40 years of Rexx
— a personal view

Hursley
23 September 2019

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http://speleotroove.com/mfc/
Overview

40 years of Rexx; a timeline …
Overview

40 years of Rexx; a timeline …

… or, in reality, 50 years …
Rexx roots go back 50 years…

In 1969 my mathematics teacher at Monkton Combe School, Julian Bewick, taught me to program using a pseudo-assembler (paper-executed) called ‘minlan’; I soon learned FORTRAN IV and wrote an interpreter for minlan …

… and on 28 September 2019 we’ll be celebrating those early days at the school!
Then ... (1970-1974)

• MFC: Pre-University student with IBM (1970)
  – PL/I compiler, compiler for minlan, etc.

• BSc Electrical & Electronic Engineering (1974)
  – University of Birmingham
  – Vacation jobs at IBM Hursley and IBM Bristol
  – lots of caving
Then ... (1974-1979)

• IBM Hursley: Test Tools Team (1974–1979)
  – building hardware for testing terminals such as the 3279 …

The team (December 1978)
(Ron Bowater, Doug Buttimer, Dave Milward, MFC)
Then ... (1974-1979)

  - building hardware for testing terminals such as the 3279 ...

The team (October 2018)
(Dave Milward, Doug Buttimer, Ron Bowater, MFC, Nick Butler)

... 2019 reunion today!
Microlink

- Used existing coax terminal link (ANR) to attach bipolar microcomputers (such as the 250ns Signetics 8X300) to mainframe

- Software included OS, Compilers, circuit layout ...
Own-time projects

• Mostly PL/I and S/360 Assembler
  – Archaeological mapping (1974)
  – Cave surveying programs (1976)
  – Several compilers and interpreters (1976+)

• STET, a STructured Editing Tool (1977)
  – and *lots* of other VM/CMS tools

• Rex (started 20 March 1979)
  – a biggie: 4,000 hours to 1982
How old was I?

well, 40 years is 40 years …
How old was I? (1979 pix)

After Cueva Toyu — Guinness ceremony
Why Rex?

• CMS had EXEC … a bit like DOS BAT

  &CONTROL OFF
  &IF &INDEX EQ 0 &GOTO -GO
  EXEC DCOPT DROP
  &IF &RETCODE GE 12 &EXIT
  -GO
  &STACK RT …

• EXEC 2: clean design, but just as ugly
  – language committee (Stephenson et al.)
  – hooks for vanilla CMS by Michel Hack
The first Rex programs

- ADDR EXEC … searches nickname file for nickname, displays name and address
- SEND EXEC … send file to a local user
- CONC XEDIT … concatenate & flow macro
- … and lots of testcases
Who used Rex?

- First distributable code was in May 1979; until then, only the one user

- The first real users (pioneers, guinea pigs, trend-setters, …) were
  - Ray Mansell (Hursley, UK)
  - Les Koehler (Raleigh, NC)

... lots of useful feedback
How did it catch on?

- Internal IBM network, VNET, rapidly growing
- VM Newsletter (Peter Capek)
- Word of mouth, Xmas card ...
- Add-ons (Steve Davies’ functions and many others)
Was there a Rex motto?

• Sort of. Pinned to the wall over my desk in Hursley was …
Was there a Rex motto?

• Sort of. Pinned to the wall over my desk in Hursley was …

Keep the language small

..... < 32 KB!
Why decimal arithmetic?

• One type = characters = decimal
  – avoids many problems \((e.g., 0.9/10 = 0.089999996)\)
  – see http://speleotrove.com/decimal/decifaq1.html

• Current is third iteration, May—July 1981
  – lots of input from language committee
  – … and from users in 43 countries
  – … and from a noisy ‘no more changes’ lobby
Why are ‘!’ and ‘?’ in symbols?

• I always intended to complete the arithmetic by adding Infinity and NaN

! was to be used for Infinity
?

was to be used for NaN

• Code freeze for product meant these and other changes (e.g., stream I/O) omitted
  – so EXECIO had to be used for files
1981: How did it become ‘official’?

