

WG21 2016-11 Issaquah Minutes

ISO/IEC JTC1 SC22 WG21 N4623 – 2016-11-28

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Chair: Clark Nelson

1. Opening activities (Monday 9:00)

1.1 Opening comments, welcome from host (PL22.16)

Sutter welcomed everyone and explained the arrangements and room assignments.

1.2 Meeting guidelines (PL22.16)

Every participant is responsible for understanding and abiding by the [INCITS Antitrust Guidelines](#) and [Patent Policy](#) and the [ISO Code of Conduct](#).

1.3 Membership, voting rights, and procedures for the meeting (PL22.16)

The chair requested that prospective PL22.16 members inform the chair (Nelson) or vice-chair (Spicer) that they are present.

Sutter explained the membership and voting rights for INCITS members, and voting for ISO global directory members. Starting in this meeting, for Friday polls we will be returning to one vote per U.S. company. Although a U.S.-domiciled company may have many members listed in the ISO Global Directory, as we used to do each company will determine which of their representatives will cast their company's vote.

Spicer explained the attendance sheet rules and requested people adding themselves print their names clearly.

1.4 Introductions

Representatives from the following countries: US, UK, Spain, Finland, Canada, Germany, Netherlands, Bulgaria, Russia, and Switzerland.

Sutter had counted at least 105 attendees.

1.5 Agenda review and approval (PL22.16 motion)

Agenda is in a revision of N4608, on the wiki.

Wakely moved to adopt the agenda, Clow seconded.

Miller asked for clarification of the status of the Coroutines TS. Sutter said that attempting to advance it to NP should have been on the agenda, so the motion is to accept the agenda with that addition.

Approved by unanimous consent (for both WG21 and .16 polls).

1.6 Editor's reports, approval of working drafts

Sommerlad asked whether LFTSv2 was feature-complete, Nelson said that the approval is only for accepting the proposed working draft as presented, any additional changes would be discussed later during the week.

Smith explained that N4604 is the committee draft and N4606 is the working draft, the only difference is the cover sheet, they are otherwise identical. Smith said LWG 13 from the previous meeting had not been applied, but there is an NB comment to apply it and fix up the wording at this meeting.

Document	Editor's report	Prospective WD
C++ Standard	N4603	N4606
Library Fundamentals V2 TS	N4601	N4600
Modules TS	N4611	N4610
Networking TS	N4613	N4612

Approved by unanimous consent.

1.7 Approval of the minutes of the previous meetings (PL22.16 motion)

Meeting	Minutes
WG21 Oulu	N4597
PL22.16 Oulu	N4598
WG21 pre-Issaquah administrative telecon	N4615

Clow moved to accept the PL22.16 minutes, Alday seconded. Approved by unanimous consent.

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

Clow noted that the NB comments on the Library Fundamentals v2 TS are attached to the wiki. The TS was feature-complete after Kona, unless something critical is raised by an NB comment, but we are not aware of anything in that category.

3. WG progress reports and work plans for the week (Core, Evolution, Library, Library Evolution)

Miller reported that NB technical comments would be addressed. The editor has asked for guidance on a few NB editorial comments, and has prepared some proposed changes for Core to review. Core will also look at some TS work. No surprises in the schedule.

Wong reported on Voutilainen's behalf that EWG would be reviewing NB comments, many of which review previously considered material, and may be discussed in plenary. Papers for post-C++17 material will be given lower priority.

Clow reported that the goals are to make enough progress on NB comments to be able to finish them in Kona. Comments will be triaged at the start of the week, and then worked through. There are a few papers on new material, and relating to the CD, and also some ballot comments for LFTSv2. No evening sessions scheduled because the day will be spent issue processing, and so doing the same again in the evenings is likely to wear people out. Meredith asked about the chances of bringing the Networking TS to PDTS this meeting. Clow said it's possible.

Macintosh reported that LEWG's plan is the same as LWG's, to process comments and if there is time to look at some papers that have come in. Halpern asked how it is decided whether a ballot comment is an evolution matter, or for LWG. Macintosh and Clow said they would discuss it and any comments that LWG consider to be design issues would be sent to LEWG.

Miller noted that Maurer and Voutilainen had done a triage of comments, with a recommended categorisation whether a comment was for CWG or EWG. Miller requested that if people disagreed with the triage and thought a comment should be seen by CWG they would put it on their agenda.

4. New business requiring action by the committee

We have several CD comments recommending adding or removing features from C++17:

ES 4, US 2, Late5: concepts (all or part) ES 5, US 68: unified call syntax P0301R0 ES 7, US 5, US 69, RU 5, Late7, Late14: default comparisons P0221R2 (all or part) ES 1, US 65, Late13: remove inline variables (P0386R2) GB 44, FI 5: elementary string conversions P0067R4 US 18, US 70: remove dynamic exception specifications P0003R4 US 22, CA 11, Late11: std::byte P0298R1 ES 6, US 21, US 67, Late8, Late10: operator dot P0252R2

To determine early whether technical work in subgroups could improve consensus on the CD, for each of the above the convener will take the following poll:

"How many people have already studied the proposal(s) to adopt/remove feature X for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

ES 4, US 2, Late5: concepts (all or part)

"How many people have already studied the proposal(s) to adopt concepts for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

Opposed: 24

To gauge the total number of voting members, there were 22 not firmly opposed.

