

WG21 November 2022 Hybrid meeting

Record of Discussion

ISO/IEC JTC1 SC22 WG21 P2732— 2022-12-05

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Chair: John Spicer

7-12 November 2022, Kona, HI USA

1. Opening activities

John Spicer opens the meeting at 08:44 AM GMT-10

1.1 Opening comments

John Spicer presents.

Please speak into the microphone so people participating over Zoom can hear. We encourage people in the room not to join the zoom meeting for wifi purposes.

1.2 Meeting guidelines

John Spicer presents.

Meetings are not public, we want everyone to be able to speak freely. Please refrain from live tweeting, blogging, taking photos or videos. Agenda is on the wiki. Talk to your neighbor if you need access to the wiki.

Every participant is responsible for understanding and abiding by the following:

[The INCITS Antitrust Guidelines](#) (INCITS C++)

[The INCITS Patent Policy](#) (INCITS C++)

[The ISO Code of Conduct](#)

[The INCITS Code of Conduct \(INCITS C++\)](#)

[The IEC Code of Conduct](#)

[The WG21 Practices and Procedures, and Code of Conduct](#)

John Spicer presents the slides. They are also linked in the agenda.

If you have any questions or concerns about CoC issues, please approach a committee officer or a NB representative and bring it to their attention.

1.3 Membership, voting rights, and procedures for the meeting

Herb Sutter : everybody who is not in the ISO directory is a convenor invited guest. We will have students from the local high school visiting on Wednesday, Additionally, university students from Hilo will be here on Monday and Tuesday. Please welcome both.

John Spicer presents voting rights.

Rules are the same for US and other NBs. Every person registered in the global directory gets one vote.

Everyone can vote in subgroups. Please see best practice for voting.

If you are representing an organization that is considering formally joining INCITS/C++, or your organization is already a member and you wish to change your voting status, please inform an officer - John Spicer, Hal Finkel, and Barry Hedquist.

Hal will be stepping down, big thank you for all the work done over the years. We had a huge improvement in the way we handle papers, attendance tracking, and many other things. Thank you.

Hal Finkel presents. We have an attendance sheet, please sign it. If you are not on there, go on the last page and add yourself there.

We will have a doodle poll for the virtual attendance. Please put your name and affiliation in the doodle poll.

Hal presents wiki information.

Hal presents Mattermost.

Thank you to Tom Honermann for all the work he put into spearheading Mattermost effort.

John Spicer presents voting procedures during the plenary.

1.4 Introductions

New members introduce themselves.

John Spicer welcomes new members.

1.5 Agenda review and approval (INCITS/C++ motion, WG21 poll)

John Spicer presents the agenda.

The meeting goals described above are derived from the schedule adopted in 2020 and described in: [P1000R4](#).

INCITS/C++ business.

WG21 motion to approve the meeting agenda.

The motion is unanimously approved by WG21.

1.6. Editor's reports, approval of working drafts

Document	Editor's report	Prospective WD
C++ Standard	N4918	N4917
Transactional Memory V2	P2682r0	N4923

WG21 motion to approve the above.

The motion is unanimously approved by WG21.

1.7. Approval of the minutes of the previous meetings (INCITS C++ motion, WG21 poll)

Meeting	Minutes
WG21 July Virtual	N4916
INCITS C++ July Virtual	pl22.16-2022-000023
WG21 pre-Kona administrative telecon	N4924

INCITS/C++ business.

WG21 motion to approve the above.

The motion is unanimously approved by WG21.

2. Liaison reports, and WG21 study group reports (see pre-meeting WG21 telecon minutes)

No discussion.

3. WG progress reports (Core, Evolution, Library, Library Evolution; see pre-meeting WG21 telecon minutes)

No discussion.

4. New business requiring action by the committee

No discussion

5. Organize working groups and study groups, establish working procedures

(Clarify rooms available for evening sessions)

Jens Maurer presents.

Thank you to those who brought audio setup gear and all the volunteers who helped set it up. This helps the virtual attendance.

Jens Maurer presents evening sessions.

Mon	7:00pm	Editorial	Chair : Thomas Köppe
Tue	7:30pm	Future of C++	Chair : Jean-François Bastien

Matthias Kretz : SG6 will meet this afternoon. We have two papers to discuss.

Jens Maurer presents meeting rooms.

Poll for in person attendance in Issaquah.

Poll for volunteers to carry projectors to the Issaquah meeting.

Jens Maurer : If you need help with core wording, please come find me.

Herb Sutter : thank you to Jens and Dietmar for figuring out the zoom arrangements.

6. Subgroup sessions

John Spicer presents.

The subgroup chairs must arrange for any proposals to be written up in the form of a motion, and made available by 8:00 PM Friday.

Chairs are encouraged to update the straw polls page as soon as they have papers ready.

Attendees are encouraged to keep track of the straw polls page and raise any concerns as early as possible.

7. Review of the meeting (Saturday 8:00 AM)

Reminder: Make sure you have marked the attendance sheet, if you have not already done so.

Subgroup status and progress reports. Presentation and discussion of proposals to be considered for consensus adoption by full WG21.

SG1: Concurrency (Giroux)

I am very proud of the meeting we had here.

