly
3	ClangLLVM	15	FLAC	27	Facebook_ZSTD	39	ITK	51	MySQL	63	Eigen
4	OpenSSL	16	WinRT	28	Glslang	40	VTK	52	Mesos	64	Wt
5	Chrome	17	Z3	29	Google_Brotli	41	Sprout	53	SDL	65	Autowiring
6	OpenCV	18	PDFium	30	Google_LiquidFun	42	LibGIT2	54	Azure_iot_sdk_c	66	Tensorflow
7	RxCpp	19	X265	31	Google_MathFu	43	LibJPEG	55	Dlib	67	Ffmpeg
8	Boost	20	RocksDB	32	Google_Protobuf	44	LibJPEG_Turbo	56	Bond	68	CNTK
9	UnrealEngine	21	VCPKG	33	Google_RE2	45	LUA	57	KTL	69	Hana
10	Electron	22	PostgreSQL	34	Google_Snappy	46	LUAJIT	58	Outcome	70	NanoRange
11	QTCreator	23	CryEngine	35	Google_VP9	47	LZ4	59	MongoDB	71	Cutlass
12	QT	24	APPLE_LZFSE	36	Google_SwiftShader	48	Serious_Engine	60	Git	72	WebKit

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2	Chakra	14	OSQuery	26	Dolphin	38	LAME	50	PHP7	62	Folly
3	ClangLLVM	15	FLAC	27	Facebook_ZSTD	39	ITK	51	MySQL	63	Eigen
4	OpenSSL	16	WinRT	28	Glslang	40	VTK	52	Mesos	64	Wt
5	Chrome	17	Z3	29	Google_Brotli	41	Sprout	53	SDL	65	Autowiring
6	OpenCV	18	PDFium	30	Google_LiquidFun	42	LibGIT2	54	Azure_iot_sdk_c	66	Tensorflow
7	RxCpp	19	X265	31	Google_MathFu	43	LibJPEG	55	Dlib	67	Ffmpeg
8	Boost	20	RocksDB	32	Google_Protobuf	44	LibJPEG_Turbo	56	Bond	68	CNTK
9	UnrealEngine	21	VCPKG	33	Google_RE2	45	LUA	57	KTL	69	Hana
10	Electron	22	PostgreSQL	34	Google_Snappy	46	LUAJIT	58	Outcome	70	NanoRange
11	QTCreator	23	CryEngine	35	Google_VP9	47	LZ4	59	MongoDB	71	Cutlass
12	QT	24	APPLE_LZFSE	36	Google_SwiftShader	48	Serious_Engine	60	Git	72	WebKit

Microsoft contributions to make /permissive- work

Diagnostics and Code Analysis

- **Better compiler diagnostics:** Member initialization order, Template dependent name diagnostics, Special member function errors, /diagnostics:caret
- **/experimental:external** switch to isolate your code from external headers
- **C++ Core Check** continuous evolution in enforcing C++ Core Guidelines
  - Now *on by default* starting with Visual Studio 2017 version 15.7
  - Checkers for
    - Type safety
    - Bounds safety
    - Lifetime management
    - Classes and interfaces
    - Resource management
    - Expressions
    - Concurrency (experimental)
  - To learn more, https://aka.ms/CppCoreCheck

9/27 10:30 – 12:00 // *Breckenridge Hall*
Thoughts on a More Powerful and Simpler C++ (5 of N),
Herb Sutter

9/27 15:15 – 15:45 // *Copper Mountain Theater*
ConcurrencyCheck – Static Analyzer for Concurrency Issues in Modern C++,
Anna Gringauze