Will not increase consensus.

ES 5, US 68: unified call syntax P0301R0

"How many people have already studied the proposal(s) to adopt unified function call for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

Opposed: 31

Will not increase consensus.

ES 7, US 5, US 69, RU 5, Late7, Late14: default comparisons P0221R2 (all or part)

"How many people have already studied the proposal(s) to adopt default comparisons (P0221R2, in full or in part) for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

Opposed: 16

Might be worth discussing on the week, but would have an uphill battle to be approved.

ES 1, US 65, Late13: remove inline variables (P0386R2)

"How many people have already studied the proposal(s) to remove inline variables for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

Opposed: 29

Will not increase consensus.

Sutter noted that the previous polls were for features which had been previously considered and decided on, but the following polls were for features which were omitted due to time constraints, not technical matters. Clow that elementary string conversions were voted on in Oulu but due to some technical inconsistencies in the paper the feature was not added to the CD. An updated paper for string conversions was reviewed in Chicago and forwarded for a poll. Spicer noted that the operator-dot proposal was withdrawn, so no complete

GB 44, FI 5: elementary string conversions P0067R4

"How many people have already studied the proposal(s) to adopt elementary string conversions for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

Opposed: 1

Clow noted that exception specifications and `std::byte` were on the agenda previously but LWG did not have time to review them. The

US 18, US 70: remove dynamic exception specifications P0003R4

"How many people have already studied the proposal(s) to remove dynamic exception specifications for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

Opposed: 1

US 22, CA 11, Late11: `std::byte` P0298R1

"How many people have already studied the proposal(s) to adopt `std::byte` for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

Opposed: 2

ES 6, US 21, US 67, Late8, Late10: operator dot P0252R2

Clow noted that comment CA 13 is also relevant and objects to adopting it.

"How many people have already studied the proposal(s) to adopt operator-dot for C++17, and have already firmly decided that they are opposed to the proposed change in any form for C++17, and that nothing we could do during the week could persuade them otherwise?"

Opposed: 30

Will not increase consensus.

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

(Clarify rooms available for evening sessions)

Nelson played Maurer. Some horse-trading took place for rooms.

Evening sessions will take place for Numerics and Reflection, presumably in the Caterall room. Sutter asked for a show of hands for an SG13 evening session. Tuesday for Numerics (SG6), Wednesday for Input (SG13), Thursday for Reflection (SG7). Evening sessions will commence at 8pm.

There is an ISO C++ Foundation members meeting scheduled at 5:30 on Monday, interested parties are welcome.

Lunch is provided, served at 12 noon, sessions resume at 1pm rather than 1:30pm. Friday lunch will run until 2:30pm as in the agenda.

6. WG and SG sessions

The WG and SG chairs must arrange for any proposals to be written up in the form of a motion, and made available by 2:30 Friday.

7. Review of the meeting (Friday 2:30)

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

SG5: Transactional memory (Wong)

Did not meet, nothing to report.

SG6: Numerics (Crowl)

Met on Tuesday. Discussed the scope of SG6 and the Numbers TS. Sketched an outline. The plan is to assemble a number of proposals into a preliminary draft-to-be, for the group on before it goes to the wider group. Some talks on how to discuss infinities and NaNs and constexpr. Brown showed a paper on a Random TS and numeric traits for a future library.

SG7: Reflection (Carruth)

Met this week. Productive discussion reviewing the static reflection paper, which is getting into good shape. Gave feedback to the authors. Happy with the current paper as an initial draft of whatever ship vehicle EWG want it in. The SG prefers targetting a TS. Lots of ideas about how to structure other APIs on top of it but appears to be a good basis. Will soon start discussing with EWG how to proceed, and hope to discuss additional interesting APIs in Kona.

SG10: Feature test (Nelson)

Did not meet, no report.

SG12: Undefined and unspecified behavior (Dos Reis)

Did not meet, no report.

SG14: Games & low latency (Wong)

Had a meeting at CppCon, with 50-60 people. Reviewed ten papers. Ran out of time talking about meta issues. Most of those papers came to this meeting. Papers also progressing to LEWG.

Consensus is to do it again at CppCon next year, but will need a larger venue.

SG13

Met on Wednesday night, reviewed one paper and gave feedback.

SG1: Concurrency (Boehm)

Met all week. Started with an initial pass through the NB comments. For all the ones recognized as SG1 comments there is a plan. A couple ended up on the straw polls page. Regarding exceptions in parallel algorithms the behavior is still to terminate, but it's a property of the execution policy so could change in future for other policies. On the topic of `shared_ptr::unique()` the original suggestion was to clarify the memory ordering, but the final change is to deprecate the function and clarify that `shared_ptr::count()` has no synchronization guarantees.

