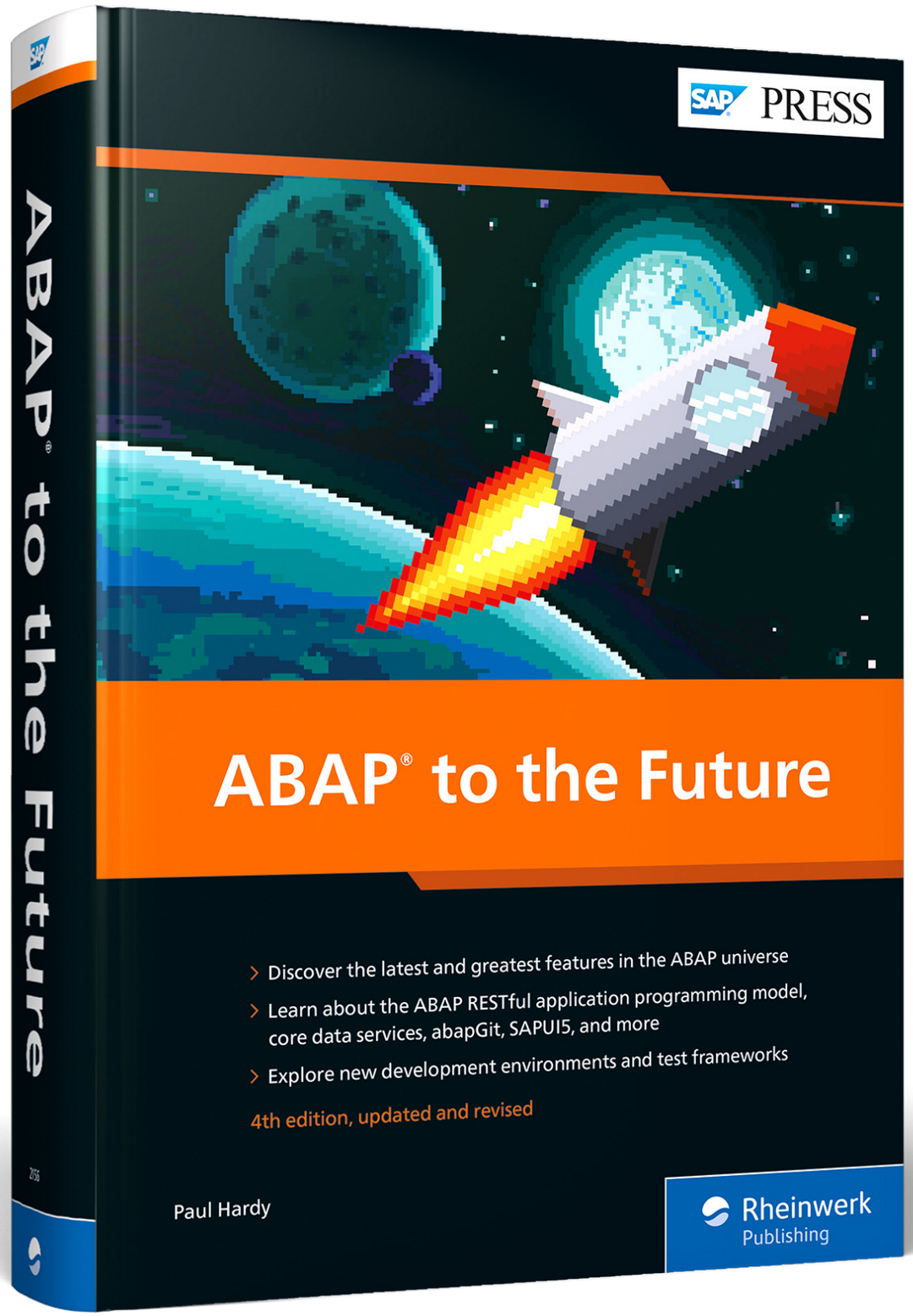

Reading Sample

This sample chapter walks through the new language features introduced in ABAP 7.4 and above. These new features are divided into the following categories: creating data, string processing, calling functions, conditional logic, internal tables, object-oriented (OO) programming, and search helps (plus one final catch-all category for topics that don't fit into any of the previous ones). For each new features, examples are provided.

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Chapter 3
New Language Features in ABAP

"It's a beautiful thing, the destruction of words. Of course the great wastage is in the verbs and adjectives, but there are hundreds of nouns that can be got rid of as well."

—George Orwell, 1984

New features, new goodies . . . could this be described as a programmer's idea of heaven? In the early 80s, when I was still a teenager, my parents bought me a BBC Microcomputer to replace my ZX81. Even then, my primary interest was programming, not playing games, and what I liked most about my new toy was the broad range of commands that were then available to me in the BBC's version of BASIC (e.g., constructs such as `REPEAT UNTIL`). Even now, many years later, I feel exactly the same when something new and exciting is added to the ABAP language.