I was concerned that we will not be able to get quorum or that long time members will be missing, but that did not happen. We had 16 people attending in person and 8 remotely. Hybrid meeting was a great experience.

We approved quite a few things. We decided to move forward with SIMD in IS26, which means IS26 will be a huge release for SG1: senders/receivers and SIMD.

SG2: Modules (Stone)

Did not meet.

SG4: Networking (Snyder)

Did not meet.

SG5: Transactional memory (Boehm/Maurer)

Did not meet.

SG6: Numerics (Kretz/Lippincott/McFarlane)

SG6 met on Monday afternoon and was already done before the first break. We looked at P1385R7 "A proposal to add linear algebra support to the C++ standard library" and took polls to inform LEWG review of the paper. We then looked at P2159R0 "An Unbounded Decimal Floating-Point Type", which is an older paper we still had in our queue. The author was not present, but we collected enough feedback what we would expect from the next revision of the paper, if any.

Special thanks to Damien for note taking.

SG7: Compile-time programming (Dusikova/Vandevoorde)

Did not meet.

SG9: Ranges (Levi/Carter)

The "Ranges" study group had a hybrid meeting on Tuesday, Nov 8th. The first two sessions were devoted to SG9-only topics and were followed by a joint session with LWG (Library wording group).

The number of attendees was 18. For all the topics except one we had both a quorum and the attendance of stakeholders had been verified before each topic was discussed (LEWG was notified on the one topic which did not, and the discussion in LEWG was postponed to the next meeting / telecon to verify the conditions are met)

The group looked at:

- NB comments: 11 (2 duplicate)
- C++23 papers: 5 (3 are part of NB comments resolution)

Detailed description:

- NB Comments:
 - Resolved:
 - FR-014-021 26.6 [range.factories] Add views::enumerate (duplicate: US 48-108 26)
 - FR-003-010 22.14.7 [format.range] formatting of ranges of tuple-like objects
 - FR-013-020 26.6.5 [range.repeat] Replace ranges::repeat with cycle_view (duplicate: US 51-113 26.6.5)
 - US 47-109 26 [ranges] Resolve open issues
 - Work In Progress:
 - DE-114 26.7.23.2 [range.zip.view], 26.7.31 [range.cartesian] const-breaking zip_view and cartesian_product_view - Forwarded to LEWG
 - DE-115 26.7.6.1 [range.all.general], 26.4.5 [range.refinements] copyable and movable views - Waiting for a revision
 - US 46-107 25.5.7.1 [counted.iterator] Too many iterator increments - Waiting for a revision
 - US 50-112 26.5.7.2 [[range.utility.conv.to](#)] Allow an omitting parentheses - Waiting for a revision
 - US 61-126 32.11 [re.iter], 26.7.14 [range.join] Handle stashing iterators - Waiting for a revision
- Papers discussed (some as part of NB comments):
 - [P2636](#): References to ranges should always be viewable (required more work)
 - [P2711](#): Ruminations on explicit multi-param constructors of views” (we accepted the proposed resolution)
 - [P2655](#) common_reference_t of reference_wrapper Should Be a Reference Type (we accepted the proposed resolution, requires a fix)
 - [P2406](#): Fix counted_iterator interaction with input iterators (required more work)
 - [P2164](#): views::enumerate (accepted for C++23)
- SG9-LWG joint session:

“Range” had a joint session with LWG to review ranges-related Library issues:

 - US 61-126 32.11 [re.iter], 26.7.14 [range.join] Handle stashing iterators (accepted, requires a paper)
 - US 47-109 26 (ranges) Resolve open issues (all resolved but one which was forwarded to LEWG with a design question)

Summary:

SG9 will continue to have monthly telecons until Issaquah, we will focus on finalizing the design of papers targeting C++23, starting with “P2636: References to ranges should always be viewable” and “P2406: Fix counted_iterator interaction with input iterators”.

I would like to take this opportunity to thank our expert attendees for their hard work in both authoring papers and reviewing them thoroughly.

I would also like to thank our assistant chair, minute-takers, technical staff, and others who helped greatly during the meeting, which allowed a productive hybrid meeting.

SG10: Feature test (Revzin/Wakely)

Did not meet.

SG12: Undefined and unspecified behavior (Dos Reis/Ballman/Wakely)

Did not meet.

SG14: Games & low latency (Wong)

Did not meet.

SG19: Machine Learning (Wong/Reverdy)

Did not meet.

SG15: Tooling (Spencer/Boeckel)

SG15 met for a day and a half, mostly discussing tooling issues related to modules. Made progress on shared understanding on how different tooling things works. We looked at a paper on creating IS for tooling. This went to EWG, and they were supportive. They asked us to figure out what it would look like and come back. We're considering making a second IS parallel to the primary C++ IS.

SG18: LEWG Incubator (Baker/Liber)

Did not meet.

SG16: Unicode (Honermann/Brett)

Did not meet.

SG17: EWG Incubator (Ballo/Keane)

Did not meet.

SG20: Education (van Winkel)

Did not meet.

SG21: Contracts (Spicer/Doumler)

SG21 "Contracts" had a hybrid meeting on Friday morning.