There's a Parallelism TS2 which has been a draft for some time. Expect a few more things to be added such as execution contexts, then it will go to PDTS.

For Concurrency TS2 there are several pieces ready. Some progress on a unified executors proposal, which might end in a separate TS.

In the longer term considering merging the Parallelism and Concurrency Technical Specifications.

Several papers advanced to other groups, including synchronized ostream, FP atomics, atomic view, distributed counters, apply for `synchronized_value`, making `memory_order` a scoped enumeration, and cleaning up signal handlers.

Evolution (Voutilainen)

NB comment processing is complete, all triaged for evolution dealt with. Postponing Modules discussion to Kona, so implementors have more time for implementation experience and other people have a chance to participate. Also reviewed a number of other proposals, but no rush to advance them to Core.

Drew attention to one paper, P0352 (smart references through delegation) is an alternative to P0252, the current operator-dot wording. Both approaches will be discussed again in Kona.

There have been a number of suggestions to discuss overall directions and goals in Kona, concrete suggestions for that are welcome.

In summary, accomplished what was planned to be accomplished. One proposal to look at on Saturday, for a language change to help reflection. Material for next meetings likely to be increasingly future-oriented.

Library Evolution (Yasskin, MacIntosh)

Met everyday this week. Prioritized NB comments that had been directed to LEWG. In some cases both LEWG and LWG looked at the same comment, and for all of them decided it was LWG material.

Looked at approximately 85 NB comments, and disposed of around 30, either approving as-is or awaiting an upcoming paper, or rejected a smaller number, and redirected some to other groups.

Also found some time to look at papers for the next version of C++ after C++17 and gave feedback to those authors.

Core (Miller)

Met all week. First responsibility was processing NB comments from CD ballot. Relied heavily on the pre-meeting triage done by Maurer and Voutilainen. Looked at all comments directed to Core and also all Editorial comments on Core clauses. Also reviewed some additional C++17 features, mostly in response to NB comments, and one which was supposed to be seen by Core in Oulu but was missed (variadic using-declarations). Looked at some refinements to class template deduction, and `std::byte`, and removal of dynamic exception specifications. Those are all being moved at this meeting.

Also looked at several pieces of TS material with Core implications. Four issues for the Modules TS which are being resolved by motions at this meeting. It had been hoped to progress the Modules TS to PDTS at this meeting, but Core felt there are still some questions to be addressed. Will work hard between now and Kona to address those so progress can be made in Kona. Looked at the Concepts paper proposing to remove restrictions on requires expressions. Also advancing Coroutines to NWI and initial WP.

Moving a few resolved issues at this meeting, some which were resolved before the meeting and some resolved during the meeting in response to NB comments.

For NB comments, reviewed all editorial comments in the core clauses and agreed on responses with the editor. 23 comments addressed by motions at this meeting. 2 comments rejected. 4 referred to other groups. 7 looked at, but no response yet, so are planned for future action.

Ballo asked whether the Modules extensions are targetting the PDTS or for the future. Voutilainen responded they are for the future.

Clow asked if variadic alias declarations allow applying transformations to a pack to produce a new pack, Spicer explained it doesn't allow that.

Brown asked what to what extent the impact on the standard library of the core motions had been analyzed. Miller said Core had not considered the library impact, but the authors of papers with library impact brought the paper to LWG.

Tong requested a motion from the floor "Move that we direct the WG21 secretariat to prepare for the next mailing a record of response to the national body comments" Sutter said we certainly need to do that, but what happens is that the record of response is sent to ISO along with the new version of the document. Van Eerd explained that this would be useful for us to track the status of comments which had already been resolved. Clow said there was already a wiki for Kona, with a page that would list the status of all NB comments. Once the page is completed, if you think the status is wrong send a mail to the relevant working group chair. Sutter explained that WG21 does not follow Roberts rules and so doesn't accept motions from the floor, but that a tracking document

for the status of NB comments is a great idea, and requests for it should be directed to the group chairs. A live document such as a wiki page seems ideal. Miller explained that for previous CDs he had maintained a tracking document that mirrored the official record of response, but he was not planning to do that this time, and thought a wiki page would be a better way to track that. Core would be updating the wiki page within the next 3-4 days to reflect the outcome of this meeting and would continue to update it following telecons. Tong noted that not all members of NBs regularly attend meetings and don't visit the wiki, and requested something more public. Dawes said that this wasn't the first time administrative issues like this had come up, and the admin reflector was set up to avoid spending time discussing them in plenary. Voutilainen said that national bodies should either wait for the formal record of response, or send experts to the meetings. Sutter said that until a few years ago national bodies that submitted comments were required to participate.

Library (Clow)

LWG had a good week. Had four goals: review NB comments for the CD, resolve NB comments on LFTSv2, ??? and ???.

Started the week by triaging all comments. Sent some to LEWG, they sent some back. After triaging made a second pass through the ones that belonged in LWG, and are moving resolutions for about 40 of them. There are more that will be accepted with changes, and about 25 where there is no consensus for change. Also had about 50 issues for the Filesystem library, which a small group spent the entire week looking at.