As time has gone by, more commands and constructs have been added to ABAP and (until the advent of SAP BTP, ABAP environment) nothing has been taken away, to ensure backward compatibility—and the rate of change seems to be accelerating violently. A fair number of changes were made as a result of the introduction of SAP NetWeaver 7.02, but this is nothing compared to the cascade of changes that came with version 7.4 and continued in versions 7.5 and beyond. This proves beyond a doubt that ABAP is not a dead language—which was a fear of many people in 2001, when there was talk (from the very top of SAP) about replacing ABAP with Java.

The quote at the beginning of the chapter, from George Orwell's novel *1984*, is about the destruction of words. The character working on the Newspeak language says to the main character, Winston Smith, that the ruling party is hell-bent on destroying existing words, as opposed to creating new ones. The idea that began with ABAP 7.4 is, in some ways, the same: many of the 7.4 changes allow you to achieve the exact same tasks as before, but with half the code or less. For example, in Newspeak, "that was wonderful, fantastic, the best thing ever" becomes "++good." In ABAP, `CONCATANATE this that INTO the_other SEPARATED BY '_'` becomes `the_other = this && '_' && that`.

Of course, it's not all about destroying words; releases 7.4 and up add a lot of brand-new functionality as well. This chapter will focus on the large number of new features that have been introduced into ABAP in the latest releases. These features are divided into the following categories, based on their general area of functionality: creating data, string processing, calling functions, conditional logic, internal tables, object-oriented (OO)

programming, and search helps (plus one final catch-all category for topics that don't fit into any of the previous ones).

ABAP Versions

In the same way that George Orwell's characters were trying to get rid of words, SAP is increasing the number—at least when it comes to having multiple names for the latest ABAP version. This started with ABAP 7.53, which was also known as 1809 (as it was released in September 2018).

The idea was that thereafter a new version of ABAP would be released on average every three months (which has been the case)—so, 1812, 1903, 1906 and so on. At time of writing, the latest version is 2108.

You get two types of periodic announcements of new ABAP versions, both with very similar naming conventions:

- Announcements concerning SAP BTP, ABAP environment (ABAP in the cloud), which come out quarterly and have names like 2012 (for December 2020)
- Announcements concerning the ABAP platform for SAP S/4HANA (ABAP on-premise), which come out annually and which used to be named 1909 after the year and month of release, but now have names like 2020 (meaning it was released at the end of 2020)

Each SAP S/4HANA on-premise ABAP version also has an internal SAP number like 7.53 (1809), or 7.54 (1909), or 7.55 (2020). In SAP presentations, the two numbers are used interchangeably—often on successive slides.

Version 7.53/ABAP 1809 strips away the last vestiges of platform-independence. That version of ABAP only works with an SAP HANA database, which in turn only works with a Linux operating system.

If you are in an SAP BTP, ABAP environment system, to see what version you're on, in ADT click the project on the left-hand side that represents the cloud system, then at the bottom-right-hand side select the **Properties** tab. You'll see something like Figure 3.1.

System information for application server 0xa0b2a0d_[redacted]

Database:	HDB, Release: 2.00.055.0, Name: H00/00/ Server: cacacd3d-e543[redacted]d89-2999f5e4, Schema: SAPABAP, Library: SQLDBC 2.08.022.1621352674
Operating System:	Linux, Version: 5.4.0-77-generic
Server:	Machine Type: x86_64, SAP System ID: 390, IP Address: 10.11.42.13, Node Name: 7a8da0a9-c302-4979-9ab0-6aa8efb75feb, Unicode System: True
Kernel:	Release: 785, Patch Level: 14, Compilation Date: Linux GNU SLES-12 x86_64 cc8.2.1 use-pr210820 Aug 21 2021 00:54:17, Kind: opt

Software Component	Release	Support Package	Support Package Level	Description
/DMO/SAP	100	n/a	0000	generated software component
DW4CORE	785	n/a	0000	DATA Warehouse
SAP_BASIS	785	SAPK-78503INSAPBASIS	0003	SAP Basis Component
SAP_CLOUD	785	SAPK-78503INSAPCLOUD	0003	SAP Cloud Component

Figure 3.1 Displaying SAP BTP ABAP Version

In this example, the ABAP release is both 7.85 and 2108 at once (they're the same thing).

3.1 Declaring and Creating Variables

Recently, SAP jumped up onto the rooftops and shouted through a megaphone that with ABAP 7.5 there's a new data type, int8, which handles really big numbers (i.e., numbers that are 18 digits long, plus or minus). I presume that's what's meant by *big data*; I had always wondered. Perhaps you need such big integers to record the number of SAP product name changes per year.

Coming down from the roof, one of the main differences between ABAP and other languages is that in ABAP we've been taught to declare all our variables at the start of the program—for example, in `TOP INCLUDE`. Other languages declare them just before they're used, and such variables tend to be more local in scope—for example, within a loop. Despite the official ABAP programming guidelines, many ABAP programmers have taken to declaring variables just before they're used for the first time, for the purposes of making the program more readable by humans and hence easier to change.

The good news is that as time goes on, changes in the ABAP language make this unofficial practice more and more acceptable. This section will discuss several features that contribute to this shift.