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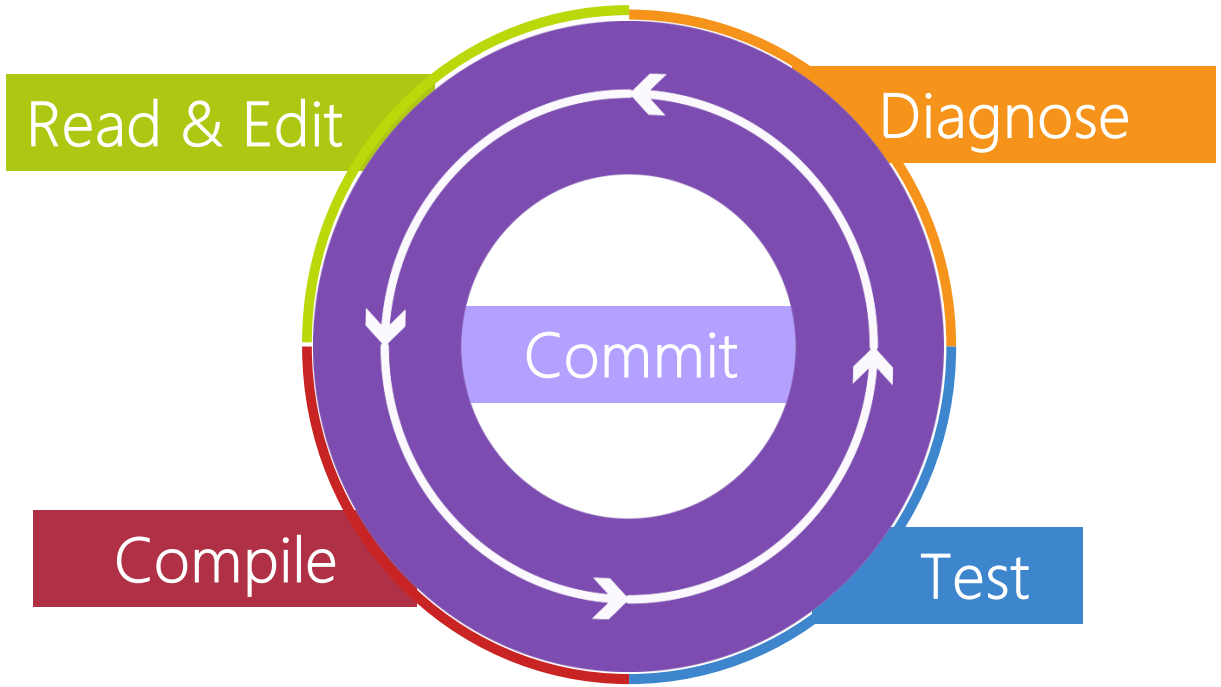
Visual Studio inner-loop

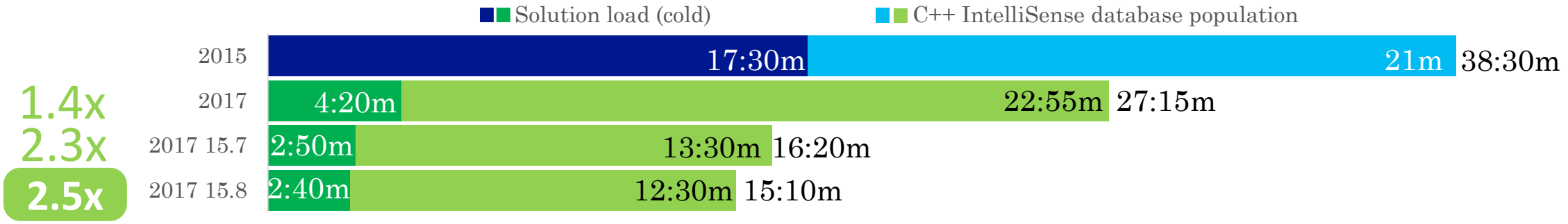
Performance, build throughput, and productivity



Visual Studio inner-loop

Performance

(First) C++ Solution Open (4000+ projects)



(Next) C++ Solution Open (4000+ projects)

Memory usage (C++ Solution, 4000+ projects)

