

Department I - C Plus Plus

Modern and Lucid C++ Advanced
for Professional Programmers

Week 13 - ISO C++ Standardization

Prof. Peter Sommerlad / Thomas Corbat
Rapperswil, 16.05.2019
FS2019



● International Organization for Standardization/International Engineering Consortium

- Joint Technology Conference 1
 - Information Technology
- Standards Committee 22
 - Programming Languages...
- Workgroup 21
 - C++

The screenshot shows a web interface for the ISO/IEC JTC 001/SC 22/WG 21 "C++" working group. The top navigation bar includes links for ISO Standards Development, ISOTC home, ISO/IEC JTC 001 "Informat...", ISO/IEC JTC 001/SC 22 "Pr...", and the current page, ISO/IEC JTC 001/SC 22/WG 21 "C++". The main content area has a header "ISO/IEC JTC 001/SC 22/WG 21 "C++"" with a "WG" icon. A "Navigation Menu" sidebar on the left lists: Committee Home, Child Committees, Committee Projects, User Guides, ISO Applications, My Committees, My Tasks, N-Documents List, Member List, Email to Secretary, Mail Archive, Committee News, and Committee Task List. The main content area features two sections: "Library" and "New Forums". The "Library" section contains a table with columns for Type, Name, Size, and a preview thumbnail. It lists several documents, including "ISO/IEC JTC 001/SC 22 "Programming languages, their environments and system software interfaces"" (Type SC), "ISO/IEC JTC 001/SC 22/WG 04 "COBOL"" (Type WG), "ISO/IEC JTC 001/SC 22/WG 05 "Fortran"" (Type WG), "ISO/IEC JTC 001/SC 22/WG 09 "Ada"" (Type WG), "ISO/IEC JTC 001/SC 22/WG 14 "C"" (Type WG), "ISO/IEC JTC 001/SC 22/WG 17 "Prolog"" (Type WG), "ISO/IEC JTC 001/SC 22/WG 21 "C++"" (Type WG), and "ISO/IEC JTC 001/SC 22/WG 23 "Programming Language Vulnerabilities"" (Type WG). The "New Forums" section shows a single entry: "ISO/IEC JTC 001/SC 22/WG 21 Forum". Below these sections is a "Structure" section with a table showing the organizational structure of the committee.

Type	Name
Tc	ISO/IEC JTC 001 "Information technology"
Wg	ISO/IEC JTC 001/JAG "JTC 1 Advisory Group"
Sc	ISO/IEC JTC 001/SC 02 "Coded character sets"
Wg	ISO/IEC JTC 001/SC 02/WG 02 "Universal coded character set"
	ISO/IEC JTC 001/SC 06 "Telecommunications and information"

WG21 working area

www.open-std.org/JTC1/SC22/WG21/ 

Welcome to the official home of

ISO IEC JTC1/SC22/WG21 - The C++ Standards Committee - ISOCPP

2016-04-01: [standards](#) | [projects](#) | [papers](#) | [mailings](#) | [internals](#) | [meetings](#) | [contacts](#)

News 2016-04-01: The deadline for the next mailing is 2016-05-30

News 2016-04-01: The [2016-03 mailing](#) is available (15000 kB tar.gz, [zip 15000 kB](#)), [individual papers](#)

News 2016-02-18: The [C++ Standard Library Issues List](#) (Revision 96) is available ([.zip](#))

News 2016-02-18: The [C++ Standard Core Language Issues List](#) (Revision 96) is available ([.zip](#))

News 2013-05-24: The [CD](#) for the new C++14 standard is released

“mailings” - official
working documents

[ISO/IEC JTC1/SC22/WG21](#) is the international standardization working group for the programming language C++.