3.1.1 Omitting Data Type Declarations

One reason ABAP 7.4 has made it less important to declare variables at the start of your routine or method is that the need for the majority of data declarations has melted away. The compiler knows what data type it wants (it has to know to be able to perform a syntax check), so why not let it decide the data type of your variable? In the examples ahead, you'll see how letting the compiler decide the data type—instead of declaring it yourself—can save you several lines of code. For example, here is a piece of code declaring a data type:

```
DATA: monster_instructions TYPE string.
monster_instructions = 'Jump up and down and howl'.
```

Without the data type declaration, you can simplify this to just the following:

```
DATA(monster_instructions) = 'Jump up and down and howl'.
```

Similarly, the following piece of code also declares a data type:

```
DATA: number_of_monsters TYPE i.
number_of_monsters = LINES( monster_table )
```

And again, you can simplify this:

```
DATA(number_of_monsters) = LINES( monster_table ).
```

As you can see, this system has the potential to dramatically reduce the number of lines in your programs. You'll see various examples of such inline declarations throughout this chapter because they have applications in many different areas of ABAP programming.

You Aren't My Type

If you're creating a domain in ABAP versions 1909 and up, you'll see when using F4 help that there are now 37 different data types available, as opposed to the 31 that were there previously. Six native SAP HANA data types have been added. Practically, that means you can (for example) create a timestamp data element using built in-type UTCLONG as opposed to having to use domain TZNTSTMPL.

3.1.2 Creating Objects Using NEW

In the Java programming language, the NEW command is used to create instances of objects (they say that everything in Java is an object). For example, MonsterFred = NEW (Monster) in Java creates an instance called Fred of the class Monster. In the same way that the ABAP runtime environment has been shamelessly stealing features from Eclipse, now the ABAP language is stealing keywords from Java—so you now have a NEW command as well.

Previously, you'd use the following code:

```
DATA: monster TYPE REF TO zcl_monster.
CREATE OBJECT monster EXPORTING name = 'FRED'.
```

Now, you'll be able use just the following line:

```
DATA(monster2) = NEW zcl_monster( name = 'FRED' ).
```

As you can see, this halves the number of lines of code you need. More importantly, the debate about whether you declare the variables at the start of a routine (per the official ABAP guidelines) or just before the variable (to aid humans who might be reading the code) is no longer relevant. You have the type of the variable right in your face at the instant the variable is created.

3.1.3 Filling Structures and Internal Tables while Creating Them Using VALUE

No doubt you're familiar with the following common statement:

```
DATA: monster_name TYPE string VALUE 'FRED'.
```

In this statement, you create a variable and give it an initial value, which can then be changed later. In the past, the ability to change initial values has only been available for

elementary data types. However, as of 7.4, the VALUE statement has come of age, and you now can define the initial values for structures and internal tables.

Listing 3.1 contains a pre-7.4 example of querying a database. In this example, you create a selection table to be used in a SQL query, but you're only interested in laboratories in which monsters will be created. But because you can't use the VALUE statement, you have to fill up one or more work areas and then append them to the selection table.

```
DATA:
  monster_type_range            TYPE ztt_bc_coseltab,
  monster_type_selection_option LIKE LINE OF monster_type_range.

monster_type_selection_option-field  = 'EVILNESS'.
monster_type_selection_option-option = 'EQ'.
monster_type_selection_option-sign   = 'I'.
monster_type_selection_option-low    = 'EVIL'."Evil Monster
APPEND monster_type_selection_option TO monster_type_range.

monster_type_selection_option-field  = 'EVILNESS'.
monster_type_selection_option-option = 'EQ'.
monster_type_selection_option-sign   = 'I'.
monster_type_selection_option-low    = 'VERY'."Very Evil Monster
APPEND monster_type_selection_option TO monster_type_range.

DATA(monster)         = NEW zcl_4_monster_model( ).
DATA(monster_headers) =
monster->retrieve_headers_by_attribute( monster_type_range ).
```

Listing 3.1 Database Query without VALUE

However, as of 7.4, you can use the VALUE statement and thus achieve the same effect with fewer lines of code (see Listing 3.2).

```
DATA(monster_headers) =
NEW zcl_4_monster_model( )->retrieve_headers_by_attribute(
VALUE ztt_bc_coseltab(
      ( field  = 'EVILNESS' )
      ( option = 'EQ' )
      ( sign   = 'I' )
      ( low    = 'EVIL' )     "Evil Monster
      ( low    = 'VERY' ) ) )."Very Evil Monster
```

Listing 3.2 Database Query with VALUE

You've avoided the need for an intermediate internal table (MONSTER_TYPE_RANGE) and avoided the need to define a work area to build up the lines of that intermediate table, and the result is code that shows what's going on clearly.