Visual Studio inner-loop

Performance

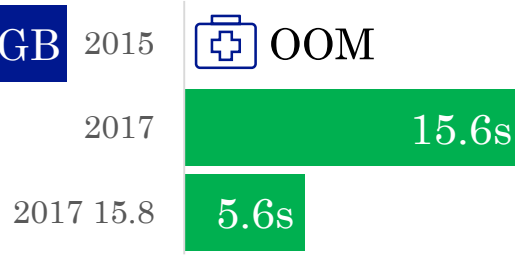
Debug session memory usage

(C++ Solution, 4000+ projects)

4.2X

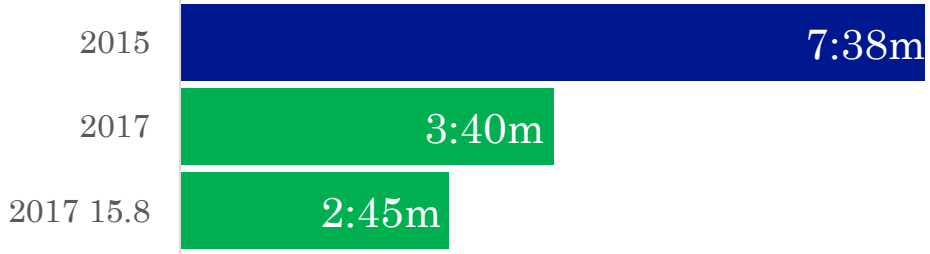
Avg. time to hit breakpoint

(C++ Solution, 4000+ projects, 10 breakpoints)



Find All References & Rename refactor

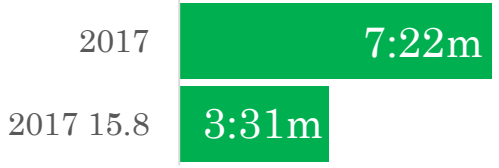
(Unreal Engine)



2.8X

Open Folder IntelliSense population

(11,000 C++ files, 1,000 folders)



Visual Studio inner-loop

Build throughput

Full Build

AAA Unreal Engine-based game

2015	2017 15.7	
2,223.48s	1,907.41s	14%

Custom AAA game engine

2015	2017 15.7	
1,703s	1,433s	16%

Incremental Build (single file change)

AAA Unreal Engine-based game

4.1X

2015	2017 15.7
288.79s	68.83s*

Custom AAA game engine

2.4X

2015	2017 15.7
82s	47s
	34s*

**) Includes additional optimizations:*

- *With /OPT:NOICF*
- *Remove /MAP*

Learn more at https://aka.ms/vcthroughput

Demo

Visual Studio inner-loop productivity

Visual Studio inner-loop

Productivity

Read & Edit

C++ Template IntelliSense
Member List filtering
Predictive IntelliSense mode
Code formatting enforcement
(via. .clang-format and/or .editorconfig)
Go To All (Ctrl + ,) with various filters
Find All References improvements
Structure guidelines
Ctrl+Click to Go To Definition
Code Analysis warnings as squiggles
Macro expansion in Quick Info
Convert macro to constexpr

Test

CodeLens integration
More unit test frameworks
- Google Test
- Boost.Test

Compile

/debug:fastlink
OSS libraries from https://aka.ms/vcpkg

Diagnose

Improved
- Error List results
- Memory and CPU Profiler

Debugging
- “Just My Code” stepping
- Step Back support
- Run to click
- Reattach to process
- Exception helper
- Conditions for “Break on exception”

Compiler diagnostics via /diagnostics:caret
ImageWatch visualizer (VS Marketplace)

