What's New and Exciting in RPG

(AKA Scott Goes Crazy.)

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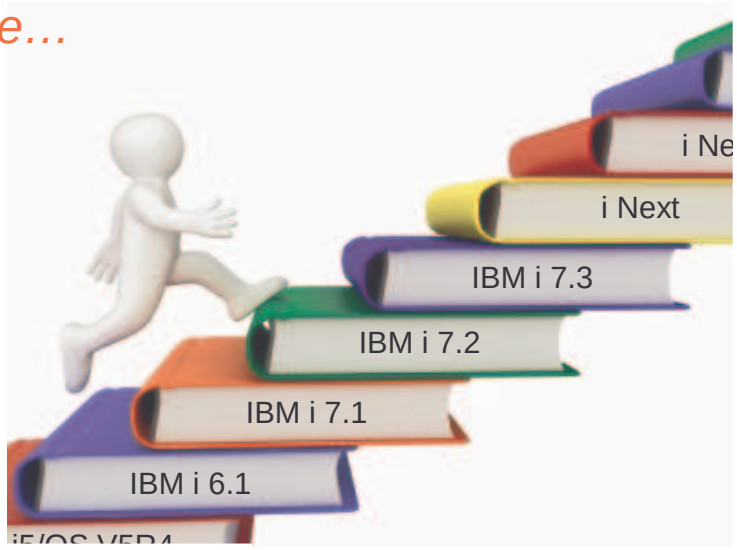
There's a band called 1023 MB.
They haven't had any gigs yet.

This Session Is Organized by Feature

This session is organized by *feature…*

…not by release.



A chart at the end will detail the releases.

IBM No Longer Waits For Next Release

This is really, really cool!

- Prior to IBM i 7.1 ("V7R1") to get new RPG feature, you waited for next release.
- Couldn't install it right away? Had to wait longer.
- Needed to support both newer and older releases? Wait longer.
- Could be 5+ years before you could use a feature you wanted.

This is no longer true!

- Starting with Open Access (should've been a 7.2 feature) most new stuff is available on all supported releases!
- Improved XML support
- Improved ALIAS support
- Free format support
- No more column restrictions!

Is This Good Or Bad?

Definitely good for developers?
- especially software companies.

Does it look bad for IBM?
- why should people update releases?
- do people perceive IBM's RPG commitment as "less"?

For this reason, IBM holds back at least some of the updates to the next release.

Support in SEU

There is none.

SEU has not had updates since IBM i 6.1 was released.
IBM i 6.1 is no longer supported.

Use RDi 9.5 (or 9.5.1) to avoid getting errors in your source editor.

Free Format (Definitions)

Released in 7.2, PTF back to 7.1

- CTL-OPT replaces H-spec
- DCL-S replaces D-spec for standalone variables
- DCL-F replaces F-spec
- DCL-DS replaces D-spec for data structures.
- New POS keyword sometimes nicer than OVERLAY(var:pos)
- Sequence of F and D specs no longer matters.

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
      ctl-opt dftactgrp(*no) option(*srcstmt:*nodebugio);

      dcl-s rrn packed(4: 0);

      dcl-f MYFILE workstn sfile(SFL01:rrn)
                           indds(inds);

      dcl-ds inds qualified;
         Exit     ind pos(3);
         Cancel   ind pos(12);
         ClearSFL ind pos(50);
         ShowSFL  ind pos(51);
      end-ds;
```

Free Format (More DS Options)

Released in 7.2, PTF back to 7.1

- Use *N for the DS name for an "unnamed" DS
- END-DS can go on the same line if you have no subfields.
- EXTNAME or EXT for externally defined structures.

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
      dcl-ds *N;
         field1 char(10);
         field2 packed(9: 2);
         field3 zoned(7: 1);
      end-ds;

      dcl-ds CUSTREC ExtName('CUSTMAS') end-ds;

      dcl-f PRINTFILE PRINTER(132);
      dcl-ds DATA len(132) end-ds;
       .
       .
      DATA = 'Print this';
      write PRINTFILE DATA;
```