In general, you hard-code the values of lines of internal tables when building up test data for unit tests, as shown in Listing 3.3.

```
mt_test_configuration[] = VALUE m_tt_configuration(
( variable_name = 'Monster Model' count = 1 possible_value = 'BTNK' )
( variable_name = 'Monster Model' count = 2 possible_value = 'KLKL')
( variable_name = 'Monster Model' count = 3 possible_value = 'ISDD' )
( variable_name = 'Evilness'      count = 1 possible_value = 'EVIL' )
( variable_name = 'Evilness'      count = 2 possible_value = 'VERY' ) ).
```

Listing 3.3 Using VALUE to Fill Multiple Lines of Internal Table

Listing 3.3 demonstrates this concept for an internal table, but you can also use this construct to fill structures, and there are three other important points to note about the VALUE keyword in that context:

- If filling an existing structure, as opposed to creating a new one, the data structure is blanked out before being filled.
- If you were formerly filling a structure with 100 lines of code, assigning a value to a structure element one at a time, you had to skip over each line manually in the debugger. If you fill them all at once with a VALUE statement, there's only one line for the debugger to skip over.
- When filling a structure with VALUE, you need one set of brackets at the start; when filling a table, you need two sets of brackets because you need each row to be enclosed in brackets.

3.1.4 Filling Internal Tables from Other Tables Using FOR

How well I remember starting to program when I was fourteen, with the good old ZX81. The BASIC language I programmed in then had constructs like FOR x = 1 TO 10, which meant you were going to loop 10 times, with the variable *X* increasing by one each time. Well, the FOR command has now arrived in the ABAP world; let's look at what it's all about.

You read about the VALUE statement in the last section; you can use it to fill an internal table, as shown in Listing 3.4.

```
DATA(table_of_monsters) = VALUE z4tt_monster_header(
 ( name = 'JIMMY' monster_number = 1 )
 ( name = 'ROLF'  monster_number = 2 ) ).
```

Listing 3.4 Fill Internal Table Using Hard Coding

That's great as an example, but in real life you fill internal tables either from the database or from other internal tables; almost never do you fill them with hard-coded values. Prior to 7.4, you could only fill one internal table from another table if the two

tables had identical column structures, and you had to add all the lines of one table to another, as follows:

```
APPEND LINES OF green_monsters TO all_monsters.
```

Fortunately, thanks to the FOR command introduced in ABAP 7.4, you can now do this in a much more elegant way: the tables can have different columns, and you can limit what's transferred based upon conditional logic. Using the VALUE and FOR keywords, this will look like Listing 3.5.

```
SELECT *
FROM z4t_monster_head
INTO TABLE @DATA(all_monsters).

DATA(neurotic_monsters) = VALUE z4tt_monster_header(
 FOR monster_details IN all_monsters WHERE ( sanity_percentage < 20 )
     ( name           = monster_details-name
       monster_number = monster_details-monster_number ) ).
```

Listing 3.5 Filling Internal Tables from Other Tables

3.1.5 Creating Short-Lived Variables Using LET

ABAP 7.4 also allows you to declare variables with short lifespans via the LET statement. These variables only exist while creating data using constructor expressions. (A *constructor expression* is a mechanism to apply assorted logic when creating a variable, such as an internal table. This is similar to the sort of logic you would find inside a constructor of an OO class, and VALUE is an example of a constructor expression.)

To illustrate the use of LET statements, say that you have a table of deadly weapons, and you want to arm some monsters. You're not particularly concerned about which monster gets which weapon, so long as each monster gets one. Listing 3.6 shows some code that creates some very short-lived local variables. The DATE = USER addition translates an internal SAP date into the format in the user settings (e.g., MM/DD/YYYY).

```
SELECT *
      FROM z4t_monster_head
      INTO TABLE @DATA(all_monsters).

DATA(iterator) = NEW lcl_weapon_iterator( ).

DO lines( all_monsters[] ) TIMES.
  DATA(arming_description) = CONV string(
    LET weapon_name  = iterator->get_next_weapon( )
        monster_name = all_monsters[ sy-index ]-name
        date_string  =
```

```
        |{ sy-datum } DATE = USER|
      IN |{ 'Monster'(018) } { monster_name } { 'was issued a'(019) } | &&
        |{ weapon_name } { 'on'(020) } { date_string }| ).
  MESSAGE arming_description TYPE 'I'.
ENDDO.
```

Listing 3.6 Creating Short-Lived Variables

> **Note**
>
> In real life, you would store the description in some sort of internal table. However, the focus here is on the `LET` statement.

In this example, the first variable gets the description of the next weapon in a list of weapons via a functional method call. Then, you read a line of the internal table of monsters—the syntax here may puzzle you, but it will be covered later in Section 3.5—and finally you fill a string variable with the system date, formatted in a human-friendly manner.

You can now use those variables you've just declared to fill up the result string. Thanks to the `LET` statement, after the statement is over those variables (`weapon_name`, etc.) don't exist any longer, as opposed to being accessible from anywhere inside the routine like regular variables.

> **Field Symbols**
>
> You can also declare field symbols, as well as variables. The type of the variable or field symbol is dynamically determined by looking at the value being passed into it.

3.1.6 Enumerations

As we know, certain variables can only have a certain range of values: a day variable can only have values from 1 to 7, a Boolean variable can only be `TRUE` or `FALSE`, and a monster's brain size can only be `NORMAL`, `SMALL`, or `MICRO`. In each case, any other value just wouldn't make sense.

How we handle this normally is by having the data element that represents the concept point to a domain with a fixed set of values. Then UI technology like SAP GUI gives an error message if the user tries to enter any other value.