Dawes reported the group had a really good week looking at the issues. There are no changes being moved yet, because a large number of the filesystem issues were inter-related and resolving any separately doesn't make sense, so they'll all be mailed together in Kona. One of the reasons it was a good week is that until now the filesystem library had had input from Windows and POSIX experts, but has now also received input from zOS experts. The specification had been designed with non-Windows and non-POSIX systems in mind, but based partly on guesswork and old memories. With input from zOS experts we can be far more certain that the spec is suitable for a wide range of filesystems. Had around 60 NB comments with no proposed wording. Rejected about 10, accepted 4 where wording was provided, and for 13 we are accepting with modifications after drafting our own resolutions. For others we know what we want and have assigned people to draft resolutions for Kona. Probably going to bring up four omnibus papers in Kona to resolve all the NB comments. There were also a number of late issues that weren't in the ballot comments, but we resolved about 4 in passing. Also reviewed the editorial comments, and met with LEWG to discuss design issues in a larger group. Thanked Herring, Josuttis, Liu, O'Neal, Plauger, and Wakely for participating in the filesystem review.

Clow also reported wording review on Technical Specifications. Ranges, Networking and Coroutines are all ready to proceed. Also resolved LFTSv2 comments and are ready to send it for publication. Also have some late comments and issue processing to be done on Saturday, and will hold a telecon before Kona.

Sutter reminded people of the voting procedures. Miller noted that the motions page had been updated so the Coroutines NWI would be moved by LWG not CWG.

CWG Motions

Motion 1 Move to accept as Defect Reports the issues in P0519R0 (Core Language "ready" issues) and apply their proposed resolutions to the C++ working paper.

Approved by unanimous consent.

Motion 2 Move to accept as Defect Reports the issues in P0520R0 (Core Language "tentatively ready" issues) and apply their proposed resolutions to the C++ working paper.

Approved by unanimous consent.

Motion 3 Move to accept Core Language issue 1343 as a Defect Report and apply the resolution in P0507R0 to the C++ working paper.

Herring asked if the definition of *constituent expression* is related to the definition of subexpression relevant to the ODR. Maurer said not directly, but they talk about the same concept, and are compatible.

Approved by unanimous consent.

Motion 4 Move to accept Core Language issue 150 as a Defect Report and apply the resolution in P0522R0 to the C++ working paper.

Approved by unanimous consent.

Motion 5 Move to apply to the C++ working paper the proposed wording in core clauses in P0003R5 ("Removing Deprecated Exception Specifications from C++17").

Miller explained that there are two motions for the same paper, but one part making the changes to the core and one to the language. Meredith expressed concern that not moving the change atomically would allow one to fail.

Approved by unanimous consent, and with acclamation.

Motion 6 Move to apply to the C++ working paper the proposed wording in P0490R0 ("Core language changes addressing National Body comments for CD C++17").

Approved by unanimous consent.

Motion 7 Move to apply to the C++ working paper the proposed wording in P0195R2 ("Pack expansions in using-declarations").

Josuttis asked if there had been any changes since Oulu. Smith reported some very minor wording tweaks.

Approved by unanimous consent.

Motion 8 Move to apply to the C++ working paper the proposed wording in P0512 ("Class

Template Argument Deduction Assorted NB resolution and issues").

Miller noted the proposal was P0512R0 but the motion title missed the revision number.

Approved by unanimous consent.

Motion 9 Move to apply to the C++ working paper the proposed core wording in P0298R2 ("A byte type definition").

Miller noted that the library parts of this proposal needed updating because of changes to the library clauses, where the underlying wording had changed. The motion is only to move the core parts. Maurer objected that this would leave dangling references from the core parts to non-existing library parts. Smith clarified that the changes to the library clauses were editorial, as the C library headers had been converted from tables to full synopses. As the editor he would be happy to apply the library changes, as they are not complicated. Maurer said the motion title was nonsensical, as it didn't make sense to move only the core parts. Josuttis asked if it was discussed in Library and Clow explained it was reviewed in Oulu on Saturday, and the edit conflicts were not known about until Friday morning in Issaquah. Plum suggested moving it all now and relying on the project editor to resolve the problems. Dawes said that if the editor could not apply the changes successfully he could and would reject the changes.

Josuttis asked if byte was a a fundamental type or a user-defined type in the library. Herring said it was a special type defined by the library but referred to in core wording, rather like `size_t`.

Amended the motion to remove the word "core" so that the whole paper would move.