Published [standards and technical reports](#) include:

- [ISO/IEC 14882:2011 Programming Language C++ - draft](#)
- [ISO/IEC TR 18015:2006 C++ Performance - draft TR](#)

Work on [projects](#) and their [milestones](#) include:

- [ISO/IEC 14882: Programming Language C++ - latest publicly available draft](#)
- [ISO/IEC TR 24733: C++ decimal floating point arithmetic extensions - draft](#)
- [ISO/IEC 29124: C++ Special Math Functions - draft](#)

Other information:

- [Some further information on C++ standardization - isocpp.org](#)
- [C++ Standard Core Issues List](#)
- [C++ Standard Core Language Issues List](#)
- [C++ Standard Library Issues List](#)
- [C++ Standard Library Issues List](#)
- [C++ Standard Evolution Issues List](#)
- [WG papers](#)
- [WG mailings](#)
- [File System TS Issues List](#)
- [ISO terminology standard ISO/IEC 2382](#)
- [WG21 business plan and convener's report 2011](#)
- Information on past and future [WG meetings](#)
- [Contacts: membership, liaisons and related work](#)
- [ISO/IEC TR 24772 Information technology -- Programming languages -- Guidance to avoiding vulnerabilities in programming languages through language selection and use](#)
- [WG internal information](#) (For members of the C++ standardization committee)

If you want further information, or want to participate, please contact your national [member body](#) or one of the [contact addresses](#) of the WG.

2016-04-01: [standards](#) | [projects](#) | [papers](#) | [mailings](#) | [internals](#) | [meetings](#) | [contacts](#)

- **NXXXX: official documents**

- standard drafts
- protocols, agendas, info
- old: proposals

- **SD-n : standing documents**

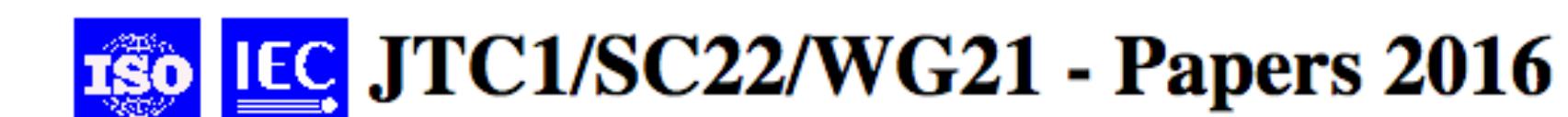
- list of members, documents

- **PXXXXRn : proposals**

- subsequently numbered proposals
 - including release numbers to keep track
 - used to be Nxxxx papers with new numbers per release

- **Issue lists (Bug reports)**

- small fixes directly, otherwise Pxxxx paper



mailing2016-02

WG21 Number	Title	Author	Document Date	Mailing Date	Previous Version	Subgroup	Di
SD-1	2016 PL22.16/WG21 document list	John Spicer	2016-02-17	2016-02			
2016-02 pre-Jacksonville							
N4568	PL22.16/WG21 draft agenda: 29 Feb-05 Mar 2016, Jacksonville, FL/US	Clark Nelson	2015-12-01	2016-02			
N4569	Proposed Ranges TS working draft	Eric Niebler	2016-02-15	2016-02			
N4570	Oulu Meeting Information	Ville Voutilainen	2016-01-08	2016-02			
N4571	2016-11 Issaquah meeting information	Herb Sutter	2016-01-21	2016-02			
N4572	WG21 telecon meeting: Pre-Jacksonville	Herb Sutter	2016-01-27	2016-02			
N4573	2017-02 Kona WG21 Meeting Information	Thomas Plum	2016-02-02	2016-02			
N4574	Withdrawn						
N4575	Networking TS Working Draft	Jonathan Wakely	2016-02-15	2016-02			
N4576	Networking TS Editor's Report	Jonathan Wakely	2016-02-15	2016-02			
N4577	Technical Specification for C++ Extensions for Concurrency	Artur Laksberg	2016-02-15	2016-02			
P0003R1	Removing Deprecated Exception Specifications from C++17	Alisdair Meredith	2016-02-09	2016-02	P0003R0	Core	
P0005R3	Adopt not_fn from Library Fundamentals 2 for C++17	Alisdair Meredith, Stephan T. Lavavej, Tomasz Kamiński	2016-11-10	2016-02	P0005R2	Library	
P0009R1	Polymorphic Multidimensional Array View	H. Carter Edwards, Christian Trott, Juan Alday, Jesse Perla, Mauro Bianco, Robin Maffeo, Ben Sander, Bryce Lelbach	2016-02-04	2016-02	P0009R0	Library Evolution, Evolution	