Commit

Force push your changes
SSH support for remotes
View commit diff

Demo

Visual Studio 2019

Visual Studio 2019

The Next IDE

Push the boundaries of **individual and team productivity**

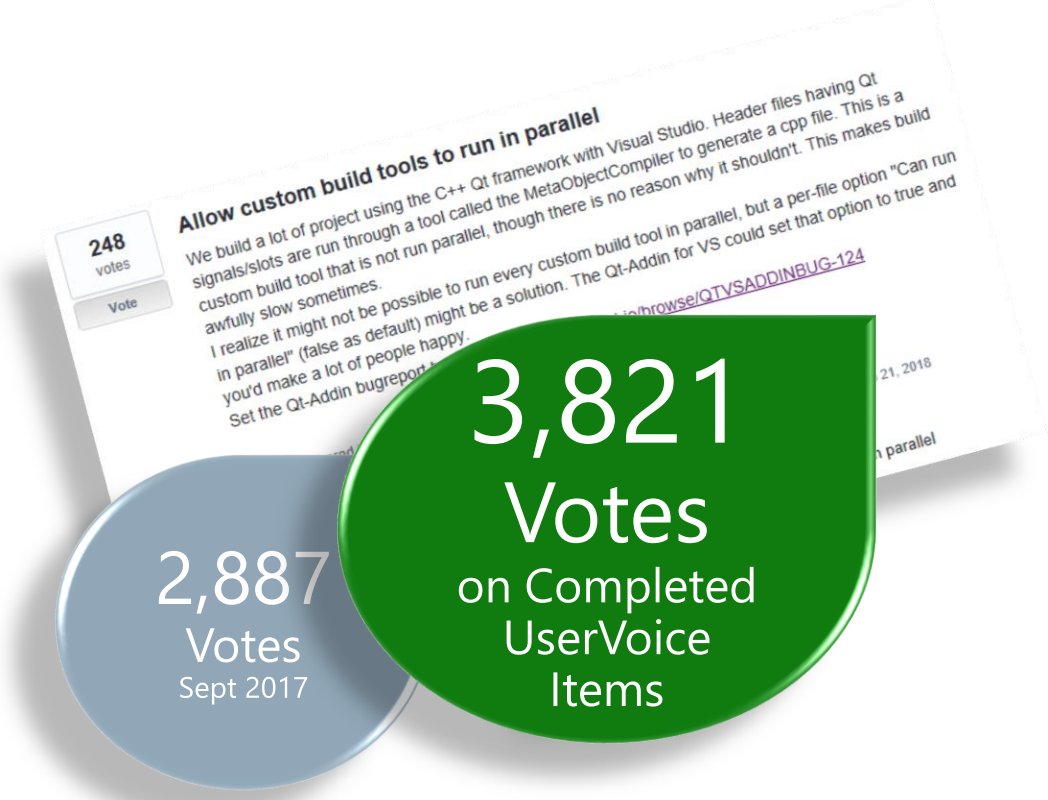
Simple, easy upgrade for everyone

Coming soon. Timing of the release… in 2019

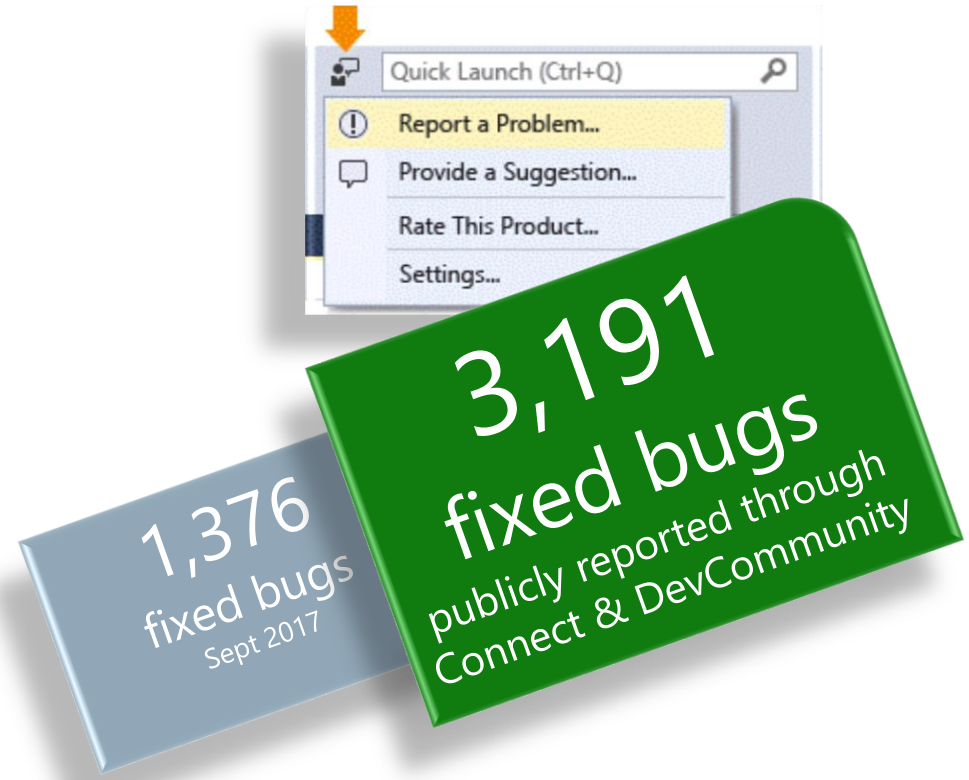
Give us **your feedback**!

You helped build it

Visual Studio User Voice
https://visualstudio.uservoice.com/



"Report a Problem…" tool
https://developercommunity.visualstudio.com



Summary

- Visual Studio Code
  - Code editor redefined, optimized for editing and debugging your C/C++ code
- MSVC – Microsoft C++ compiler and libraries
  - The best choice of toolset on Windows
- Visual Studio 2017
  - Fast and easy workload installation, Pain-Free Upgrade, Open Folder
  - Performance you can feel
  - Most productive IDE for your editing, building, debugging
- Any C++ developer, building any type of app
  - No matter what platform you are targeting
- Microsoft
  - We are listening and participating, tell us what you want to see next (@visualc)

Thank you!

Other sessions

Monday, September 24th

- 14:00 – 15:00
  How to Write Well-Behaved Value Wrappers
  - by Simon Brand
- 15:15 – 16:15
  How C++ Debuggers Work
  - by Simon Brand