We first reviewed [P2695R0](#) "A proposed plan for Contracts in C++" and adopted this proposal as SG21's official roadmap for getting a Contracts MVP into C++26.

We then discussed [P2680R0](#) "Contracts for C++: Prioritizing Safety" and took a poll on whether to encourage further work in this direction. The poll fell short of reaching consensus, but there are still many open questions about this proposal, and significant interest from SG21 members in getting the answers. We therefore decided to have a telecon in December 2022 dedicated to P2680 to give the author a chance to address those questions. We have since collated these questions into a paper, [P2700R0](#).

We will also have another SG21 telecon between now and Issaquah to discuss [P2659R1](#) "A Proposal to Publish a Technical Specification for Contracts", which we did not have time for in Kona.

SG22: C/C++ Liason (Ballman)

Did not meet.

ABI Group (Vandevoorde)

Did not meet.

SSRG: Safety/Security (Dos Reis)

Did not meet.

Admin (Finkel)

Did not meet.

Evolution (Bastien)

National Body Comments

- 33 National Body Comments Total
 - 16 Closed as Duplicates, and confirmed via EWG vote
- 17 National Body Comments Reviewed
 - 5 Rejected: FR-027-006, US 21-053, US 14-043, US 12-041, FR-023-007
 - 9 Accepted & Forwarded a resolution to CWG: FR-026-018, GB-059, GB-051, US 16-045, DE-046, CA-065, GB-048, GB-055, DE-038
 - 1 Forwarded to LEWG with EWG Blessing: GB-089
 - 2 Needs to come back to EWG (Will see in Telecons/Issaquah): FR-025-017, US 8-036

9 Papers Forwarded to CWG Targeting C++26

- P1061R0 Structured Bindings can introduce a Pack
- P2361R0 Unevaluated string literals
- P2014R0 aligned allocation of coroutine frames
- P0609R1 Attributes for Structured Bindings
- P2558R0 Add @, \$, and ` to the basic character set (Steve Downey)
- P2621R0 UB? In my Lexer?

- P2686R0 Updated wording and implementation experience for P1481 (constexpr structured bindings)
- P1967R0 #embed - a simple, scannable preprocessor-based resource acquisition method
- P2593R0 Allowing static_assert(false): To be forwarded after Issaquah unless a better proposal comes up

4 Papers Reviewed and Forwarded to LEWG

- P2641R0 Checking if a union alternative is active
- P2546R0 Debugging Support
- P0876R5 fiber_context - fibers without scheduler
- P2141R0 Aggregates are named tuples

13 Papers provided feedback/encouragement

- P0901R2 Size feedback in operator new
- P2677R0 Reconsidering concepts in-place syntax
- Pattern Matching:
 - P2211R0 Exhaustiveness Checking for Pattern Matching
 - P2169R0 A Nice Placeholder With No Name
 - P2392R2 Pattern matching using is and as
 - P2688R0 Pattern Matching Discussion for Kona 2022
- P2561R1 An error propagation operator
- P2656R0 C++ Ecosystem International Standard
- Pointer Provenance
 - P2547R0 Language support for customisable functions
 - P2188R0 Zap the Zap: Pointers should just be bags of bits
 - P2434R0 Nondeterministic pointer provenance
- P2632R0 A plan for better template meta programming facilities in C++26
- P2671R0 Syntax choices for generalized pack declaration and usage

3 Papers Without Consensus to continue

- P2669R0 Deprecate changing kind of names in class template specializations
- P2174R0 Compound Literals
- P2381R0 Pattern Matching with Exception Handling

CWG Issue Reviewed

- Paper Needed: CWG2463 Conditions for trivially copyable classes

EWG Issues Backlog Cleanup

- Reviewed 20 Core Issues assigned to EWG
 - 2 Marked Resolved
 - 1 Marked as "Needs a Paper"
 - 17 Closed as "Not A Defect"

Additional Presentations

- Evening Session on: The Future of C++
- The Val object model

Thank you to all our scribes, presenters, authors, and attendees (both remote and in person!).

Library Evolution (Adelstein Leibach/Fracassi/Craig)

Work Done At 2022-11 Kona:

C++23 NB Comments & Issues 19

C++23 Papers 12

C++26 & TS Papers 18

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Total 49

C++23:

- Ranges
- Formatting
- Deprecation
- barrier
- start_lifetime_as

C++26 and TSes:

- Linear Algebra
- mdspan
- function_ref
- Static and SBO vectors
- RCU
- Hazard Pointers
- Library Fundamentals v3 TS
- Concurrency v2 TS

Don't worry!

If you missed any discussions, you can still vote electronically.

P2650R11: 2022-11 Library Evolution Electronic Polls

Backlog:

C++23 NB Comments & Issues 1 + 1 received

C++23 Papers 0

C++26 & TS Papers 4 + 6 received

—

Total 5 + 7 received

Major Upcoming Topics:

- Senders (forwarded, waiting for additional papers)
- Networking (in study group, waiting for updates)
- Numerics (in study group)
- Linear Algebra
- Hive (author not available until 2022-02)
- SIMD (received at 2022-11)

Leadership:

Three staff run each session:

Chair: leads discussion, manages time, determines consensus.