FEATURES

[Working Draft of the next standard](#)



[Current ISO C++ status](#)

[Upcoming ISO C++ meetings](#)

[Compiler conformance status](#)

ABOUT

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UPCOMING EVENTS

[C++ track @ NDC Oslo](#)
Jun 6-10, Oslo, Norway

[ISO C++ summer meeting \(agenda\)](#)
Jun 20-25, Oulu, Finland

[CppCon 2016](#)
Sep 18-23, Bellevue, WA, USA

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About

Standard C++ Foundation

Goals and Purpose

Standard C++ Foundation is a Washington 501(c)(6) not-for-profit organization whose purpose is to support the C++ software developer community and promote the understanding and use of modern Standard C++ on all compilers and platforms.

In particular, two near-term goals of that mission are:

1. To promote dissemination of correct and up-to-date information about modern C++.
2. To promote greater availability of high-quality C++ libraries, including both standard libraries (by reducing barriers to submitting and adopting libraries in Standard C++ itself) and community libraries (by having an organized, and ideally tool-supported, way for C++ developers to discover and use libraries).

The Foundation is funded by sponsor members, book royalties, CppCon proceeds, and in the future possibly other sources. It uses these funds primarily to assist with running WG21 meetings, fund the next year's CppCon, pay isocpp.org website development and maintenance expenses, and in the