Van Eerd expressed strong reservations with the proposal. Not with the type but with what he envisioned happening in future. In 25 years of using types called `byte` none of them behaved like this, so it wasn't standardizing existing practice. Feedback from the wider community has already expressed confusion. The intention is that this is not a number, so you can't use it for RGBA. Users who want a byte type will try to use this and find it isn't what they want. All his issues could be solved by renaming it. Sutter noted this was comment CA 11, and was discussed in LEWG with some Canadian experts present. Dos Reis noted other NB comments in support of the type. Coe reported that the LEWG discussion on it was brief, and minuted, and didn't have much of interest to discuss. Tong drew a parallel to `std::launder` which intentionally had a non-descriptive name so people would have to look it up before using it, but this type had a name that people did think they knew what it was, but would be surprised. Dos Reis said the behavior of this type corresponded precisely to the standard's concept of a byte. Sutter asked if this type was being used in exactly the places where the standard referred to a byte. Miller explained the problem as having multiple ways to talk about the concept of a byte as a unit of memory, where some places used `char` or `unsigned char`. The hope is that eventually all places could use `byte` but it's currently only used for some places. Dawes said that some users would be upset that they couldn't do arithmetic on `std::byte`, but that he had used something like it specifically where they wanted to forbid arithmetic, which had been popular and widely used.

Sutter said the name would not be bikeshedded in committee, and that if people wanted to vote No on the whole proposal because they didn't like the name, they could do that, but that the vote would only be to take the feature as a whole or not at all. No option to take it with a different name.

Tong noted that although it had been used in core wording for years that doesn't mean this definition is the common one most people would use.

Wakely asked if this was required to be added to `<cstddef>` only and not `<stddef.h>`. Meredith said it was exactly like `nullptr_t`.

Favor	Opposed	Abstain
24	15	11

Motion did not pass.

Sutter asked if anyone opposed would still be opposed with a different name. Edwards noted that adding this now would mean it was only in the working paper for six months before being in a standard, which would be a very short time for it to be visible to the community.

Tong asked if renaming could happen fast enough whether the motion could be brought again on Saturday. The chair and convenener said no.

Motion 10 Move to accept as Defect Reports the issues in P0500R0 and apply their proposed resolutions to the Modules TS working paper.

Approved by unanimous consent.

Motion 11 Move to apply to the Concepts TS working paper the proposed wording in P0266R2 ("Lifting Restrictions on `requires-Expressions`").

Garcia said the proposal gave a local solution that doesn't account for the big picture. It says that while the similar Concepts Lite code could be written today it would need to be written as a concept. It is funny that a proposal attempting to do something that is different to concepts is being applied to the Concepts TS. Sommerlad took the opposite meaning from the paper, that it simplifies the concept syntax. Brown explained that the TS did two things, one is to make concepts first-class citizens into the language, but in support of that it also adds the machinery of `requires` clauses. The way you use a concept is in a `requires` clause (even if not explicitly, by using the abbreviated forms). It is a fair characterization to say that a `requires` clause (of which a `requires` expression can be a part) is akin to what the library does today with `enable_if` expressions. So it can be used to remove overloads from being considered. They can be used even without concepts, and he would like to have `requires` expressions today even without concepts. The purpose of the paper is to remove a single sentence that allows defining a template in a single line instead of as a primary template and a specialization.

Voutilainen said this was to be applied to the TS WP, although there is no current New Work Item and no plan to do a new Concepts TS at this time.

Tong reported that people trying to use concepts were surprised by the limitation on `requires` expressions, and this lifted it, resolving items on the concepts issues list.

Garcia asked if the key concepts experts had been present for discussions. Voutilainen said they had been present in EWG. Dos Reis said Stroustrup had been present for discussions in Jacksonville and

voted strongly against this change. Garcia said that in a language with concepts he expected not to use `enable_if` so that a feature to help with `enable_if` wasn't useful.

Merrill reported that it is already supported by the GCC implementation, and that it seems like a sensible thing to do. It allows easier integration with `constexpr if`.

Carter reported experience using concepts without this, and that this feature would allow removing a couple of thousands of lines of code from the Ranges library implementation.

Favor	Opposed	Abstain
42	1	8

Motion passed.

LWG Motions

Motion 1 Move to modify the LFTS V2 working paper with the NB comment responses in N4616 (NB Responses PDTS 19568 2 Collated Comments).

Favor	Opposed	Abstain
35	0	12

Motion passed.

Motion 2 Move to modify the LFTS V2 working paper the proposed wording in P0253R1 (Fixing a design mistake in the searchers interface in Library Fundamentals).

Clow explained that this was supposed to move in Oulu but the minutes from that meeting recorded that the motion was only for the WP not the TS. This motion is to definitely apply it to the TS.

Approved by unanimous consent.

Motion 3 Move to appoint an editing committee composed of Marshall Clow, Geoffrey Romer, and Daniel Krüglér to approve the correctness of the LFTS V2 working paper as modified by the motions approved at this meeting, and to direct the Convener to transmit the approved updated working paper for publication.

Approved by unanimous consent.

Motion 4 Move to modify N4560 - Ranges TS by applying P0370R2 (the changed parts were reviewed at this meeting) and P0022R2 - Proxy Iterators for the Ranges Extensions (which was reviewed in Oulu) and P0441R0 - Merging Writable and MoveWritable(which was reviewed this week).

Van Eerd asked whether these three papers needed to be moved together due to being interrelated, or could have been moved as separate motions.

Approved by unanimous consent.

Motion 5 Move to appoint an editing committee composed of Eric Niebler, Casey Carter and Marshall Clow to approve the correctness of the Ranges working paper as modified by the motions approved at this meeting, and to direct the Convener to transmit the approved updated working paper for PDTS ballot.