Admin: supports chair, manages queue, attendees & chat.
Minute Taker: records minutes.
Staff on duty rotate. Constantly expanding and training staffing.

Hybrid:

~40% remote, ~60% in-person.

Logitech Group system worked well. Two screens was too complicated. Screen sharing to Zoom worked best. Hard to track both Mattermost and Zoom chat.

Schedule:

Remote attendees were always on-time. In-person attendees were often delayed. Lack of quorum forced last-minute schedule changes. 8AM start, 15 minute breaks, 90 minute lunch are impractical. We should align schedule with reality.

Suggestion:

9AM start, 5PM end, 30 minute breaks, 120 minute lunch.

Remote:

Library Evolution telecons and mailing list reviews will continue. Telecons may scale down to twice a month in 2023. Library Evolution electronic polling will continue. We will electronic poll subjects discussed at hybrid meetings.

2022-02 exception: C++23 subjects won't be electronically polled.

Guidelines:

Develop and formalize more guidelines.

- Library design guidelines:
 - Concepts vs traits.
 - requires vs Mandates:.
 - Conversions between types.
 - Error handling.
- Procedure guidelines:
 - Consensus/voting for different kinds of decisions.
 - Paper checklist.
 - Paper sizing.
 - Prioritization.

Thank you.

Core (Maurer)

CWG processed NB comments this week,

2 duplicate, 2 rejected, 28 accepted = 34 total.

CWG also discussed priority 1 issues and prioritized new issues.

There is a plan to hold three teleconferences between now and the Issaquah meeting.

Note that straw polls have been partially split to allow independent voting.

CWG 2645 edits library wording and was approved by LWG.

CWG 2602 was retracted.

Library (Wakely)

LWG met all week. We had a smallish group, 6-12 people, with a mix of in-person and remote. We had a joint session with SG9 with slightly higher attendance, although there's a lot of overlap in LWG regulars and SG9 regulars anyway.

The audio set up worked great all week, helped by a small room so nobody was too far from the microphones.

Jeff chaired the room all week and Dietmar took minutes ALL week.

I mostly just edited XML and updated issues overnight, with help from Daniel. Thanks very much to both Jeff and Dietmar.

We processed everything sent to us and have also cleared a lot of our backlog.

Not all NB comments are in the polls today; some were processed but aren't ready for plenary yet, some are still waiting for LEWG to formally send them to us.

Some stats, possibly not 100% accurate.

18 NB comments are ready to ship in Kona or at the next meeting.

4 NB comments in rejected state.

8 still being worked on. They've all been looked at but are waiting for LEWG to finish polls, or for new resolutions to be drafted.

We generally opened a new library issue for NB comments, and processed them as issues for the group to review and vote on, rather than writing papers to resolve them as we did for most of the C++20 ballot comments.

The issues that resolve NB comments are in the second issues poll.

The first issues poll is for normal LWG issues that were Ready (or Tentatively Ready) before the meeting started.

After finishing NB comment work we also saw a number of papers for C++26 and held the inaugural P2300 review session. If you missed that, there will be MANY more p2300 review sessions (that's senders and receivers).

We processed four Concurrency TS papers, three forwarded to plenary for polling today. Not sending the Concurrency TS to DTS ballot because we weren't asked to.

SG1 and LEWG should let us know when they want that to happen.

Direction Group (Orr)

Did not meet.

CWG polls

1. Accept as Defect Reports all issues except 2635 and 2602 in [P2709R0](#) (Core Language Working Group "ready" Issues for the November, 2022 meeting) and apply their proposed resolutions to the C++ Working Paper.

No discussion.

No objection to unanimous consent.
Motion passes.

2. Accept as a Defect Report issue 2635 (Constrained structured bindings) in [P2709R0](#) (Core Language Working Group "ready" Issues for the November, 2022 meeting) and apply its proposed resolution to the C++ Working Paper.

No discussion.
Objections in the room.

Herb Sutter : every expert in the global directory can vote. If you are here as a guest or you are not sure you are in the global directory, please do not vote.

In favor : 58 (39 in person + 19 online)
Opposed : 4 (4 in person + 0 online)
Abstain : 17 (8 in person + 9 online)

Motion passes.

3. Accept as Defect Reports all issues except 2615, 2639, 2640, 2652, 2653, 2654, and 2538 in [P2710R0](#) (Core Language Working Group NB comment resolutions for the November, 2022 meeting) and apply their proposed resolution to the C++ Working Paper, resolving the NB comments as indicated.

No discussion.
No objection to unanimous consent.
Motion passes.

4. Apply the proposed resolutions of issues 2615, 2639, 2640, 2652, and 2653 in [P2710R0](#) (Core Language Working Group NB comment resolutions for the November, 2022 meeting) to the C++ Working Paper, resolving the NB comments as indicated.

No discussion.
No objection to unanimous consent.
Motion passes.

5. Accept as a Defect Report issue 2654 (Un-deprecation of compound volatile assignments) in [P2710R0](#) (Core Language Working Group NB comment resolutions for the November, 2022 meeting) and apply its proposed resolution to the C++ Working Paper, resolving NB comment US 16-045.