Free Format (Procedures)

Released 7.2, PTF back to 7.1

- DCL-PROC and END-PROC replaces P-spec.
- DCL-PI and END-PI replace D-spec with PI.
- You can use *N on the DCL-PI for same name as the DCL-PROC.
- Prototypes are only needed when there's no matching PI in the same module

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

      dcl-proc myProcedure;

         dcl-pi myProcedure int(10);  ( --or--   dcl-pi *N int(10); )
            parm1 char(10) const;
            parm2 packed(7: 2) const;
         end-pi;

         dcl-s myVar like(parm2);

         return myVar;

      end-proc;
```

EXPORT(*DCLCASE)

Previously, when procedure name was case-sensitive, you had to repeat it in ExtProc:

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
     D MiXeDcAsEnaMe   PR                  ExtProc('MiXeDcAsEnaMe')
     D   parm1                      10a   const

     P MiXeDcAsEnaMe   B                   Export
     D MiXeDcAsEnaMe   PI
     D   parm1                      10a   const
      /free
        ... whatever procedure does ...
      /end-free
     P                 E
```

*DCLCASE makes DCL-PROC case-sensitive. Released in 7.2, PTF back to 7.1

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
      dcl-proc MiXeDcAsEnaMe export(*dclcase);
         dcl-pi *n;
            parm1 char(10) const;
         end-pi;
         // whatever procedure does.
      end-proc;
```


EXTPROC(*DCLCASE)

Can be used to call procedures with case-sensitive names without ExtProc. Released in 7.2, PTF back to 7.1

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

       dcl-pr MiXeDcAsEnaMe int(10) extproc(*dclcase);
         parm1 char(10) const;
       end-pr;

       MiXeDcAsEnaMe(myVariable);
```

... can also be used with APIs, such as the Unix-type ones ...

```
       dcl-pr unlink int(10) extproc(*dclcase);
         path pointer value options(*string);
       end-pr;

       unlink('/tmp/deleteMe.txt');
```

Mix Free Format With Fixed

Released in 7.2, PTF back to 7.1

- The /free and /end-free options are no longer required

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

      dcl-s Y packed(9: 2);
    D X               s              9p 2

      x = 27.50;
    C                   eval      Y = 25.50
```

- D/F spec sequence doesn't matter, even in fixed format

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
     D DATA            ds            132
     FPRINTFILE O    F  132         PRINTER
     C                   eval       DATA = 'Print Me'
     C                   write      PRINTFILE     DATA
```


"Fully Free" Columns Support

Released in 7.3, PTF for 7.1 and 7.2

- Start with **FREE keyword in col 1 of line 1 of your source
- Start with column 1, no limit in line length (aside from record length)
- No length limit on line at all when using IFS files
- cannot use fixed format statements (except via copy book)
- copy books that want **FREE also code it on col 1, line 1 of copy book.
- After line 1 starting with ** is for CTDATA

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
**FREE
dcl-s states char(12) dim(4) ctdata;
dcl-s x      int(10);

for x = 1 to %elem(states);
   dsply states(x);
endfor;