Inside programs, though, we're sunk. There's nothing to stop you from putting a meaningless value like `P` into a variable typed as `ABAP_BOOL` or putting `9` into an integer meant to represent a day or putting `BIG` into a monster brain size variable.

Moreover, a variable might be so specific to your application that there's no domain in the DDIC, but you still want to limit the possible values the variable can hold at runtime.

In the past, you did this by declaring several constants with the possible values, but elsewhere in the code nothing stopped values other than the constants being assigned to the variable.

Other languages, like Java, have had the concept of *enumerations* to solve these sorts of problems for years, and with release 7.51 this concept comes to the ABAP language as well.

Simply put, an enumeration is a place in your code where you list the possible values a semantic concept (like monster brain size) can have. Listing 3.7 shows how to define an enumeration; in essence, it's an extension of the existing `TYPE` construct.

```
TYPES: BEGIN OF ENUM monster_brain_size,
         normal,
         small,
         micro,
       END OF ENUM monster_brain_size.

  DATA: brain_size TYPE monster_brain_size.
```

Listing 3.7 Basic Enumeration

Normally, you declare the `TYPE` of a variable to be either an elementary type like an integer or a data element (with the underlying type derived from the associated domain). In Listing 3.7, you type the variable based on the enumeration. In this case, the `TYPE` of the variable will be an integer.

"Why an integer?" I hear you ask. Well, what's happened under the hood is that three constants have been declared:

- `NORMAL = 0`
- `SMALL = 1`
- `MICRO = 2`

Now if you try something like this:

```
brain_size = 4
```

You'll get a syntax error—or indeed a runtime error (which you can catch with exception class `CX_SY_CONVERSION_NO_ENUM_VALUE`) if the source value is only determined at runtime. Instead, programmers are forced to write something like the following:

```
brain_size = normal.
```

This also forces the code to look more like plain English, so you're improving stability and readability at the same time.

The spooky thing is that if you pass the constant into a text field like a string, it magically transforms from an integer like `0` to the text string `NORMAL`—that is, the name of the constant.

At this point, you might be saying that this example isn't very realistic. You're correct: monster brain size isn't an integer, it's a 10-character field. Of course it is; that goes without saying.

An enumeration doesn't have to be an integer. You can define it as a different sort of data type, as in Listing 3.8, in which we wanted a 10-character field but ran into a syntax error as soon as the field length was above eight characters. The reason for this is that, as of yet, enumerations aren't really like domains; you're not supposed to be interested in the actual value of the constant an enumeration value represents, just its name.

```
TYPES:
     brain_size TYPE c LENGTH 8,
     BEGIN OF ENUM monster_brain_size BASE TYPE brain_size,
       normal VALUE IS INITIAL,
       small  VALUE 'SMALL',
       micro  VALUE 'MICRO',
     END OF ENUM monster_brain_size.

   DATA(brain_size) = NEW monster_brain_size( small ).
```

Listing 3.8 Noninteger Enumeration

You might be asking why `NORMAL` has no value: it's because one of the values has to be initial, so usually the default value gets that honor.

Now let's take this to the next level (of code readability) and define the enumeration as not a set of constants, but a structure of constants, as in Listing 3.9.

```
TYPES: BEGIN OF ENUM monster_brain_size
        STRUCTURE brain_sizes,
             normal,
             small,
             micro,
         END OF ENUM monster_brain_size
         STRUCTURE brain_sizes.

   DATA(brain_size) = brain_sizes-small.
```

Listing 3.9 Enumeration with Structure

As mentioned, at the moment, domains and enumerations are two totally unrelated things, despite both appearing to do the same job, but in the future we're likely to get automatic linking with actual DDIC domains.

We're also promised an even better sort of constant: one that gets its value dynamically assigned at runtime but has an immutable value once created. If and when that happens, I'll dance around the room with joy.

3.1.7 New Mathematical Operators

As mentioned earlier, after 7.52, the naming for ABAP releases changed, and they also come out a lot faster because of SAP BTP, ABAP environment. The release in September 2018 was called 1809, for example, and two months later 1811 was released.

The 1811 release "stole" a concept from other languages like Java called *assignment operators*. It's designed to make the code more compact.

The following three statements all perform the exact same task; the last one is the new construct:

```
ADD 3 TO number
number = number + 3
number += 3
```

This is a fine example of a new tool that makes the coding shorter but less readable. Everyone would be able to guess what the first two lines of code above did, but you would need specialized knowledge to know what `+=` did.

You use the same sort of pattern for other mathematical operators; for example, to divide a number by three, you use `number /= 3`.