Directors & Officers



Chandler Carruth
Treasurer

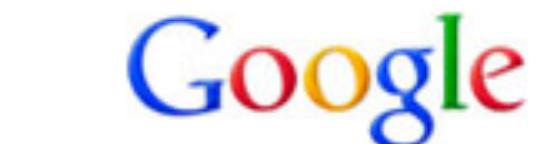


Beman Dawes
Secretary

Gold Members



Bjarne Stroustrup



Herb Sutter
President



Michael Wong
Vice President



Morgan Stanley

- Previous revisions took 9-11 years

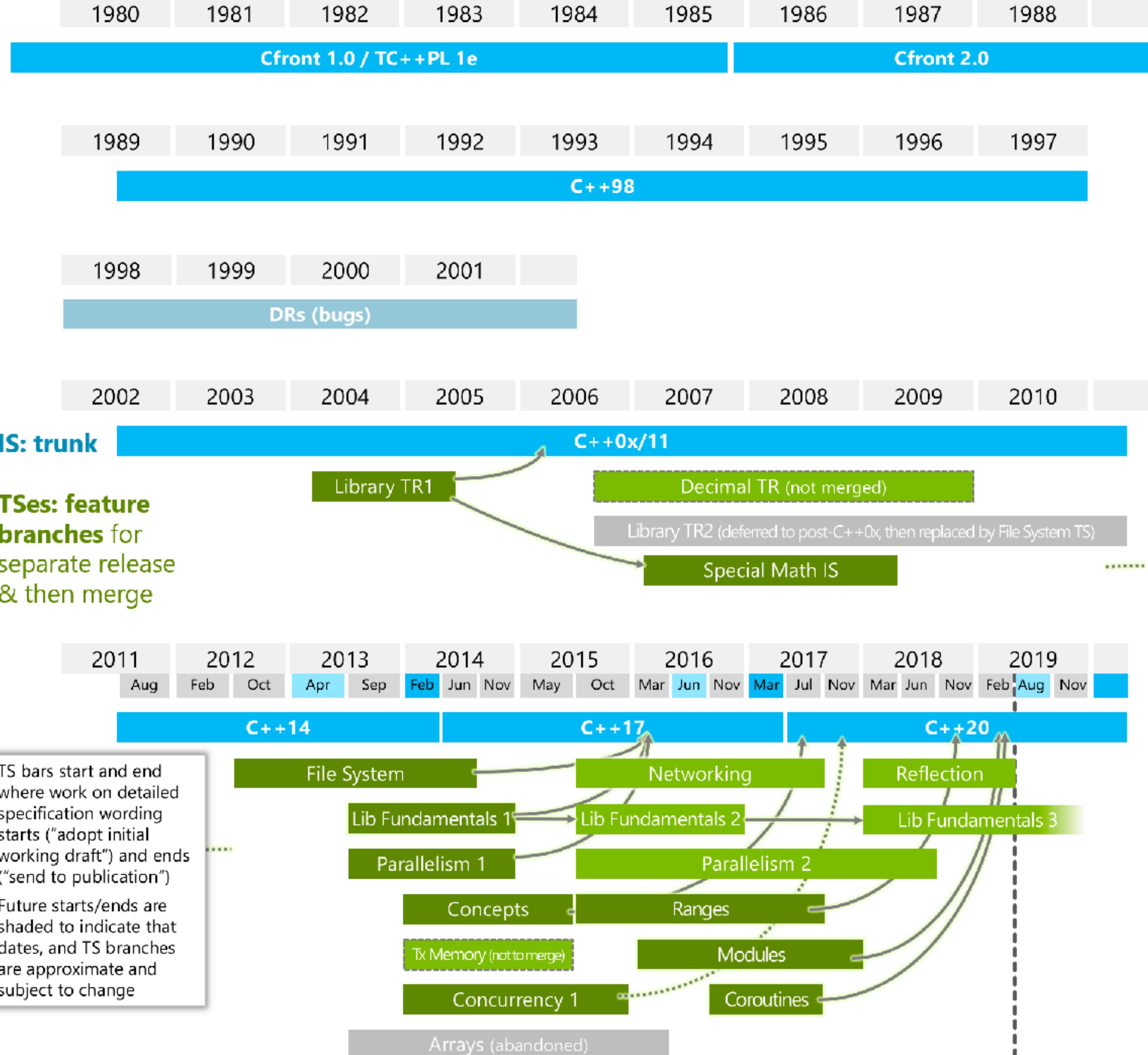
- C++03 was bug fix release

- New model after C++11

- fixed 3 year iterations
- variable content
- incremental

- 2-3 meetings p. year

- different locations
- 1-2 non-us typically
- 2010/14/18 at HSR Rappi



2018 ISO C++ Standardization Meeting in Rapperswil

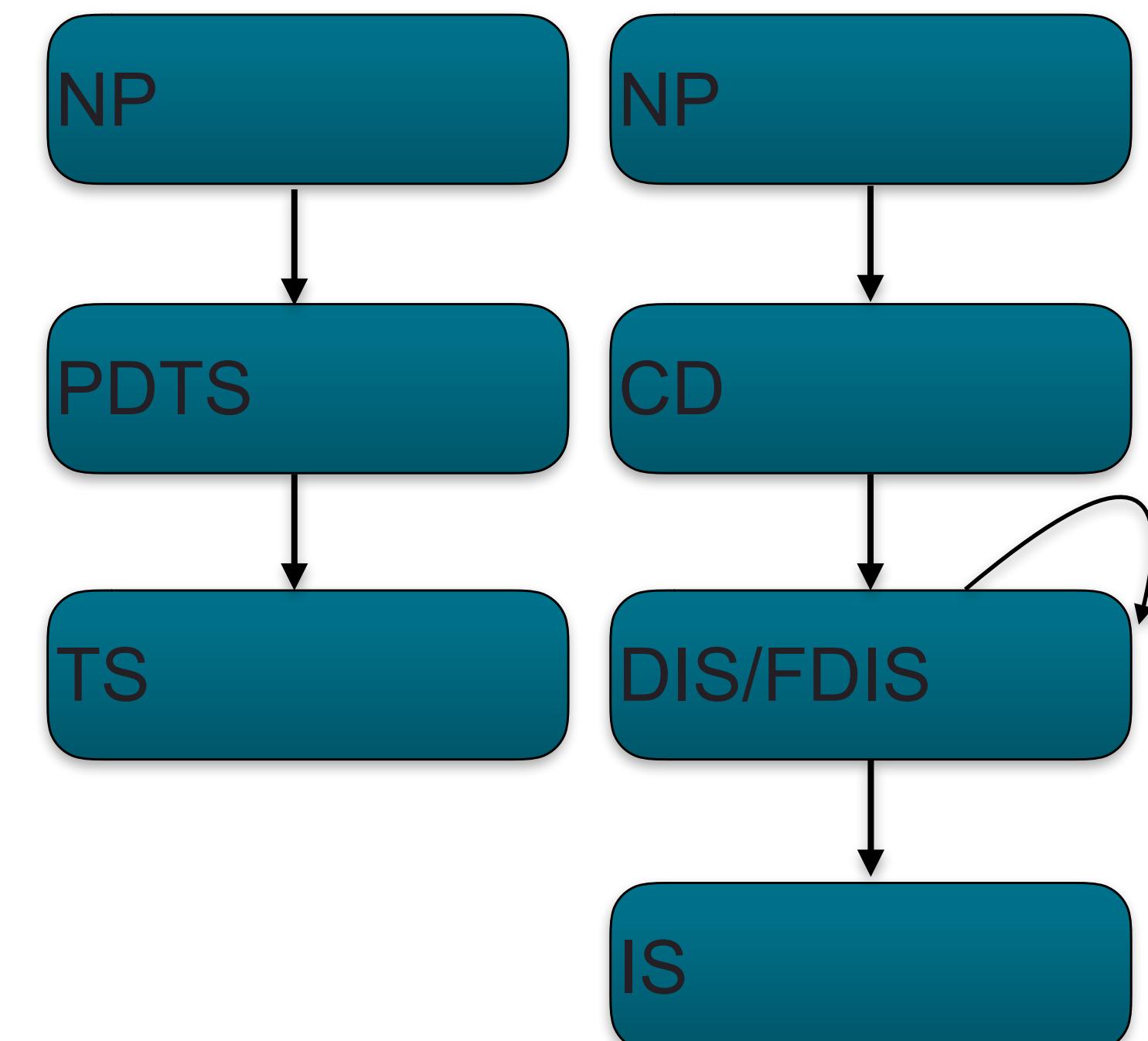
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Thematical study groups and TS (technical specifications)

8

Group	Proj#	Type	Title	Toronto	Albu- querque	Jackson- ville	Rapper-swi l	San Diego	Kona
				Jul 2017	Nov 2017	Mar 2018	Jun 2018	Nov 2018	Feb 2019
WG21	14882	IS	Programming Language C++	Publish					
LEWG	19568	TS	Library Fundamentals			NP			
EWG/LEWG	19569	TS	Arrays (abandoned)						
SG1, Concurrency	19570	TS	Parallelism		PDTS	Publish			
SG1, Concurrency	19571	TS	Concurrency						
SG1, Concurrency	22277	TS	Coroutines	Publish					
SG2, Modules	21544	TS	Modules	PDTS	Publish				
SG3, File System	18822	TS	File System						
SG4, Networking	19216	TS	Networking	Publish					
SG5, Tx Memory	19841	TS	Transactional Memory						
SG6, Numerics									
SG7, Compile-time pgm	tbd	TS	Reflection		NP	PDTS	Publish?		
SG8, Concepts	19217	TS	Concepts						
SG9, Ranges	21425	TS	Ranges	Publish					
SG10, Feature Test	SD-6	SD	Feature Testing Recommendations						
SG11, Databases									
SG12, UB & vulnerabilities									
SG13, HMI									
SG14, Low Latency									

