

# QIF 4.0 Development

Dr. Thomas Kramer

Thomas Kramer Consulting, LLC

QIF 4.0 Development Project Manager  
and Lead Modeler

Dr. Daniel Campbell, Capvidia  
Chair, QIF 4.0 Working Group

April 19, 2024



# Outline

---

- Personal introduction, Tom Kramer
- Timeline for finishing the QIF 4.0 standard
- How did we get here?
- Github repository qif-dev
- Development process
- Plusses and minuses of past progress
- Major changes from QIF 3.0
- Other changes from QIF 3.0
- What Else Will Be Added?
- QIF 3.0 to 4.0 Transition
- Quality control on XML schema model



# Personal Introduction, Tom Kramer

---

- Employed by IBM as 1401 programmer, 1961
- PhD in mathematics, Duke University, 1971
- National Research Council, 1971-1975
- US House of Reps Committee on Science and Tech 1975-1984
- NIST Guest Researcher 1984-2021
- helped develop and worked with STEP 1989-2006
- helped develop and worked with DMIS 1996-2011
- QIF developer 2010 --

# Timeline for finishing the QIF 4.0 Standard

---

- Text editing meeting – March 18
- Write new text and edit old – March 19 - July 24
- Stop Tech Development – July 31
- Clauses: Complete text editing – June 1- September 24
- Monolithic QIF 4.0 doc editing – June 1- September 31
- DMSC Standards Committee review, editing, vote – October 7 – 11
- Submit to ANSI – October 18
- ANSI request for public comment – October 25
- ANSI Public Review and Commentkickoff – 45 days, end December 9
- DMSC Respond to balloting – 10 days, end December 19
- ANSI processes balloting results – January 10, 2025
- DMSC publish ANSI/QIF 4.0 standard – January 31, 2025



# How did we get here?

---

- DMSC members in 2010: **Let's build a standard for computer-processable data in dimensional metrology.**
- Quality Information Framework formative meeting - 2010 IMTS
- QIF 1.0 standard 2013 – QIFPlans, QIFResults, Library (8)
- QIF 2.0 standard 2014 – added QIFProduct with MBD, QIFStatistics, QIFRules, QIFMeasurementResources, QIFDocument top level. Library (15)
- QIF 2.1 standard 2015 – XSLT added, github
- QIF 3.0 standard 2018 – Single document, signature added

# How did we get here? (2)

---

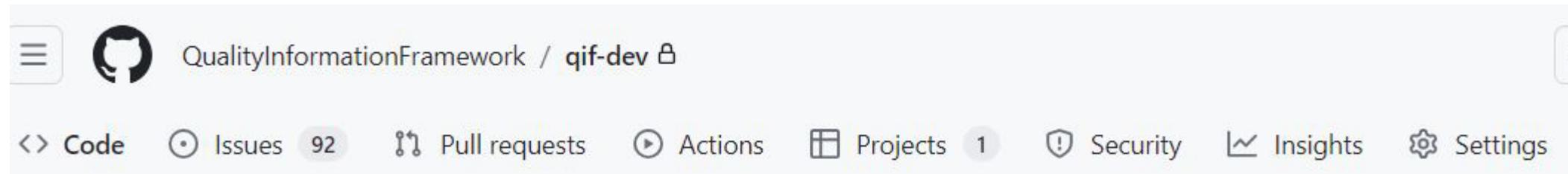
- 2019-2022 – QIF 3.0 issues raised in qif-community
- 2020 – Japanese express interest in QIF, propose additions
- 2021 – non-contact working group is active
- 2021 April – I start revising 3.0 schema files for next QIF version
- 2022 April – DMSC board approves 12-week project to define scope of next QIF version, project starts
- 2022 July – Project report submitted, recommends QIF 4.0
- 2022 October – **Project to develop QIF 4.0 starts**
- 2022 October-now – Biweekly meetings of QIF 4.0 WG



# Github repository qif-dev

- everything on QIF 4.0 kept in qif-dev github repository

<https://github.com/QualityInformationFramework/qif-dev>



- representatives of DMSC member companies have access
  - contact Tom or Daniel for access if you are from a member company
- Two ways to get a copy of qif-dev
  - click **<> Code** and then click *Download ZIP (1.4 gb)*
  - *git clone https://github.com/QualityInformationFramework/qif-dev*