3.2 String Processing

The English comedy trio The Goodies once sang:

> *String, string, string, string, everybody loves string,*
> *String for your pants, string for your vest!*
> *Everybody knows—string is best!*

If you're anything like me, you may spend half your life calling the `CONVERSION_EXIT_ALPHA_INPUT` and `CONVERSION_EXIT_ALPHA_OUTPUT` functions to add and remove leading zeroes from document numbers such as delivery numbers. For example, you might remove the zeroes when showing messages to the user, but then then add them back before you read the database (see Listing 3.10).

```
DATA: monster_number TYPE z4de_monster_number VALUE '0000000001'.

"Remove Leading Zeroes ready for Output to User
CALL FUNCTION 'CONVERSION_EXIT_ALPHA_OUTPUT'
  EXPORTING
    input  = monster_number
  IMPORTING
    output = monster_number.

message_container->add_message_text_only(
```

```
EXPORTING
iv_msg_type = /iwbep/if_message_container=>gcs_message_type-error
iv_msg_text = |Monster No { monster_number } | &&
              |does not want to be deleted| ).

"Add back leading zeroes in case you need to read database
CALL FUNCTION 'CONVERSION_EXIT_ALPHA_INPUT'
  EXPORTING
    input  = monster_number
  IMPORTING
    output = monster_number.
```

Listing 3.10 Removing and Adding Leading Zeroes by Function Call

In ABAP 7.4, this type of action can be taken in a more compact manner by using the `ALPHA` formatting option, which does the exact same thing as the two function modules used in Listing 3.10. To remove the leading zeroes in 7.4, you can write code such as that in Listing 3.11.

```
DATA: monster_number TYPE z4de_monster_number VALUE '0000000001'.

message_container->add_message_text_only(
EXPORTING
iv_msg_type = /iwbep/if_message_container=>gcs_message_type-error
iv_msg_text = |Monster No { monster_number ALPHA = OUT }
               does not want to be deleted| ).
```

Listing 3.11 Removing Leading Zeroes via Formatting Option

When using the method shown in Listing 3.11, the monster number variable is totally unchanged. Only the output to the end user is affected, so you can read the database straightaway if you so desire.

3.3 Calling Functions

You often have to jump through hoops to play around with the variables in your programs before you can call other methods or functions. Luckily for you, this only gets easier over time. This section will discuss the new ABAP functionalities that make calling functions much easier than it has been in the past.

3.3.1 Avoiding Type Mismatch Dumps when Calling Functions

It can drive you up the wall when you've declared a variable that you want to either pass into or get back from a method of a function module and the variable type doesn't

match the expected parameter type. With a method, you get a syntax error; with a function module, you get a short dump at runtime. To be safe, you have to keep jumping in and out of the function module signature to see how the variables were typed. This process is tedious, so it's led to people creating custom *patterns*, in which you enter a function module name, the signature is read, and then a whole list of variables is declared with the same type as all the function parameters. Well, half of the problem has now gone away, because if the sole purpose of a variable is to receive a value from a method or function, then the variable can be declared inline and the type read from the parameter definition.

To see this new functionality, look at Listing 3.12. This is an example of what most people have always done: declare some local variables to be passed into a method, cross your fingers, and hope you've declared the variable the same way as the input parameter. If not, you get a syntax error.

```
DATA: changes_to_be_made  TYPE /bobf/t_frw_modification,
      actual_changes_made TYPE REF TO /bobf/if_tra_change,
      bottle_of_messages  TYPE REF TO /bobf/if_frw_message.

DATA(bopf_service_manager) =
     /bobf/cl_tra_serv_mgr_factory=>get_service_manager(
     zif_4_monster_c=>sc_bo_key ).

"Change Data in Memory
bopf_service_manager->modify(
EXPORTING it_modification = changes_to_be_made
IMPORTING eo_change       = actual_changes_made
          eo_message      = bottle_of_messages ).
```

Listing 3.12 Declaring Variables with (Hopefully) Same Types as Method Parameters

With ABAP 7.4, however, you can accomplish the same thing by declaring the variables returned from the method not at the start of the routine but rather at the instant their values are filled by the method, as shown in Listing 3.13.

```
DATA: changes_to_be_made TYPE /bobf/t_frw_modification.

DATA(bopf_service_manager) =
     /bobf/cl_tra_serv_mgr_factory=>get_service_manager(
     zif_4_monster_c=>sc_bo_key ).

"Change Data in Memory
bopf_service_manager->modify(
EXPORTING it_modification = changes_to_be_made
```

```
    IMPORTING eo_change       = DATA(actual_changes_made)
              eo_message      = DATA(bottle_of_messages) ).
```

Listing 3.13 Using Inline Declarations to Avoid Possible Type Mismatches

This latter approach has several advantages:

- There are fewer lines of code.
- You can't possibly get a type mismatch error or dump.
- If you change the signature definition, then the result variable adapts itself accordingly.

Therefore, this approach is more compact and hopefully easier to read (and thus maintain), safer, more resistant to change, and all in all less fragile.

This approach comes into its own when creating object instances using factory methods; the factory will return a different subclass of the base object depending on assorted logic, but the calling program shouldn't care. For example, the pre-7.4 code would look as follows:

```
DATA: monster TYPE REF TO zcl_green_monster.
monster = zcl_laboratory=>build_new_monster( ).
```

Post 7.4, the code would look as follows:

```
DATA( monster ) = zcl_laboratory=>build_new_monster( ).
```

Later in this book, you'll see that in frameworks such as Web Dynpro (Chapter 12) and the Business Object Processing Framework (BOPF; Chapter 8), you're regularly creating lots of objects with complicated data types. Not having to declare really complicated variable types before the call to fill up such variables with values cleans up a lot of the boilerplate code and allows you to concentrate on what's really important.