Halpern asked whether the Ranges TS was dependent on the Concepts TS, which Clow confirmed to be the case. Dos Reis said it was dependent on the Concepts TS, not the Concepts working draft.

Approved by unanimous consent.

Motion 6 Move to modify N4612 - Networking TS by applying P0405R0 (reviewed in Chicago) and P0423R0 (Variable templates for Networking TS traits; reviewed in Chicago).

Approved by unanimous consent.

Motion 7 Move to appoint an editing committee composed of Jonathan Wakely, Chris Kohlhoff and Lars Gullik Bjønnes to approve the correctness of the Networking TS working paper as modified by the motions approved at this meeting, and to direct the Convener to transmit the approved updated working paper for PDTS ballot.

Approved by unanimous consent.

Motion 8 Move to direct the convener to request a new work item for a Technical Specification on C++ Extensions for Coroutines and create a working paper with P0057R7 ("Wording for Coroutines") as its initial content.

Josuttis asked what the status of competing proposals was. Voutilainen said this was the only proposal mature enough for a TS.

Favor	Opposed	Abstain
42	2	8

Motion passed.

Motion 9 Move to appoint an editing committee composed of Geoffrey Romer, Dinka Ranns, and Gor Nishanov, and James Dennett to approve the correctness of the Coroutines TS working paper as modified by the motions approved at this meeting, and to direct the Convener to transmit the approved updated working paper for PDTS ballot.

Maurer, Miller and Spicer noted that CWG was not aware this would be going to PDTS at this meeting.

Favor	Opposed	Abstain
20	10	21

Carruth explained opposition was in order to allow Core to do an additional review with the knowledge that it was going for PDTS ballot. Vollmann explained opposition was due to a desire to see two approaches in the TS and it currently only contains one. Spicer explained opposition was

procedural due to Core not being aware the plan was to go to PDTS ballot.

Sutter asked if it was likely there would still be objections in Kona if Core did a review. Miller said if Core had time to review it and nobody objected it should be able to proceed.

Riegel said he'd like to see a runtime library part of the TS, so that an OS without a ready-made runtime for it would be able to experiment with it.

Maurer expressed concerns about the breadth of the interface between the Core and Library parts of the proposal, which were expressed in the Core review. He had understood that those ideas would at least be investigated before going to PDTS.

Motion did not pass.

Sutter suggested looking at it again in Kona.

Motion 10 Move to apply to the C++ working paper all of the issues (one) in P0304R1 (C++ Standard Library Issues Resolved Directly In Issaquah). This is issue #2770, which is the only P1 issue remaining.

Approved by unanimous consent.

Motion 11 Move to apply to the C++ working paper all of the issues in P0165r3 (C++ Standard Library Issues to be moved in Issaquah) with the exception of 2768 (which has been pulled back) and 2570, 2745, 2750, and 2733 (which apply to the LFTS)

Approved by unanimous consent.

Motion 12: Response to US 81 and RU 4 Move to apply to the C++ working paper the proposed wording in P0426R1 (Constexpr for `std::char_traits`).

Coe noted discussion in LEWG about whether it was implementable. Smith said he had an implementation about to land in Clang trunk.

Approved by unanimous consent.

Motion 13: Response to US 80 and FI 6 Move to apply to the C++ working paper the proposed wording in P0403R1 (Literal suffixes for `basic_string_view`).

Dawes asked if Jeffrey Yasskin was onboard with this. Clow said he'd discussed it a long time ago, not sure of his current position.

Approved by unanimous consent.

Motion 14: Response to GB 50 Move to apply to the C++ working paper the proposed wording in P0505R0 (Wording for GB 50 - constexpr for chrono).

Approved by unanimous consent.

Motion 15: Response to CA 16 Move to apply to the C++ working paper the proposed wording in P0418R2 (Fail or succeed: there is no atomic lattice). This also resolves LWG issue 2445.

Bastien explained that this relaxed some unclear restrictions on `compare_exchange`

Approved by unanimous consent.

Motion 16: Response to GB 58 Move to apply to the C++ working paper the proposed wording in P0508R0 (Wording for GB 58 - structured bindings for `node_handles`).

Approved by unanimous consent.

Motion 17: Response to GB 68, US 155, US 154 Move to apply to the C++ working paper the proposed wording in P0503R0 (Correcting library usage of "literal type").

Approved by unanimous consent.

Motion 18: Response to FI 19 Move to apply to the C++ working paper the proposed wording in P0414R2 (Merging `shared_ptr` changes from Library Fundamentals to C++17) and P0497R0 (Fixes to `shared_ptr` support for arrays).

Meredith re-expressed his dislike of the feature but that we had already decided to accept the feature at a previous meeting and he had no new information.

Approved by unanimous consent.

Motion 19: Response to CH 3A Move to apply to the C++ working paper the proposed wording in P0504R0 (Revisiting in-place tag types for any/optional/variant).

Approved by unanimous consent.