Tuesday, September 25th

- 14:00 – 15:00
  What Could Possibly Go Wrong?: A Tale of Expectations and Exceptions
  - by Simon Brand and Phil Nash
- 15:15 – 15:45
  Overloading: The Bane of All Higher-Order Functions
  - by Simon Brand

Wednesday, September 26th

- 12:30 – 13:30
  C++ Community Building Birds of a Feather
  - with Stephan T. Lavavej and others
- 15:15 – 15:45
  Don't Package Your Libraries, Write Packagable Libraries!
  - by Robert Schumacher
- 15:15 – 15:45
  What's new in Visual Studio Code for C++ Development
  - by Rong Lu

Wednesday, September 26th

- 15:50 – 16:20
  Value Semantics: Fast, Safe, and Correct by Default
  - by Nicole Mazzuca
- 16:45 – 17:45
  Memory Latency Troubles You? Nano-coroutines to the Rescue! (Using Coroutines TS, of Course)
  - by Gor Nishanov
- 18:45 – 20:00
  Cross-Platform C++ Development is Challenging – let Tools Help!
  - by Marc Goodner and Will Buik

Thursday, September 27th

- 9:00 – 10:00
  Inside Visual C++'s Parallel Algorithms
  - by Billy O'Neal
- 10:30 – 12:00
  Thoughts on a More Powerful and Simpler C++ (5 of N)
  - By Herb Sutter
- 15:15 – 15:45
  ConcurrencyCheck – Static Analyzer for Concurrency Issues in Modern C++
  - by Anna Gringauze
- 16:45 – 17:45
  Class Template Argument Deduction for Everyone
  - by Stephan T. Lavavej