3.3.2 Using Constructor Operators to Convert Strings

Often, one routine consists largely of a call to several smaller routines (such as `FORM` routines, function modules, and methods). The problem with this is that sometimes the result of one routine has to have its type converted before it can be passed into another routine (e.g., the period from a standard SAP ERP Financials function tends to be two characters long, but if you want to pass that period into a controlling function, then it needs to be three characters long).

Another even more common example is that often you have a variable that is a string, or maybe `NUMC4`, and you want to pass that variable into a function that only accepts input of a certain type (say, `CHAR60`). You can't pass the variable directly; you have to move it into a helper variable, as shown in Listing 3.14.


```
DATA: helper        TYPE c LENGTH 60,
      castle_number TYPE n LENGTH 4 VALUE '0001'.

helper = castle_number.

"In the below the EXTENSION_ID is CHAR60
DATA(message_bottle) = CAST if_amc_message_producer_pcp(
    cl_amc_channel_manager=>create_message_producer(
      i_application_id       = 'ZAMC_4_MONSTERS'
      i_channel_id           = '/monsters'
      i_channel_extension_id = helper ) ).
```

Listing 3.14 Moving Variable into Helper Variable

In ABAP 7.4, however, this can be simplified by use of a specific type of constructor operator, `CONV`, the job of which is to convert values from one type to another. In Listing 3.15, the `CONV` function reads the target data type from the `IMPORTING` parameter definition and then converts the string (or whatever) into the type the parameter is expecting. Once again, this is shorter, safer, and more adaptive.

```
DATA: castle_number TYPE n LENGTH 4 VALUE '0001'.

"In the below the EXTENSION_ID is CHAR60
DATA(message_bottle) = CAST if_amc_message_producer_pcp(
    cl_amc_channel_manager=>create_message_producer(
      i_application_id       = 'ZAMC_4_MONSTERS'
      i_channel_id           = '/monsters'
      i_channel_extension_id = CONV #( castle_number ) ) ).
```

Listing 3.15 Converting String with Constructor Variable

3.3.3 Functions Expecting TYPE REF TO DATA

When you import parameters of functions or methods, a specific type of parameter is usually required. But in some situations you don't know the variable type until runtime. In such cases, the only way to achieve what you want is to use dynamic programming.

In cases in which you don't know the exact data type until runtime, often the importing parameter of the method is typed as `TYPE REF TO DATA`. This is what happens, for example, when you call methods that build up a dynamic signature to pass into a dynamically defined method. BOPF, which you will read about later in the book, uses this mechanism all the time. You also may have used parameters that declared `TYPE REF TO DATA` when you needed to store an arbitrary number of values of different data types in a log along with their descriptions.

In pre-7.4 ABAP, you would do something along the lines of the code in Listing 3.16 to satisfy the requirement of a method that expects to receive a parameter of the TYPE REF TO DATA type.

```
DATA: bopf_monster_header_records TYPE z4tt_monster_header,
      header_record_reference     TYPE REF TO data.

LOOP AT bopf_monster_header_records INTO DATA(bopf_monster_header_record).
  "Before 7.4
  CREATE DATA header_record_reference LIKE bopf_monster_header_record.
  GET REFERENCE OF bopf_monster_header_record INTO header_record_reference.

  "After 7.4
  header_record_reference = REF #( bopf_monster_header_record ).

  "IS_DATA is type REF TO DATA
  io_modify->update(
    iv_node = is_ctx-node_key
    iv_key  = bopf_monster_header_record-key
    is_data = header_record_reference ).

ENDLOOP.
```

Listing 3.16 Filling TYPE REF TO DATA Parameter

As you can see in Listing 3.16, now you can get rid of most of the code and still achieve the same thing by using the constructor operator REF and the hash (#) symbol. Because the runtime system knows the data type of VALUE, the REF# function can read this and create the data object, which is then passed into the method that expects a TYPE REF TO DATA object to be passed in.

3.4 Conditional Logic

By now, it won't come as a shock that again I'm going to mention the ZX81. The language it used back in 1981 was able to handle statements like IF (A + B) > (C + D) THEN .... Later, in 1999, when I started programming in ABAP, I missed this ability. Luckily, with the advent of ABAP 7.02, which I first had access to in 2012, I was once again able to do this sort of thing. (It might have taken 31 years for them to work out how to do this, but it was worth the wait.)

In ABAP 7.40, the IF/THEN and CASE constructs you know and love keep on getting easier. The next sections will explain how.

3.4.1 Omitting ABAP_TRUE

When functional methods were introduced to ABAP, part of the idea was that this would make the code read a bit more like English. Over the years, the consensus among ABAP programmers both inside and outside of SAP was that if you were creating a method that returned a value saying whether or not something is true, then the returning parameters should be typed as ABAP_BOOL.