**
California
Ohio
Mississippi
Wisconsin
```

Free Format Is Awesome!

Free format for H, F, D and P specs
- Available in 7.2+, PTF available for 7.1 – no waiting!
- Much easier for new programmers to learn
- Adds new features like *DCLCASE and POS
- Fixed "bad-old" features with F/D spec order and /free /end-free
- Already extremely widely used in the RPG industry!!

The main complaint at the time this was released was
- Still limited to using columns 8 – 80
- But this was fixed later with *FREE support
- So many cool new things, I just can't handle it!

CCSIDs Are Really Important

Funny how many programmers, especially in the USA, seem to ignore CCSIDs.

You use CCSIDs every time you use text.
- Letters, symbols, punctuation, etc.
- Everything that isn't raw binary data like images, sound, or binary numbers!!
- That's the vast majority of what we do in business programming!

If you don't think about the CCSID of your data, the computer *assumes* the default.
- Shouldn't you, the programmer know what's going on?
- When the CCSID is different, don't you want to be in control of what's happening?

CCSIDs Are Not Just For Foreign Countries!!
- In the USA, we typically use CCSID 37, which is one flavor of EBCDIC
- There are many others – even the UK's is different!
- France, Germany, Italy, Spain, Mexico, French Canada, China, Korea, etc
- There are different EBCDICs for each, different ASCIIs for each

Unicode is the best!
- Most modern – today's solution, not yesterdays!
- Supports all characters for all languages all in one CCSID!

Char/Alpha CCSID Support

Released in 7.2 (Not available in 7.1)

- CCSID keyword when defining your fields
- Can be EBCDIC, ASCII or UTF-8 Unicode
- RPG now natively works with all of these character sets!!
- /SET and /RESTORE can be used to set the defaults for a group of definitions

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
dcl-s var1 char(100);                   // default is job CCSID (37 for me)
dcl-s var2 char(100) ccsid(*utf8);      // special value *UTF8 = CCSID 1208

/set ccsid(*char: *utf8)

dcl-s var3 varchar(100);
dcl-s var4 char(200);

/restore ccsid(*char)

var1 = 'MEEEE SCOTT!';                  // EBCDIC, default
var2 = var1;                            // converted to UTF-8
var3 = 'HIIIM SCOTT!';                  // also converted.
var4 = var3;                            // no conversion needed
var1 = var3;                            // converted to EBCDIC
```


More Special Values

Released in 7.2 (Not available in 7.1)

- Already saw CCSID(*UTF8) is UTF-8, same as CCSID 1208
- CCSID(*UTF16) is UTF-16 same as CCSID 1200 (for double-byte fields)
- External data structures can use CCSID(*EXACT) to match the CCSIDs of the file the definition came from.
- CCSID(*HEX) when you never want conversion between CCSIDs
- CCSID(*JOBRUN) uses the job's default CCSID
- CCSID(*JOBRUNMIX) uses the mixed CCSID related to job CCSID

```
Create Table PSNFILE (
  Name    char(30) ccsid 1208,
  Address char(40) ccsid 37
)
rcdfmt PSNFILEF;
```

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
       dcl-s var1 ucs2(10) ccsid(*utf16);
       dcl-s var2 char(10) ccsid(*hex);
       dcl-s var3 char(10) ccsid(*jobrun);

       // Name will have CCSID 1208, Address will have CCSID 37
       dcl-ds PSNFILE ext ccsid(*exact) end-ds;
```

CTL-OPT CCSID Keywords

Released in 7.2 (Not available in 7.1)

- CTL-OPT (H-Spec) CCSID keyword sets default for whole module
- You can also set CCSID(*UCS2:1200), but we've had that for a long time.

```
....+....1....+....2....+....3....+....4....+....5....+....6
     H ccsid(*char: *utf8)
      -or-
     ctl-opt ccsid(*char: *utf8);
```

Released in 7.2, PTF for 6.1, 7.1

CTL-OPT (H-Spec) CCSIDCVT keyword has two functions

- *EXCP causes RPG to send an exception (error) when a character would be lost by CCSID conversion
- *LIST puts a listing of all of the automatic CCSID conversions that are taking place into your compile listing, so it's easy to see where stuff is being translated automatically.