• Internal CMS included XEDIT-editor-based tools, almost all developed using Rex

• Claude Hans in Endicott decided to add Rex even before EXEC 2 shipped; Rick McGuire involved from March 1981

• SHARE talk in 1981 … Ted Johnston (SLAC) asked IBM CEO (Frank Cary) for Rex
1981: A setback…

- IBM PC announced in August
  The very first thread on the new ‘IBMPC FORUM’ was: “who’s writing Rex for the PC?” – many keen volunteers …

- … but a group in San Jose was officially funded to write Rex for PC – so no one else tried; unfortunately they wrote it in Pascal – so the project failed
1982: Why ‘REXX’?

• Trademark search in 1982 found an unrelated product called *Rex-80*

• Lawyers insisted that ‘X’ be added … … and ‘REXX’ not be used in product name … and acronym was expanded

• Estimated cost of the change: $1,000,000+
1984: Rexx is 5

• Rexx is now public, in VM/CMS, and widely used

• MFC is working on image processing (and writing the Rexx ‘Blue Book’)

• Charles Daney is working on Personal Rexx for the PC
1985: Rexx, Lexx – related?

• Oxford University Press (with IBM) was computerizing the OED (21,000 pages, 60 million words keyed, SGML markup)

… but they had no good way of editing it

• Hence the Lexx editor for Lexicographers
  – programmable by Rexx macros
<entry>
  <hwsec> <hwgp> <hwlem> bungler </hwlem> </hwgp> <pron>b</pron> (I), ηγλαυ</pron>.
</hwgp> <vfl>Also <vd>6</vd> <vf>bongler</vf>, <vd>7</vd> <vf>bunglar</vf>. </vfl> <etym>f. as prec. +
  <xra> <xlem>-er</xlem> <hom>1</hom> <hom> <xra></xra></etym>
</sen> One who bungles; a clumsy unskilful worker. </sen> <quot> <qdat>1533
  </qdat> <auth> More </auth> <wk> Answ. Poyson. Bk. </wk> Wks. (1557) 1089/1
  </qtxt> He is even but a very bungler. </qtxt> </quot> <qdat>1642
</qdat> <auth> Milton </auth> <wk> Apol. Smect. </wk> Wks. 1738 I. 127
</qtxt> If any Carpenter, Smith, or Weaver, were such a bungler in his
  Trade. </qtxt> </quot> <qdat>1820 <qdat> <auth> Irving
  </auth> <wk> Sketch Bk. </wk> II. 326 </qtxt> A bungler at all sports that
required patience or adroitness. </qtxt> </quot> <qdat>1858
</qdat> <auth> Hawthorne </auth> <wk> Fr. & It. Jrnls. </wk> I. 292 </qtxt> The
greatest bungler that ever botched a block of marble. </qtxt> </quot>
</sen> para=t Hence <blem>bungler-like</blem> <pos>a.</pos> and
  <pos>adv.</pos>
</sen> <quot> <qdat>1603 </qdat> <auth> Florio </auth> <wk> Montaigne
  </wk> (1634) 491 </qtxt> That Painter...having bungler-like drawn...some Cockes.
</qtxt> </quot> <qdat>1613 </qdat> <auth> Cotgr. 
</auth> <qtxt> (I) Rudement </I>...ruggedly, harshly, bunglarlike.
</qtxt> </quot> </entry>
bungler (bəŋˈɡlər). Also 6 bongler, 7 bunglar.
[f. as prec. + -ER1.]

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1986 – 1987

• Lots of new Rexx implementations (MVS, AIX, AS/400, MUSIC, Unix, etc.)

• Rexx added to IBM System Applications Architecture
  – with its own Architecture Review Board, etc.