Motion 20: Response to US 18, US 70 and GB 43 Move to apply to the C++ working paper the proposed wording in P0003R5 (Removing Deprecated Exception Specifications from C++17).

Tong noted there was also a Canadian comment that is resolved by this.

Approved by unanimous consent.

Motion 21: Response to US 112, US 115, US 116, US 117, US 120, US 181, FI 22, CH 3B, CH 4, CH 5, CH 6, and CH 8 Move to apply to the C++ working paper the proposed wording in P0510R0 (Disallowing references, incomplete types, arrays, and empty variants).

Approved by unanimous consent.

Motion 22: Response to GB 62 Move to apply to the C++ working paper the proposed wording in P0516R0 (Clarify That `shared_future`'s Copy Operations have Wide Contracts).

Approved by unanimous consent.

Motion 23: Response to GB 41 and GB 42 Move to apply to the C++ working paper the proposed wording in P0509R1 (Updating “Restrictions on exception handling”).

Maurer said the wording is not exactly what the Core language would say, but it's good enough.

Approved by unanimous consent.

Motion 24: Response to US 15, US 16, US 167, US 168, US 169, US 170, CA 17 Move to apply to the C++ working paper the proposed wording in P0502R0 (Throwing out of a parallel algorithm terminates—but how?).

Approved by unanimous consent.

Motion 25: Response to US 163 Move to apply to the C++ working paper the proposed wording in P0517R0 (Make `future_error` Constructible).

Approved by unanimous consent.

Motion 26: Response to CA 14 Move to apply to the C++ working paper the proposed wording in P0521R0 (`shared_ptr use_count/unique`)).

Favor	Opposed	Abstain
36	0	12

Motion 27: Response to FI 15, GB 69 Move to apply to the C++ working paper the proposed wording in P0513R0 (Poisoning the Hash). Also resolves LWG 2791 and LWG 2543.

Approved by unanimous consent.

Motion 28: Response to FI 5 Move to apply to the C++ working paper the proposed wording in P0067R5 (Elementary string conversions, revision 5)

Approved by unanimous consent.

Motion 29 Move to apply to the C++ working paper the proposed wording in P0435R1 (Resolving LWG Issues re `common_type`). Resolves LWG issues 2465 and 2763.

Dos Reis asked if we had a common language for `common_type`? Clow said this allowed users to hook into `common_type` with their own specializations.

Approved by unanimous consent.

Josuttis requested that the record show that this was one of the most constructive meetings he'd been to and that it was an opinion shared by several others.

Van Eerd thanked the host. Brown moved to thank the convener, the officers, the project editors, the main editor and TS editors, the working group chairs, the scribes, the scribes, the scribes, the people who take the notes, the people who spent untold hours writing papers for us to consume, and those who spent more hours consuming them, and the people who pay for us to attend these meetings

and their spouses too. Approved by acclamation.

8. WG and SG sessions continue (Saturday 8:30)

9. Closing activities (Saturday 1:00)

9.1 Confirm WG21 consensus to adopt proposals (“consent agenda”, approved without discussion if no new information)

No new information. Confirmed consensus to adopt all proposals.

9.2 PL22.16 motions, if any

None.

9.3 Issues delayed until today

None.

10. Plans for the future (PL22.16)

10.1 Next and following meetings

- 2017-02-27/03-04: Kona, HI, US (N4573)
- 2017-07-10/15: Toronto, ON, CA (N4607)
- 2017-11-06/11: Albuquerque, NM

Sutter thanks the attendees on telecons and the Chicago library meeting and asked if there were plans for more meetings. Miller gave notice there would be telecons, probably three or four before Kona, on dates to be decided. Core are behind in dealing with issues so will focus on trying to reduce the outstanding issues list before Kona. Clow plans to have two telecons December and one in January, with no dates set.

Wong reported that SG14 continues to have monthly telecons, next is Dec 14 2-4pm Eastern. Usually the second Wednesday of the month.

10.2 Mailings

- 2016-11-28: Post-Issaquah
- 2017-02-06: Pre-Kona

Deadline for papers is 14:00 UTC.

11. Adjournment (PL22.16 motion)

Library and Core will both be continuing for a few more hours today to process issues.

Thanked the host.

Keane moved to adjourn, Carruth seconded. Approved by unanimous consent.

12. Attendance

The column "WG21" designates official PL22.16 or WG21 status ("P", "A", "E", "M")

The column "PL22.16" indicates organizations eligible to vote by "V", and advisory membership by "A".