```
....+....1....+....2....+....3....+....4....+..
     H ccsidcvt(*list)
      -or-
     ctl-opt ccsidcvt(*excp);
```


CCSIDCVT(*EXCP)

What should happen if you convert a character that cannot exist in the result CCSID?

Default: A substitution character is inserted that shows that some character is missing.

With *EXCP: An exception/error is sent to your RPG program

```
    ....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+
01  **FREE
02  ctl-opt ccsidcvt(*excp: *list);
03  ctl-opt ccsid(*CHAR: *UTF8) ccsid(*ucs2: *utf16);
04
05  dcl-s var1 ucs2(2);
06  dcl-s var2 char(10);
07  dcl-s var3 char(10) ccsid(*jobrun);
08
09  var1 = u'4f605978';     // Chinese characters for "Ni Hao" in UTF-16
10  var2 = var1;            // converted to UTF-8
11  var3 = var2;            // converted to US-EBCDIC

    RNQ0452 Some characters could not be converted from
            CCSID(1208) to CCSID(37)
```

CCSIDCVT(*LIST)

```
    ....+....1....+....2....+....3....+....4....+....5....+....6....+....7...
01  **FREE
02  ctl-opt ccsidcvt(*excp: *list);
03  ctl-opt ccsid(*CHAR: *UTF8) ccsid(*ucs2: *utf16);
04
05  dcl-s var1 ucs2(2);
06  dcl-s var2 char(10);
07  dcl-s var3 char(10) ccsid(*jobrun);
08
09  var1 = u'4f605978';     // Chinese characters for "Ni Hao" in UTF-16
10  var2 = var1;            // converted to UTF-8
11  var3 = var2;            // converted to US-EBCDIC
```

CCSIDCVT(*LIST) adds this to compile listing:

```
                    C C S I D   C o n v e r s i o n s
    From CCSID        To CCSID          References
    1200              1208                10
    1208              *JOBRUN             11
* * * * *   E N D   O F   C C S I D   C O N V E R S I O N S   * * * * *
```


Disabling Database CCSID Conversion

Historically, RPG didn't work with multiple CCSIDs in the same program.

- but the database did!
- therefore, RPG converted all database CCSIDs to/from the job's CCSID
- for backward compatibility, it still does!

Now that it does work with lot of CCSIDs (as we just discussed)

- It's often better to keep the original database CCSIDs in RPG
- We can use RPG's features to convert them if needed.

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7...
**FREE
ctl-opt openopt(*nocvtdata);           // Default for whole program

dcl-f MYFILE workstn sfile(SFL01:rrn)
02  ctl-opt ccsidcvt(*excp: *list);
03  ctl-opt ccsid(*CHAR: *UTF8) ccsid(*ucs2: *utf16);
04
05  dcl-s var1 ucs2(2);
06  dcl-s var2 char(10);
07  dcl-s var3 char(10) ccsid(*jobrun);
08
09  var1 = u'4f605978';     // Chinese characters for "Ni Hao" in UTF-16
10  var2 = var1;            // converted to UTF-8
11  var3 = var2;            // converted to US-EBCDIC
```

Expanded Timestamps

Released 7.2

You can now specify how many fractional seconds you want. You can have up to 12 digits of fractional seconds in a timestamp field.

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

dcl-s ts   timestamp     inz(*sys);  // YYYY-MM-DD-hh.mm.ss.ffffff (default)

dcl-s ts0  timestamp(0)  inz(*sys);  // YYYY-MM-DD-hh.mm.ss
dcl-s ts1  timestamp(1)  inz(*sys);  // YYYY-MM-DD-hh.mm.ss.f
dcl-s ts3  timestamp(3)  inz(*sys);  // YYYY-MM-DD-hh.mm.ss.fff
dcl-s ts12 timestamp(12) inz(*sys);  // YYYY-MM-DD-hh.mm.ss.fffffffffffff
```

The `INZ()` keyword, `TIME` opcode and `%timestamp()` BIF still only set the first 3 fractional digits. The remainder of the timestamp is set to zeroes unless you initialize it yourself with an API or similar.

%SUBDT Digits/Decimals

Released in 7.2
The %SUBDT BIF can specify

- a number of digits returned in 3rd parameter
- a number of decimal places when working with *SECONDS