• Major disagreement over Rexx in OS/2
1988 – 1989

- **Object REXX (Oryx)** started by Simon Nash and team in Winchester (1988)
  - IBM Endicott involvement (from 1989)
    - (Eventually shipped in 1996)

- IBM Corporate Award ($90,000) for Rexx (1988)

- **REXX Compiler for VM/CMS** shipped from Vienna (1989, also MVS later)
1990 – 1994

• First Rexx Symposium organized by Cathy Dager \textit{et al} at SLAC (17 May 1990)

• 20+ Rexx books published 1990–1994 (including \textit{The Rexx Language, 2nd Ed.})

• SLAC has over 5,000,000 lines of Rexx

• MFC writes PMGlobe and GoServe … customized by Rexx
PMGlobe then ...
... and now
1995: All change

- New IBM Strategy for languages …

  … Smalltalk

- Rexx development moved from Endicott to Böblingen (Germany)

- … yet Java was on the horizon …
1995 – 1999

• MFC ports Java to OS/2 (1995), then bootstraps NetRexx with Rexx (1996/7)

• 14 more Rexx books published

• ANSI Rexx (X3.274-1996) published

• Object REXX ships for OS/2, Windows, Linux, and AIX
2000 – 2009

- NetRexx interpreter in 2000–2001
2010 – 2019

• NetRexx transferred to RexxLA  (2011)

• IEEE 754-2019  (revision started 2015)

• Open Object Rexx (ooRexx) and NetRexx continue to improve

• RexxLA also now manages the Regina interpreter (classic ANSI Rexx) and BSF4ooRexx (Java binding)
Rexx publications

- 51 Rexx books
- 68 manuals and guides (mostly IBM)
- Many articles and papers

For details, see:
http://speleotrove.com/rexxhist/rexxbook.html
Rexx implementations

- Runs on dozens of operating systems: VM ... Unix ... Linux ... DOS ... Windows ... Android ... Lego Mindstorms ...

- 18 IBM products/implementations

- 9 other commercial implementations

For details, see:
http://speleotrove.com/rexxhist/rexxxplat.html
Rexx resources

• More history, background information, early programs, documentation, etc. at:
  http://speleotrove.com/rexxhist/

• Some sample Rexx programs:
  http://speleotrove.com/rexx/Rexx_code.html

• And, of course, The Rexx Language Association website:  http://rexxla.org/
Rexx impact …

• Decimal arithmetic and other Rexx features are increasingly common (in C 202x, Lua, Python, Ruby, and many others)

• Rexx style, goals, and achievements are as important now as they were in 1979
  – readability, simplicity, portability, valuing people time, decimal arithmetic …
  – and everyone here has contributed to that!
Questions?
Backup slides...
Why SIGNAL?

• Early addition to Rex (1979)

• Intended as an exception mechanism (quit from deeply nested programs)
  – but there was no way to propagate it up through CMS calling mechanism (SVC 202)
  – NetRexx uses Java exception mechanism, which works just as originally intended:

    signal NumberFormatException
The idea behind parse templates?

- Designed from the ground up, inspired by VM/CMS commands and macros
  - ‘SET FONT Times Roman’
    Template: word1 word2 remainder
  - ‘COPY A A A = = B (REPLACE’
    Template: stuff ‘(‘ options ‘)’
GoServe response time graph

Response times [seconds]
Average is 0.244s

Response goal [0.07s]

☑ Color on main window

Response options
Rexx improvements in NetRexx?

- Most popular: `--` notation for comments
- Keyword `loop` for `do` constructs that loop
- All constructs integrate exceptions (catch) and exit code (finally), and can be labeled
- Compare is caseless
• Truly keyword-free

• Cleaner stem notation: `bark['pup'] = 'yap'
  – consistent with arrays: `array[4] = 'four'

• Self-defining hex constants: \(2\times 81 \rightarrow -127\)
  – and escapes in string literals

• New `trace var a b c` (Mansell request, 1979!)
... more

- Select case:

  ```
  select case i+1
    when 1     then say 'one'
    when 1+1   then say 'two'
    when 3, 4, 5 then say 'many'
  end
  ```

- dropped **numeric fuzz**, stack, commands

- function tweaks (e.g., `upper()`, `lower()`)