PL22.16 members

Company / Organization	NB	Representative	WG21	PL22.16
AMD		Brian Sumner	A	V
Apple		Duncan Exon Smith	A	V
Apple	CA	JF Bastien	A	A
Argonne National Lab		Hal Finkel	P	V
Bloomberg		John Lakos	P	V
Bloomberg	UK	Alisdair Meredith	A	
Bloomberg	UK	Dietmar Kühl	A	
Bloomberg		David Sankel	A	
Brown		Walter E. Brown	E	
Cisco Systems		Lars Gullik Bjønnes	P	V
Dinkumware		P.J. Plauger	P	V
Dinkumware		Tana Plauger	A	
Edison Design Group		John H. Spicer	P	V
Edison Design Group		Daveed Vandevoorde	A	
Edison Design Group		Jens Maurer	A	
Edison Design Group		William M. Miller	A	
Facebook		Louis Brandy	P	V
Facebook		Eric Niebler	A	
Facebook		Lee Howes	A	
Facebook		Maged Michael	A	
FlightSafety International		Billy Baker	P	V
Google		Chandler Carruth	A	V
Google		Geoffrey Romer	A	
Google		Hans Boehm	A	

Company / Organization	NB	Representative	WG21	PL22.16
Google		James Dennett	A	
Google	UK	Richard Smith	A	
Google		Thomas Koeppe		
Google		Titus Winters	A	
Google		Tim Shen		
GreenWireSoft		Juan Alday	P	V
IBM		Paul E. McKenney	P	V
IBM	CA	Hubert Tong	A	
IBM		Shuo Feng Liu		
Intel		Clark Nelson	P	V
Intel		Pablo Halpern	A	
Intel		Erich Keane		
KCG Holdings		Thomas Rodgers	A	V
Lawrence Berkeley		Bryce Adelstein-Lelbach	P	V
Lawrence Livermore		James Frederick Reus	P	V
Los Alamos National Laboratory		Li-Ta Lo	P	V
Los Alamos National Laboratory		S. Davis Herring	A	
Louisiana State University		Hartmut Kaiser	P	V
Louisiana State University		Agustin Berge	A	
Microsoft		Jonathan Caves	P	V
Microsoft		Gabriel Dos Reis	A	
Microsoft		Herb Sutter	A	
Microsoft		Stephan T. Lavavej	A	
Microsoft		Gor Nishanov	A	
Microsoft		Andrew Pardoe	A	
Microsoft		Casey Carter	A	
Microsoft		Billy R. O'Neal III		
Microsoft		Adam Foxman	A	
NVidia		Jared Hoberock	A	V
NVidia		Michael Garland	A	
NVidia		Olivier Giroux	A	
NVidia		Zach Laine		
Oracle		Paolo Carlini	P	V
Oracle		Maxim Kartashev	A	
Perennial		Barry Hedquist	P	V
Perennial		Beman G. Dawes	A	
Perennial		Lawrence Crowl	A	
Plum Hall		Thomas Plum	P	V
Plum Hall	FI	Ville Voutilainen	A	

Company / Organization	NB	Representative	WG21	PL22.16
Programming Research Group		Christof Meerwald	A	V
Qualcomm		Marshall Clow	P	V
Red Hat		Jason Merrill	P	V
Red Hat	UK	Jonathan Wakely	A	
Red Hat		Torvald Riegel	A	
Ripple Labs		Howard E. Hinnant	P	V
Ripple Labs		Scott Schurr	A	
Sandia National Labs		Carter Edwards	P	V
Sandia National Labs		David Hollman		
Seymour		Bill Seymour	P	V
Sony Computer Entertainment		Sunil Srivastava	P	V
Sony Computer Entertainment		Michael Spencer	A	
Stellar Science		Kelly Walker	P	V
Symantec		Mike Spertus	P	V
Synopsys		Tom Honermann	A	A
Synopsys		Michael Price	A	

Other WG21 members

Company / Organization	NB	Representative	WG21
CERN/FNAL	BG	Vasil Vasilev	M
Codeplay	CA	Michael Wong	M
Mozilla	CA	Botond Ballo	M
Christie Digital	CA	Tony Van Eerd	M
Université de Sherbrooke	CA	Patrice Roy	M
Vollmann Engineering	CH	Detlef Vollmann	M
HSR	CH	Peter Sommerlad	M
	DE	Fabio Fracassi	M
University Carlos III	ES	J. Daniel García	M
CryptoTec	FI	Mikael Kilpeläinen	M
	RU	Anton Polukhin	M
Symantec	UK	Dinka Ranns	M
PDT Partners	UK	Jeff Snyder	M
	UK	Jonathan Coe	M
Maven Securities	UK	Mathias Gaunard	M
Credit Suisse	UK	Neil Horlock	M
	UK	Roger Orr	M

Participating non-members

Company / Organization	NB	Representative
MongoDB		Adam Martin
Markit		David Stone
		Faisal Vali
Blizzard		James Touton
University of Nice		Jean-Paul Rigault
Tanium		Lisa Lippincott
Amazon		Louis Dionne
Ferrari		Marco Arena
Visma		Marius Banciza
		Matt Calabrese
Bob Taco Industries		Michael McLaughlin
Mail Ru Group		Mikhail Maltsev
LindenLab		Nat Goodspeed
MongoDB		Nathan Myers
		Nicolai Josuttis
Roundhouse Consulting		Pete Becker
Sparx Engineering		R. Ben Voight
Vevy Europe		Raffaele Rialdi
Xilinx		Ronan Keryell
Wargaming Seattle		Sean Middleditch
Adam Factory		Vanini Mirco
ARM		Will Deacon
		Zhihao Yuan