```
....+....1....+....2....+....3....+....4....+....5....+....6....+...
**FREE
dcl-s ts    timestamp inz(z'2016-09-16-18.09.33.123456');
dcl-s year4 packed(4: 0);
dcl-s year2 packed(2: 0);
dcl-s secs  packed(4: 2);

year4 = %subdt(ts:*years:4);     //  year4 = 2016
year2 = %subdt(ts:*years:2);     //  year2 = 16
secs  = %subdt(ts:*seconds:4:2); //  secs = 33.12
```

ALIAS Support on Files/Tables

Consider this physical file:

- short field names were hard to understand
- ALIAS allows longer names, but prior to 7.1, we couldn't use them in RPG!

```
....+....1....+....2....+....3....+....4....+....5....+....6....+..
.
A          R CUSTREC
A            CUSTNO          4S 0       ALIAS(CUST_NUM)
A            CUBLAD         30A         ALIAS(CUST_BILLING_ADDRESS)
A            CUBLCT         20A         ALIAS(CUST_BILLING_CITY)
A            CUBLST          2A         ALIAS(CUST_BILLING_STATE)
A            CUBLZP         10A         ALIAS(CUST_BILLING_ZIP)
A            CUSHNM         30A         ALIAS(CUST_SHIPPING_ADDRESS)
A            CUSHCT         20A         ALIAS(CUST_SHIPPING_CITY)
A            CUSHST          2A         ALIAS(CUST_SHIPPING_STATE)
A            CUSHZP         10A         ALIAS(CUST_SHIPPING_ZIP)
A          K CUSTNO
```


ALIAS Support in SQL

Long names are enabled by default in SQL

- You can use "for" to also give a short name (optional)
- If you don't use "for", SQL will generate a short name like CUS00001

```
....+....1....+....2....+....3....+....4....+....5....+....6....+...
Create Table CUST (
  CUST_NUM                for CUSTNO numeric(4, 0) not null,
  CUST_BILLING_ADDRESS    for CUBLAD char(30) not null,
  CUST_BILLING_CITY       for CUBLCT char(20) not null,
  CUST_BILLING_STATE      for CUBLST char(2)  not null,
  CUST_BIllING_ZIP        for CUBLZP char(10) not null,
  CUST_SHIPPING_ADDRESS   for CUSHAD char(30) not null,
  CUST_SHIPPING_CITY      for CUSHCT char(20) not null,
  CUST_SHIPPING_STATE     for CUSHST char(2)  not null,
  CUST_SHIPPING_ZIP       for CUSHZP char(10) not null,
  primary key (CUST_NUM)
)
rcdfmt CUSTREC;
```

Original 7.1 Alias Support

ALIAS keyword would generate long names

- but only worked with data structure I/O
- required "qualified" keyword on file to avoid I-specs and O-specs

```
....+....1....+....2....+....3....+....4....+....5....+....6....+...
     FCUST      UF   E           K DISK    QUALIFIED ALIAS

     D CUST_IN       E DS                  extname(CUST:*input)
     D                                     qualified alias
     D CUST_OUT      E DS                  extname(CUST:*output)
     D                                     qualified alias

     D Key             s                   like(CUST_IN.CUST_NUM)

      /free
       key = 1000;
       chain key CUST CUST_IN;
       if %found;
          eval-corr CUST_OUT = CUST_IN;
          if cust_out.cust_billing_address = *blanks;
             cust_out.cust_billing_address = cust_out.cust_shipping_address;
             cust_out.cust_billing_city    = cust_out.cust_shipping_city;
             cust_out.cust_billing_state   = cust_out.cust_shipping_state;
             cust_out.cust_billing_zip     = cust_out.cust_shipping_zip;
             update CUST.CUSTREC CUST_OUT;
          endif;
       endif;
```


Improved Alias Support

Released 7.3, PTF for 7.1, 7.2

- ALIAS now works without data structures
- Compiler-generated I-specs/O-specs now support the longer names

```
....+....1....+....2....+....3....+....4....+....5....+....6....+...