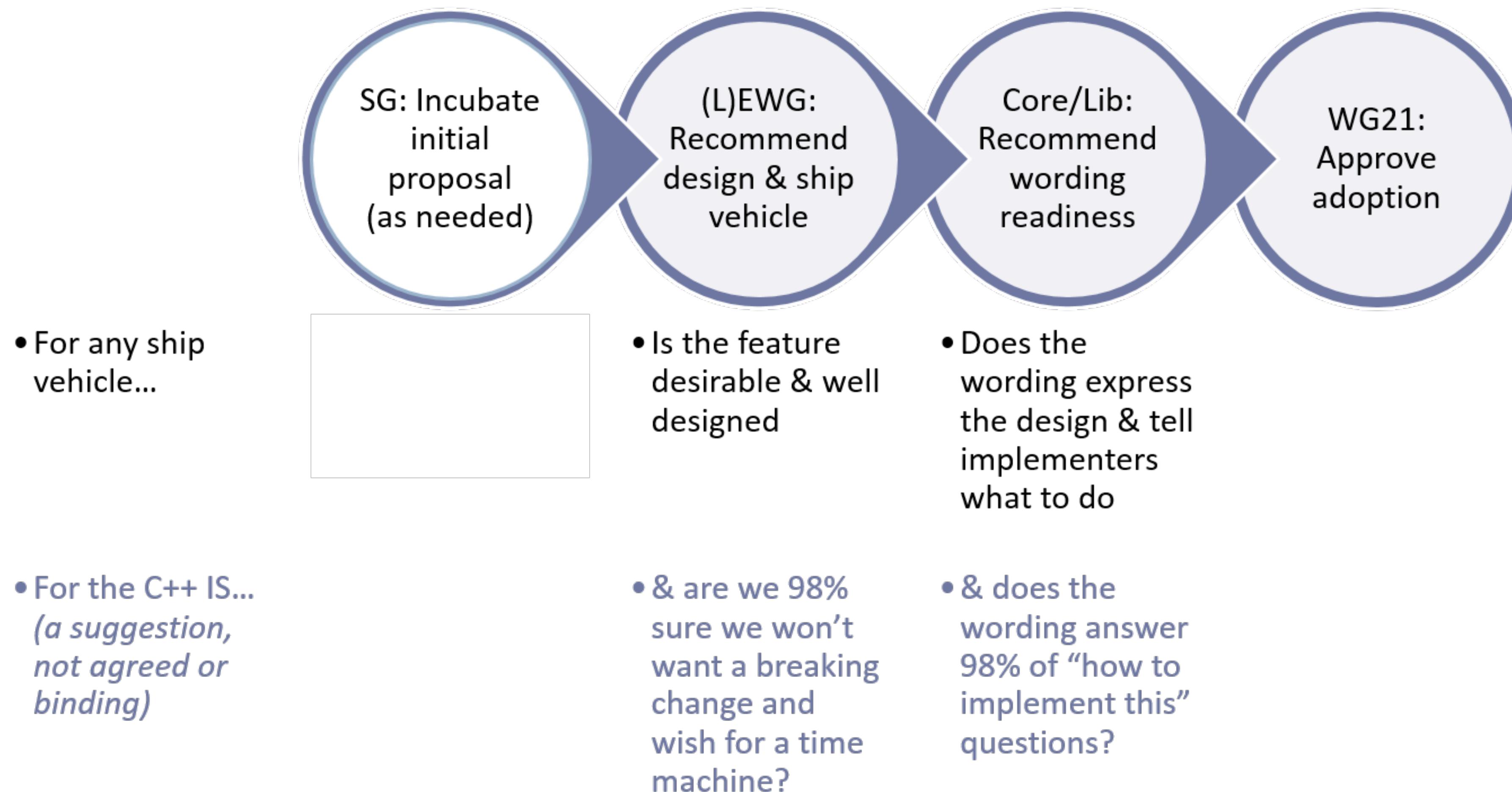


Stage	IS	TS	Level	Ballot Period	Requirements & Notes
10 Proposal	NP	NP	SC22	3 mo	5 NBs agree to actively participate
30 Committee	CD	PDTS	SC22	2, 3, or 4 mo 3-6 mo	Principal comment stage, 2/3 Yes majority
40 Enquiry	DIS	—	JTC1 / ITTF	3 mo	2/3 Yes, ≤ 1/4 No
50 Approval	FDIS	—	JTC1 / ITTF	2 mo	No comments, 2/3 Yes, ≤ 1/4 No