No discussion.
Objections in the room.

In favor : 53 (42 in person + 11 online)

Opposed : 10 (2 in person + 8 online)
Abstain : 25 (14 in person + 11 online)

Herb Sutter polls for NB positions against this motion.
None.

Motion passes.

6. Accept as a Defect Report issue 2538 (Can standard attributes be syntactically ignored?) in [P2710R0](#) (Core Language Working Group NB comment resolutions for the November, 2022 meeting) and apply its proposed resolution to the C++ Working Paper, resolving NB comment GB-055.

No discussion.
Objections in the room.

In favor : 57 (37 in person + 20 online)
Opposed : 8 (5 in person + 3 online)
Abstain : 20 (15 in person + 5 online)

Herb Sutter polls for NB positions against this motion.
France opposes. The comment has been filed and discussed internally before this meeting.

Herb Sutter : EWG, was this concern fully heard?
Erich Keane : yes.

Motion passes.

7. Apply the changes in [P2589R1](#) (static operator[]) to the C++ Working Paper, resolving NB comment CA-065.

No discussion.
No objection to unanimous consent.
Motion passes.

8. Accept as a Defect Report and apply the changes in [P2647R1](#) (Permitting static constexpr variables in constexpr functions) to the C++ Working Paper, resolving NB comment GB-048.

No discussion.
No objection to unanimous consent.
Motion passes.

9. Accept as a Defect Report and apply the changes in [P2564R3](#) (constexpr needs to propagate up) to the C++ Working Paper, resolving NB comment DE-046.

No discussion.
Objections in the room.

In favor : 66 (46 in person + 20 online)
Opposed : 0 (0 in person + 0 online)
Abstain : 21 (11 in person + 10 online)

Motion passes.

10. Accept as a Defect Report and apply the changes in [P2706R0](#) (Redundant specification for defaulted functions) to the C++ Working Paper, resolving NB comment US 26-061.

No discussion.
No objection to unanimous consent.
Motion passes.

11. Accept as a Defect Report and apply the changes in [P2615R1](#) (Meaningful exports) to the C++ Working Paper, resolving NB comment GB-059.

Davis Herring : this addresses another NB comment.
Jens Maurer : we do not vote on duplicate NB comments. The NB comment number is only for general information.
No objection to unanimous consent.
Motion passes.

12. Apply the changes in [P2718R0](#) (Wording for [P2644R1](#) Fix for Range-based for Loop) to the C++ Working Paper, resolving NB comment DE-038.

Ville Voutilainen : is there deployment experience of this change?
Erich Keane : EWG asked about implementation experience and there was none.
Jens Meurer: CWG didn't say there was implementation experience

Herb Sutter : was implementability discussed ?
Jens Maurer : CWG discussed the mechanics of implementation, and no concern was raised.
Erich Keane: EWG asked explicitly about implementation concern, and none was raised.

Objections in the room.

In favor : 72 (48 in person + 24 online)
Opposed : 4 (1 in person + 3 online)
Abstain : 13 (7 in person + 6 online)

Motion passes.

LWG polls

Library Fundamentals Technical Specification polls

1. Apply the changes for all Tentatively Ready issues in [P2705R0](#) (C++ Library Fundamentals TS Ready Issues to be moved in Kona, Nov. 2022) to the Working Paper for C++ Extensions for Library Fundamentals, version 3.

No discussion.
No objection to unanimous consent.
Motion passes.

2. Apply the changes in [P0987R2](#) [↗](#) (`polymorphic_allocator<>` instead of type-erasure) to the Working Paper for C++ Extensions for Library Fundamentals, version 3.

No discussion.
No objection to unanimous consent.
Motion passes.

3. Apply the changes in [P2708R1](#) (No Further Fundamentals TSes) to the Working Paper for C++ Extensions for Library Fundamentals, version 3.

No discussion.
No objection to unanimous consent.
Motion passes.

Concurrency Technical Specification polls

4. Apply the changes in [P2396R1](#) (Concurrency TS fixes) to the Working Paper for Extensions for C++ for Concurrency, version 2.

No discussion.
No objection to unanimous consent.
Motion passes.

5. Apply the changes in [P1478R8](#) (Byte-wise atomic memcpy) to the Working Paper for Extensions for C++ for Concurrency, version 2.

No discussion.
No objection to unanimous consent.
Motion passes.

6. Apply the changes in [P1202R5](#) (Asymmetric Fences) to the Working Paper for Extensions for

C++ for Concurrency, version 2.

No discussion.
No objection to unanimous consent.
Motion passes.

C++23 polls

7. Apply the changes for all Ready and Tentatively Ready issues in [P2703R0](#) (C++ Standard Library Ready Issues to be moved in Kona, Nov. 2022) to the C++ working paper.

No discussion.
No objection to unanimous consent.
Motion passes.

8. Apply the changes for all Immediate issues in [P2704R0](#) (C++ Standard Library Immediate Issues to be moved in Kona, Nov. 2022) to the C++ working paper.

No discussion.
No objection to unanimous consent.
Motion passes.