     FCUST      UF   E           K DISK    ALIAS

     D Key             s                   like(CUST_NUM)

      /free
       key = 1000;
       chain key CUST;
       if %found;
          if cust_billing_address = *blanks;
             cust_billing_address = cust_shipping_address;
             cust_billing_city    = cust_shipping_city;
             cust_billing_state   = cust_shipping_state;
             cust_billing_zip     = cust_shipping_zip;
             update CUSTREC;
          endif;
       endif;
```

Relaxed DS I/O Rules

Prior to this update, if you use data structures for I/O, you must have separate ones for *INPUT and *OUTPUT.

Released 7.3, PTF for 7.2, 7.1

- Can use EXTNAME(MYFILE:*ALL) for any type of I/O
- Or can use LIKEREC(MYFILE) (with no usage) for any type of I/O

```
**FREE
dcl-f CUST disk keyed usage(*input: *output: *update);
dcl-ds rec extname('CUST':*ALL) qualified alias end-ds;

chain 1000 CUST rec;

if %found;
   rec.cust_billing_address = '123 Main Street';
   update CUSTREC rec;
else;
   rec.cust_num = 1000;
   rec.cust_shipping_address = '123 Main Street';
   write CUSTREC rec;
endif;
```

Same DS on chain, update and write operations

Improved Null Support

For some time, RPG has had support for database nulls in it's native I/O (i.e. "F-spec files") using ALWNULL(*USRCTL) and the %NULLIND BIF.

In version 7.3 (no PTFs for older versions), RPG has extended this support with the NULLIND keyword. This keyword enables you to:

- Define your own (standalone) fields as null-capable.
- Define your own indicators to replace the %NULLIND BIF
- Associate a null map data structure with a record data structure to handle nulls in data structure I/O

Like the %NULLIND BIF, the NULLIND keyword requires ALWNULL(*USRCTL) to be specified on the CTL-OPT or H-spec.

Standalone Null-Capable Field

I've wanted this for a long time!!

```
     H alwnull(*usrctl)

     D ShipDate        s                D   nullind
```

Also free format:

```
**FREE
ctl-opt alwnull(*usrctl);

dcl-s ShipDate date NULLIND;
```

Use %NULLIND to check/set the null indicator (same as a database field)

```
if %nullind(ShipDate) = *OFF;
   msg = 'Order was shipped on ' + %char(ShipDate:*USA);
else;
   msg = 'Order has not been shipped';
endif;

%nullind(ShipDate) = *ON;
```


Works with OPTION(*NULLIND)

Null capable fields can be passed between subprocedures as well

```
dcl-s ShipDate date NULLIND;
  .
  .
TestNull(ShipDate);
  .
  .
dcl-proc TestNull;
   dcl-pi *N;
      TheDate Date options(*nullind);
   end-pi;
   if %nullind(TheDate);
      dsply 'is null';
   else;
      dsply 'is not null';
   endif;
end-proc;
```

Use Your Own Indicator for Nulls

```
ctl-opt alwnull(*usrctl);

dcl-s NullShipDate ind;
dcl-s ShipDate date NULLIND(NullShipDate);

// This is the same as %nullind(ShipDate) = *ON
NullShipDate = *ON;

// This is the same as IF %NULLIND(ShipDate)=*ON
if NullShipDate = *ON;
   // not shipped
endif;
```

Also works in fixed format (in case you were wondering)

```
     H alwnull(*usrctl)

     D NullShipDate    s               N
     D ShipDate        s               D   nullind(NullShipDate)
```


Using NULLIND for Files

Released in 7.3, LIKEREC/EXTNAME can be used with *NULL to build a data structure that has the null indicators for a database record.

For example, consider this file

```
Create Table NULLTEST (
   CustNo numeric(4, 0) not null,
   FirstOrd date,
   AmtOwed decimal(9, 2),
   SalesRep char(30)
)
rcdfmt NULLTESTF;
```

FirstOrd, AmtOwed and SalesRep are null capable (but CustNo is not)

RPG code example on next slide

LIKEREC/EXTNAME *NULL

Released in 7.3

- Requires ALWNULL(*USRCTL)
- Still need to say *INPUT/*OUTPUT/*ALL so it knows which fields to include
- Add *NULL to make it the null map for the record
- Add NULLIND to the "normal" record DS to associate the null map to it.