# Github repository qif-dev (2)

---

- Issues
  - can filter issues by open, closed, text
  - can add issues
  - can add comments to issues
- github project **QIF4 Development**
  - numbered line items, one issue per line (not in order by issue number)
  - used to assign developers to issues
  - records start, target finish, and actual finish dates
  - records issue open or closed
  - two clicks to get there – *Projects*, then *QIF4 Development*
  - two views available, ViewTwo has action planned or taken

# Development Process

---

- Working groups meet to discuss issues
- QIF 4.0 WG meets every other week on Monday
- Issues to consider listed in agenda
- Issues assigned to individuals (mostly TK, some Bob Stone)
- TK also tackles issues and consults other major QIF model developers via email (Daniel, Bob Stone, Victor Mikushin)
- Proposed solutions presented at QIF 4.0 WG meeting

# Plusses and Minuses of Past Progress

---

- Issues plus – 81 issues closed since start of project (Oct 2022)
- Issues minus – 88 issues are still open
- 40 issues are new since start of project
- Working groups other than the QIF 4.0 WG and the Functional Testing WG have not been active

# Major Changes from QIF 3.0

---

- Resources – optical measurement devices added.  
Improvements for digital calibration certificates
- Model Based Characteristics – types and elements added for items in the Model Based Characteristics (MBC) proposed standard
- External File References – Now collected in one top-level element of QIFDocument, elsewhere referenced by id, can now reference a section of a standard or specification.

# Other Changes from QIF 4.0

---

- Not easy to summarize
  - through March 19, 2024, QIFbackup folder has changes described in 503 paragraphs in 176 files
- May now use combinations of SI units
- Volume and Illuminance added as named unit types
- Decimal numbers replaced by doubles (allows exponentials)
- Better and more keys and keyrefs
- Better and more XSLT
- Name *QPid* changed to *UUID*

# Other Changes from QIF 4.0 (2)

---

- Per unit area tolerances improved
- More information about references, including UUID references
- Rebuilt representations for nominal and measured environments
- Characteristics and Notes reference only features
- Handling of *Individually* keyword settled
- Many anonymous choices changed to named choice types
- Group of coaxial features improved (e.g., *isValveSeat* added)

# Other Changes from QIF 4.0 (3)

---

- Multiple rules sets in one QIFDocument allowed, and description added
- Every type with a QIF id has an Attributes element

# What Else Will Be Added?

---

- Not easy to predict, but TK hopes for:
- Functional testing model
- More support for optical measurement
- Better models of performance test results
- Better model for calibration certificates
- More measurement resource types
- Solutions for many other open issues

# QIF 3.0 File to QIF 4.0 Transition

---

- QIF 3.0 will still be available
- Plan to make a QIF 3.0 to 4.0 instance file converter available
- Prototype built in XSLT to show feasibility

# Quality Control on XML Schema Model

---

- Before putting changes to schema files in qif-dev, the following steps are taken:
  - Run each changed schema file through the xmlSchemaParser. Also check the schema file in XMLSpy and/or Oxygen XML editor. Fix errors if any. Compare xmlSchemaParser output file to input file and edit input file format if needed.
  - Run each changed schema file through the QIFDocumentationChecker. Fix documentation errors if any.
  - Run the xmlSchemaXPathChecker on QIFDocument.xsd (which checks 21 XML schema files). Correct errors in xpaths of keys and keyrefs, if any. If xpaths are suspected missing, run the xmlSchemaPathFinder, evaluate results, and add missing paths.

# Quality Control on XML Schema Model (2)

---

- Run the orphan finder to find types defined but not used.
- Use the xmlInstanceParserGenerator to regenerate the source code for the QIFDocumentParser (YACC, Lex, and C++).
- Rebuild the QIFDocumentParser from the source code.
- Run the regression test (runs each of 36 test files through the QIFDocumentParser).
- Update any test file reported not valid against the new schema model. Fix any schema errors revealed by the regression test.
- Use Oxygen XML Editor to regenerate the QIF4.0devOxyBrowser