9. Apply the changes in [P2602R2](#) (Poison Pills are Too Toxic) to the C++ working paper. This addresses ballot comment US 49-111.

Herb Sutter : please use descriptive paper titles.
No objection to unanimous consent.
Motion passes.

10. Apply the changes in [P2167R3](#) (Improved Proposed Wording for LWG 2114 (contextually convertible to `bool`)) to the C++ working paper. This addresses ballot comment US 32-073.

No discussion.
No objection to unanimous consent.
Motion passes.

11. Apply the changes in [P2539R4](#) (Should the output of `std::print` to a terminal be synchronized with the underlying stream?) to the C++ working paper. This addresses ballot comment US 58-123 (and duplicates US 59-124 and FR-001-019).

No discussion.
No objection to unanimous consent.
Motion passes.

12. Apply the changes in [P1264R2](#) (Revising the wording of stream input operations) to the C++ working paper. This partially addresses ballot comment FR-018-004.

No discussion.
No objection to unanimous consent.
Motion passes.

13. Apply the changes in [P2505R5](#) (Monadic Functions for `std::expected`) to the C++ working paper. This addresses ballot comments GB-093, US 36-091, US 35-092, and FR-011-009.

No discussion.
No objection to unanimous consent.
Motion passes.

14. Apply the changes in [P2696R0](#) (Introduce *Cpp17Swappable* as additional convenience requirements) to the C++ working paper.

No discussion.
No objection to unanimous consent.
Motion passes.

WG21 Polls

Poll 1

Appoint a review committee composed of Jonathan Wakely, Alisdair Meredith and Michael Hava to approve the correctness of the Working Paper for C++ Extensions for Library Fundamentals, version 3 as modified by the polls approved at this meeting, and direct the Convener to transmit the approved updated Working Paper ~~for publication~~ to PDTS ballot.

Jens Maurer : poll has been amended to say “to PDTS ballot” rather than “for publication”.

No objection to unanimous consent.
Motion passes.

8. Closing activities

8.1 Issues delayed until today

Inbal Levi presents thank you slides.

Rogar Orr : this was a very successful hybrid event. Thank you to everyone who helped make it so.

8.2 INCITS C++ motions, if any

INCITS business.

9. Plans for the future (INCITS C++)

9.1. Next and following meetings

2023-2-6/11: Issaquah, WA, USA (N4925)

Gabriel Dos Reis : Is it possible that INCITS will veto this meeting?

John Spicer : In theory, it's possible, but it's highly unlikely.

Herb Sutter : This should be just a formality. We had the same poll for this meeting

Daniel Garcia : When will we know it's definitely in Issaquah ?

Herb Suter : We know now. The contract has been signed.

(tentative) 2023-06-12 to 17: Varna, Bulgaria; VMware, Chaos Group

Mark Zeren : We have tentative dates. I don't expect that to change. We will have more information soon.

2023-11-06 to 11: Kona, HI, USA; Standard C++ Foundation

Herb Sutter : Let me know if you are interested in hosting a meeting in 2024

9.2. Mailings

Note: These are the closest regular mailings and not special pre/post meeting mailings.

2022-12-15: Post-Kona

2023-01-15: Pre-Issaquah

Hal Finkel : If you are here and have not signed an attendance sheet, please sign it. I'm stepping down as chair of Admin Group, please welcome Nevin Liber as the new chair. We decided not to have an admin meeting this week. Tom Honermann isn't here and we wanted to discuss Mattermost. There will still be a November mailing.

If you are online and haven't signed the doodle poll, please sign it.

Nathan Meyers: I can't sign the doodle poll retroactively.

Hal Finkel : That shouldn't be a problem, let me know if you need proof of attendance.

Herb Sutter: Thank you to Tom and everyone else who helped kick off Mattermost. How many are comfortable to say attendees are expected to use Mattermost ?
(many hands raised)

Herb Sutter: Are there any objections to saying people should have access to Mattermost ?
(10 hands raised)

Hubert Tong : the two questions are not clear. There's a difference between having access to Mattermost and expecting people to follow it.

Inbal Levi : Mattermost was really helpful in finding people when we needed them to be in the room.

Herb Sutter : Is there anyone who objects to saying we should be using Mattermost for chats, rather than Zoom ?

John Spicer : That decision should be up to the chairs.

LWG : uses mattermost almost exclusively because zoom chat wasn't zooming in properly

Peter Brett : zoom is better for clarifying who is speaking.

Nevin Liber : we have to figure out what we want to get out of mattermost

10. Adjournment (INCITS C++ motion)

Meeting adjourned at 9:49 AM GMT-10.