```
**FREE
ctl-opt alwnull(*usrctl);

dcl-f NULLTEST disk usage(*input:*update);

dcl-ds NULL likerec(NULLTESTF:*ALL:*NULL);
dcl-ds REC  likerec(NULLTESTF:*ALL) nullind(NULL);

read NULLTEST rec;

if null.FirstOrd = *ON;
   null.FirstOrd = *off;
   Rec.FirstOrd = %date();
   update NULLTESTF rec;
endif;
```


Use NULLIND in Prototypes

You can use NULLIND on prototypes/procedure interfaces…

- must specify an indicator parameter, NULLIND(field) not just NULLIND
- Indicator parameter must be passed in the same parameter list
- works with both standalone fields and data structures

```
CheckFields(rec : null);
  .
  .
dcl-proc CheckFields;
   dcl-pi *n;
      r likeds(rec) nullind(n);
      n likeds(null);
   end-pi;

   if n.AmtOwed = *off;
      dsply (%char(r.CustNo) + ' owes ' + %char(r.AmtOwed));
   endif;

   if n.SalesRep = *ON;
      dsply (%char(r.CustNo) + ' has no sales rep');
   endif;
end-proc;
```

Reverse Scanning

Released in 7.3

- %SCANR is like scan, but scans right-to-left
- it will find the last occurrence of a string rather than the first

```
Pathname = '/home/sklement/test/sales2015.csv';

pos = %scanr('/': Pathname);

// pos = 20

Stmf = %subst(Pathname:pos+1);

// Stmf = sales2015.csv

DirName = %subst(Pathname:1:pos-1);

// dirname = /home/sklement/test

*inlr = *on;
```


Limit Scanning

Released in 7.3

- %SCAN now has an optional length parameter
- previously had start position, but not length
- works with %SCANR as well.

```
// from last slide:
//   Pathname = /home/sklement/test/sales2015.csv
//   pos = 20

if %scan('test': PathName: 1: pos) > 0;
   // "test" was found in the directory portion
   dsply 'test found';
endif;

if %scan('sales': PathName: 1: pos) = 0;
   // "sales" was not found in the directory portion
   dsply 'sales not found';
endif;

x = %scanr('/': PathName: 1: pos-1);
// x = 15
```

TGTCCSID keyword

Released with 7.3 TR1, PTF SI62605 (7.1 = SI62580, 7.2 = SI62604)

- We've had the ability to put source in the IFS for a long time.
- Have always supported EBCDIC
- IFS code could be ASCII by translating to a "matching" EBCDIC (one that supports the same characters.)
- Prior to this update, IFS code could not be Unicode because this would confuse the compiler – there is no flavor of EBCDIC that supports (all of) the same characters as Unicode.
- With the TGTCCSID compile keyword, you can specify the EBCDIC to use, so source can be stored in Unicode now.
- Code is still converted to EBCDIC – still have EBCDIC's limitations.
- Not that exciting? But maybe useful for compatibility with editors, change management, version control systems, etc.