- **SG1, Concurrency:** Olivier Giroux (Nvidia).
 - * SG2, Modules.
 - * SG3, File System.
 - * SG4, Networking.
- **SG5, Transactional Memory:** Hans Boehm (Google).
- **SG6, Numerics:** Lawrence Crowl. Numerics topics, including but not limited to fixed point, decimal floating point, and fractions.
- **SG7, Compile-time programming:** Chandler Carruth (Google). Initially focused on compile-time reflection capabilities, then expanded to compile-time programming in general.
 - * SG8, Concepts.
 - * SG9, Ranges.
- **SG10, Feature Test:** John Spicer (Edison Design Group). Means for portable code to check whether a particular C++ product implements a feature yet, as we continue to extend the standard.
- * SG11, Databases. Database-related library interfaces.
- **SG12, UB & Vulnerabilities:** Gabriel Dos Reis (Microsoft). A systematic review to catalog cases of vulnerabilities and undefined/unspecified behavior in the standard, and recommend a coherent set of changes to define and/or specify the behavior. **Collaboration with ISO SC22/WG23**
- **SG13, HMI & I/O (Human/Machine Interface):** Roger Orr (BSI). Selected low-level output (e.g., graphics, audio) and input (e.g., keyboard, pointing) I/O primitives.
- **SG14, Game Development & Low Latency:** Michael Wong (Codeplay). Topics of interest to game developers and (other) low-latency programming requirements.
- **SG15, Tooling:** Bryce Adelstein Lelbach (NVIDIA). Topics related to creation of developer tools for standard C++, including but not limited to modules and package management.
- **SG16, Unicode:** Tom Honermann (Synopsis). **Topics related to Unicode text processing in C++.**
- **SG17, EWG Incubator:** JF Bastien (Apple). A pipeline stage in front of EWG for language proposals that aren't yet ready for EWG or that EWG does not yet have bandwidth to consider.
- **SG18, LEWG Incubator:** Bryce Adelstein Lelbach (NVIDIA). A pipeline stage in front of LEWG for library proposals that aren't yet ready for LEWG or that LEWG does not yet have bandwidth to consider.
- **SG19, Machine Learning:** Michael Wong (Codeplay). Address and improve on C++'s ability to support fast iteration, better support for array, matrix, linear algebra, in memory passing of data for computation, scaling, and graphing, as well as optimization for graph programming.
- **SG20, Education:** JC van Winkel. Produce guidance for modern course materials for C++ education.

- **Discuss idea on mailing list/group**
 - std-discussion (existing features) std-proposals (new features)
- **Write proposal (obtain pNNNN paper number and write and submit R0)**
 - Markdown-Support: <https://mpark.github.io/programming/2018/11/16/how-i-format-my-cpp-papers/>
- **LEWGI/EWGI (library - evolution working group incubator SG17/SG18)**
 - first screening and feedback
- **LEWG/EWG**
 - design feedback and evolution
- **LWG/CWG**
 - final wording
- **Committee Vote for inclusion in standard document draft or TS**

Requires good Marketing
for the feature, not only
technical merit.
Explain it over and over
again.



<https://isocpp.org/std/the-life-of-an-iso-proposal>

- **Several BIG language features (+ some smaller)**
 - PS: we will need 10 years to grasp and fix them
- **Concepts**
 - "enable_if" built into the language
- **Contracts**
 - `[[expects: ...]]`, `[[ensures: ...]]`, `[[assert: ...]]`
- **Coroutines**
 - `co_yield`, `co_await`, `co_return`
- **Modules**
 - `export`, `module`, `import`
- **Many big and small Library extensions**
- **Concepts**
 - also in library (for Ranges)
 - need a lot of work to replace older concepts
- **Ranges**
 - big! Pipes&Filters Syntax
- **Date & Time**
 - time zone
- **More, some by me (Peter S.)**
 - `osyncstream`,
 - may be: improved `stringstream`, `spanstream`

- **Networking TS**
- **Reflection TS**
- **Unicode (full support)**
- **Executors (Concurrency TS2)**
- **more Parallelism (Parallelism TS2)**
- **Compile-time Regular Expressions**
- ...