11. Attendance

First Name	Last Name	Representing	Type of attendance
Dave	Abrahams	ANSI (United States)	Face-to-Face
Michael	Adams	SCC (Canada)	Virtual (online web conference)
Bryce	Adelstein Lelbach	ANSI (United States)	Face-to-Face
Arian	Ajdari	DIN (Germany)	Virtual (online web conference)
Juan	Alday	ANSI (United States)	Face-to-Face
Parsa	Amini	ANSI (United States)	Virtual (online web conference)
Olga	Arkipova	ANSI (United States)	Virtual (online web conference)
Ruslan	Arutyunyan	ANSI (United States)	Virtual (online web conference)
Billy	Baker	ANSI (United States)	Face-to-Face
Lewis	Baker	ANSI (United States)	Face-to-Face
Aaron	Ballman	ANSI (United States)	Virtual (online web conference)
Shanawaz	Basith	ANSI (United States)	Face-to-Face
Jean-Francois	Bastien	SCC (Canada)	Face-to-Face
Joshua	Berne	ANSI (United States)	Face-to-Face
Brian	Bi	ANSI (United States)	Face-to-Face
Frank	Birbacher	ANSI (United States)	Face-to-Face

Ben	Boeckel	ANSI (United States)	Virtual (online web conference)
Hans	Boehm	ANSI (United States)	Face-to-Face
Nemanja	Boric	ANSI (United States)	Face-to-Face
Peter	Brett	BSI (United Kingdom)	Virtual (online web conference)
Gonzalo	Brito Gadeschi	ANSI (United States)	Face-to-Face
Bret	Brown	ANSI (United States)	Face-to-Face
Jorg	Brown	ANSI (United States)	Face-to-Face
Walter E	Brown	ANSI (United States)	Virtual (online web conference)
Matthew	Butler	ANSI (United States)	Virtual (online web conference)
Sebastian	Büttner	ANSI (United States)	Virtual (online web conference)
Matt	Calabrese	ANSI (United States)	Face-to-Face
Chandler	Carruth	ANSI (United States)	Virtual (online web conference)
Casey	Carter	ANSI (United States)	Virtual (online web conference)
Jonathan	Caves	ANSI (United States)	Face-to-Face
Wyatt	Childers	ANSI (United States)	Face-to-Face
Philip	Craig	BSI (United Kingdom)	Face-to-Face
Benjamin	Craig	ANSI (United States)	Virtual (online web conference)
Joshua	Cranmer	ANSI (United States)	Virtual (online web conference)
Guy	Davidson	BSI (United Kingdom)	Face-to-Face
Gabriel	Dos Reis	AFNOR (France)	Face-to-Face
Robert	Douglas	ANSI (United States)	Face-to-Face
Timur	Doumler	BSI (United Kingdom)	Face-to-Face
Steve	Downey	ANSI (United States)	Face-to-Face
Hana	Dusíková	UNMZ (Czech Republic)	Virtual (online web conference)
Daniela	Engert	ANSI (United States)	Virtual (online web conference)
Andreas	Fertig	DIN (Germany)	Face-to-Face
Jake	Fevold	ANSI (United States)	Face-to-Face
Hal	Finkel	ISO/IEC JTC 1/SC 22/WG 21	Face-to-Face
Marco	Foco	UNI (Italy)	Virtual (online web conference)
Fabio	Fracassi	DIN (Germany)	Face-to-Face
Jose Daniel	Garcia Sanchez	UNE (Spain)	Face-to-Face
Michael	Garland	ANSI (United States)	Virtual (online web conference)

Mungo	Gill	NSAI (Ireland)	Virtual (online web conference)
Olivier	Giroux	ANSI (United States)	Face-to-Face
David	Goldblatt	ANSI (United States)	Virtual (online web conference)
Nathaniel	Goodspeed	ANSI (United States)	Face-to-Face
Charles-Henri	Gros	ANSI (United States)	Face-to-Face
Bernhard Manfred	Gruber	SNV (Switzerland)	Virtual (online web conference)
Bengt	Gustafsson	SIS (Sweden)	Face-to-Face
Pablo	Halpern	ANSI (United States)	Face-to-Face
Hannes	Hauswedell	IST (Iceland)	Face-to-Face
Michael Florian	Hava	ASI (Austria)	Face-to-Face
Barry E	Hedquist	ANSI (United States)	Virtual (online web conference)
Davis	Herring	ANSI (United States)	Virtual (online web conference)
Howard	Hinnant	ANSI (United States)	Virtual (online web conference)
Mark	Hoemmen	ANSI (United States)	Virtual (online web conference)
Tom	Honermann	ANSI (United States)	Virtual (online web conference)
Lee	Howes	ANSI (United States)	Virtual (online web conference)
Nicolai	Josuttis	DIN (Germany)	Virtual (online web conference)
Shoaib	Kamil	ANSI (United States)	Virtual (online web conference)
Tomasz	Kamiński	AFNOR (France)	Virtual (online web conference)
Erich	Keane	ANSI (United States)	Face-to-Face
Ronan	Keryell	ANSI (United States)	Face-to-Face
Rostislav	Khlebnikov	ANSI (United States)	Face-to-Face
Thomas	Köppe	ANSI (United States)	Face-to-Face
Elias	Kosunen	SFS (Finland)	Virtual (online web conference)
Matthias	Kretz	DIN (Germany)	Face-to-Face
Andrzej	Krzemieński	PKN (Poland)	Virtual (online web conference)
Dietmar	Kuhl	ANSI (United States)	Face-to-Face
Peter	Kulczycki	ASI (Austria)	Virtual (online web conference)
Zach	Laine	ANSI (United States)	Face-to-Face
John	Lakos	ANSI (United States)	Face-to-Face
Damian	Lebrun-Grandié	ANSI (United States)	Face-to-Face
Inbal	Levi	SII (Israel)	Face-to-Face