```
CRTRPGMOD TGTCCSID(37)           // or any valid EBCDIC CCSID
CRTBNDRPG TGTCCSID(*JOB)         // or special value *JOB

CRTRPGSQLI RPGPPOPT(*LVL2) COMPILEOPT('TGTCCSID(*JOB)')
```


Sooooo Many Enhancements

There are so many enhancements, I don't even have time to cover them all in-depth! Here are some that I didn't cover in this talk:

Not covered, because these are already well known:

- XML-INTO was enhanced with countprefix, datasubf (7.1, ptf for 6.1)
- XML-INTO support for case=convert and namespaces (7.2 ptf for 7.1, 6.1)
- Open Access and the HANDLER keyword (7.2 ptf for 7.1, 6.1)

Not covered because "too trivial"

- PGMINFO can be used to control which procedures are included in PCML
- VALIDATE(*NODATETIME) slightly improves date/time performance by eliminating error checking (don't use this, please)
- DCLOPT(*NOCHGDSLEN) allows %SIZE to figure out the size of a data structure in some definitions by guaranteeing that input, output and calcs won't change the length.

During 7.1 Development Cycle

	6.1	7.1	7.2	7.3
Sort and Search Qualified DS Arrays		X	X	X
Sort in Ascending or Descending		X	X	X
%SCANRPL BIF		X	X	X
%LEN(*MAX)		X	X	X
ALIAS Support		X	X	X
RTNPARM		X	X	X
%PARMNUM		X	X	X
Prototypes Are Optional		X	X	X
Procedures Convert CCSIDs when CONST		X	X	X
Teraspace Storage model		X	X	X
Default ACTGRP is now *STGMDL		X	X	X
H-spec option to change ALLOC to teraspace		X	X	X
Encrypted Debugging View		X	X	X
XML-INTO datasubf and countprefix	ptf	X	X	X

During 7.2 Development Cycle

	6.1	7.1	7.2	7.3
XML-INTO namespaces options	ptf	ptf	X	X
XML-INTO case=convert	ptf	ptf	X	X
CCSIDCVT keyword to list or give exceptions during auto-converts	ptf	ptf	X	X
Date/Time efficiency VALIDATE(*NODATETIME)	ptf	ptf	X	X
Open Access	ptf	ptf	X	X
CCSID support on A data type (and UTF-8)			X	X
CCSID(*EXACT)			X	X
CCSID(*HEX) and hex literals			X	X
Conversion During Concatenation			X	X
OPENOPT(*NOCVTDATA) and DATA(*NOCVT)			X	X
/SET and /RESTORE			X	X
Control %SUBDT Length			X	X
Timestamps up to 12 fractional digits (why??)			X	X
Free-Format H, F, D and P specs		ptf	X	X
No more need for /free and /end-free		ptf	X	X
File/Definitions Can be In Any Sequence (Fixed/Free)		ptf	X	X
EXPORT(*DCLCASE)			X	X

During 7.3 Development Cycle

	6.1	7.1	7.2	7.3
**FREE ("fully free form")		ptf	ptf	X
%SCANR BIF				X
Length Parameter to %SCAN				X
Improved ALIAS support		ptf	ptf	X
Relaxed DS I/O rules		ptf	ptf	X
Improvements to DB Null Support -- NULLIND				X
Improvements to PCML generation		ptf	ptf	X
DCLOPT(*NOCHGDSLEN)		ptf	ptf	X
TGTCCSID keyword to allow source code in Unicode		ptf	ptf	ptf

Get The Latest PTFs

You can any of the features (if available for your release of IBM i) by installing these PTFs.

There is no need to install separate PTFs for each feature, these PTFs (and their pre-requisites) include it all.

7.1
- *CURRENT compiler: SI61169
- TGTRLS(V6R1M0) compiler: SI53442
- runtime: SI58913

7.2:
- *CURRENT compiler: SI62208
- TGTRLS(V7R1M0) compiler: SI60690
- TGTRLS(V6R1M0) compiler: SI52577
- runtime: SI58915

7.3:
- *CURRENT compiler: SI61030
- TGTRLS(V7R2M0) compiler: SI61083
- TGTRLS(V7R1M0) compiler: SI61125
- runtime: SI59831

This Presentation

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Thank you!