Nevin	Liber	ANSI (United States)	Face-to-Face
Lisa	Lippincott	ANSI (United States)	Face-to-Face
Bruno	Lopes	ANSI (United States)	Virtual (online web conference)
Colin	MacLean	ANSI (United States)	Face-to-Face
Wesley	Maness	ANSI (United States)	Face-to-Face
ADAM	Martin	ANSI (United States)	Face-to-Face
Jens	Maurer	ANSI (United States)	Face-to-Face
Paul	McKenney	ANSI (United States)	Face-to-Face
Christof	Meerwald	ASI (Austria)	Face-to-Face
Jeffrey	Mendelsohn	ANSI (United States)	Face-to-Face
Alisdair	Meredith	ANSI (United States)	Face-to-Face
Maged	Michael	ANSI (United States)	Face-to-Face
William	Miller	ANSI (United States)	Face-to-Face
Nicolas	Morales	ANSI (United States)	Face-to-Face
René Ferdinand Rivera	Morell	ANSI (United States)	Virtual (online web conference)
Sergei	Murzin	ANSI (United States)	Virtual (online web conference)
Nathan	Myers	ANSI (United States)	Face-to-Face
Darius	Neațu	ANSI (United States)	Virtual (online web conference)
Eric	Niebler	ANSI (United States)	Virtual (online web conference)
Gor	Nishanov	ANSI (United States)	Face-to-Face
David	Olsen	ANSI (United States)	Virtual (online web conference)
Roger	Orr	BSI (United Kingdom)	Face-to-Face
Nathan	Owen	ANSI (United States)	Face-to-Face
Michael	Park	SCC (Canada)	Face-to-Face
Fernando	Pelliccioni		Virtual (online web conference)
Paul	Preney	SCC (Canada)	Virtual (online web conference)
Mateusz	Pusz	PKN (Poland)	Face-to-Face
Nina Dinka	Ranns	BSI (United Kingdom)	Face-to-Face
Dan	Raviv	SII (Israel)	Virtual (online web conference)
Barry	Revzin	ANSI (United States)	Face-to-Face
Alex	Riegler	ANSI (United States)	Face-to-Face
Jean-Paul	Rigault	AFNOR (France)	Virtual (online web conference)

Thomas	Rodgers	ANSI (United States)	Face-to-Face
Daniel	Ruoso	ANSI (United States)	Face-to-Face
Ben	Saks	ANSI (United States)	Face-to-Face
Iain	Sandoe	BSI (United Kingdom)	Face-to-Face
David	Sankel	ANSI (United States)	Virtual (online web conference)
Stephen	Schurr	ANSI (United States)	Face-to-Face
Thomas	Scogland	ANSI (United States)	Face-to-Face
Kirk	Shoop	ANSI (United States)	Face-to-Face
Nathan	Sidwell	BSI (United Kingdom)	Virtual (online web conference)
Mikael	Simberg	SNV (Switzerland)	Virtual (online web conference)
Jeff	Snyder	BSI (United Kingdom)	Face-to-Face
Tim	Song	ANSI (United States)	Face-to-Face
Michael	Spencer	ANSI (United States)	Face-to-Face
Michael	Spertus	ANSI (United States)	Face-to-Face
John	Spicer	ANSI (United States)	Face-to-Face
David	Stone	ANSI (United States)	Face-to-Face
Bjarne	Stroustrup	ANSI (United States)	Virtual (online web conference)
Herb	Sutter	ISO/IEC JTC 1/SC 22/WG 21	Face-to-Face
Doug	Teeple	ANSI (United States)	Face-to-Face
David	Tenty	SCC (Canada)	Virtual (online web conference)
Hubert	Tong	SCC (Canada)	Virtual (online web conference)
Christian	Trott	ANSI (United States)	Face-to-Face
Daveed	Vandevoorde	ANSI (United States)	Face-to-Face
David	Vitek	ANSI (United States)	Virtual (online web conference)
Michael	Vitrano	ANSI (United States)	Virtual (online web conference)
Alexandru	Voicu	ANSI (United States)	Virtual (online web conference)
Michael	Voss	ANSI (United States)	Face-to-Face
Ville	Voutilainen	SFS (Finland)	Virtual (online web conference)
Jonathan	Wakely	ISO/IEC JTC 1/SC 22/WG 21	Virtual (online web conference)
Kelly	Walker	ANSI (United States)	Virtual (online web conference)
Andreas	Weis	DIN (Germany)	Face-to-Face
Anthony	Williams	BSI (United Kingdom)	Virtual (online web conference)

Gerald (Jerry)	Williamson	ANSI (United States)	Face-to-Face
Michael	Wong	SCC (Canada)	Face-to-Face
Shafik	Yaghmour	ANSI (United States)	Virtual (online web conference)
Zhihao	Yuan	ANSI (United States)	Face-to-Face
Mark	Zeren	ANSI (United States)	Face-to-Face
Andrei	Zissu	SII (Israel)	Virtual (online web conference)
Victor	Zverovich	ANSI (United States)	Face-to-Face