For example, the ZCL_MONSTER->IS_SCARY method should return ABAP_TRUE if the monster is in fact scary but ABAP_FALSE if it's not quite as monstrous as it should be. So far, so good. However, as Listing 3.17 shows, something's rotten in the state of Denmark.

```
DATA(monster) =
zcl_monster_model=>get_instance( '0000000001' ).

IF monster->is_scary( ) = abap_true.
  MESSAGE 'Oh No! Send for the Fire Brigade!' TYPE 'I'.
ENDIF.
```

Listing 3.17 ABAP_TRUE

Why do you need the = ABAP_TRUE at the end? It doesn't make the sentence any more readable, just longer. As any English teacher will tell you, adding words that do not change the sentence's meaning to a sentence only makes you sound long-winded. The answer is that you had to do this because otherwise the syntax check would fail.

As of release 7.4 (SP 8), however, you can now do just what you would expect and omit ABAP_TRUE, as shown in Listing 3.18.

```
DATA(monster) =
zcl_monster_model=>get_instance( '0000000001' ).

IF monster->is_scary( ).
  MESSAGE 'Oh No! Send for the Fire Brigade!' TYPE 'I'.
ENDIF.
```

Listing 3.18 Omitting ABAP_TRUE

In Listing 3.18, what's happening from a technical point of view is that if you don't specify anything after a functional method, the compiler evaluates it as IS_PRODUCTION( ) IS NOT INITIAL. An ABAP_TRUE value is really the letter *X*, so the result is not initial, and so the statement is resolved as true.

Opinion is divided as to whether it is a Good Thing to have a true Boolean data type in a programming language. SAP says no, and the creators of every other programming language ever invented in the history of the universe say yes. This is why there are workarounds like this in ABAP.

That said, you have to be really careful when using this syntax; it only makes sense when the functional method is passing back a parameter typed as ABAP_BOOL. As an example, consider the code in Listing 3.19.

```
DATA(monster) = NEW zcl_monster_model( ).

IF monster->wants_to_blow_up_world( ).
  DATA(massive_atom_bomb) = NEW lcl_atom_bomb( ).
  massive_atom_bomb->explode( ).
ENDIF.
```

Listing 3.19 IF Statement without Proper Check

If the functional method in Listing 3.19 returns a string and that string is NO NO! Do not blow up the world, whatever you do, do not blow up the world, then the result is NOT INITIAL and thus evaluated as true, and so it's curtains for all of us.

3.4.2 Using XSDBOOL as a Workaround for BOOLC

Another common situation with respect to Boolean logic (or the lack thereof) within ABAP is a case in which you want to send a TRUE/FALSE value to a method or get such a value back from a functional method. In ABAP, you can't just say something like the following:

```
RF_IS_A_MONSTER = ( STRENGTH > 100 AND SANITY < 20)
```

But in some programming languages, you can do precisely that (can you guess which computer could do that in 1981?). Again, we have a workaround in the form of the built-in BOOLC function (see Listing 3.20).

```
* Do some groovy things
* Get some results
* Postconditions
zcl_dbc=>ensure( that = 'A result table is returned'
which_is_true_if = boolc( rt_result[] IS NOT INITIAL ) ).
```

Listing 3.20 BOOLC

In Listing 3.20, you pass in a TRUE/FALSE value based on whether an internal table has any entries. This works fine.

But what if you want to test for a negative using this method? Say, for example, that you want to pass into the IF_TRUE parameter a TRUE/FALSE value that's true if the table is empty. If you use the previous technique using BOOLC, then things start going horribly wrong. This can be demonstrated by running the code in Listing 3.21.


```
DATA: empty_table TYPE STANDARD TABLE OF ztmonster_header.

  IF boolc( empty_table[] IS NOT INITIAL ) = abap_false.
    WRITE:/ 'This table is empty'.
  ELSE.
    WRITE:/ 'This table is as full as full can be'.
  ENDIF.
  IF boolc( 1 = 2 ) = abap_false.
    WRITE:/ '1 does not equal 2'.
  ELSE.
    WRITE:/ '1 equals 2, and the world is made of snow'.
  ENDIF.
```

Listing 3.21 Testing for Negative

When you run this code, the output is as follows:

1. This table is as full as full can be.
2. 1 equals 2, and the world is made of snow.

Oh, dear! The reason for this outcome is a fundamental design flaw in the built-in function BOOLC. Instead of returning a one-character field defined in the same way as ABAP_BOOL, it returns a string. If the string is an X (TRUE), then all is well—but in ABAP, comparing a string of one blank character with the blank character inside ABAP_FALSE means that the comparison fails, even though the values are identical.

Therefore, given that a real Boolean variable is out of the question for whatever reason, a new workaround is needed. Fixing BOOLC so that it returns an ABAP_BOOL value would have been too easy, so in ABAP 7.4 a newly created built-in function was added, called XSDBOOL, which does the same thing as BOOLC but returns an ABAP_BOOL type parameter. You can see an example of its use in Listing 3.22. The function was not invented for this purpose, but it works, and that's all that matters.

```
* Then do the same using XSDBOOL.
  IF xsdbool( empty_table[] IS NOT INITIAL ) = abap_false.
    WRITE:/ 'This table is empty'.
  ELSE.
    WRITE:/ 'This table is as full as full can be'.
  ENDIF.
   IF xsdbool( 1 = 2 ) = abap_false.
    WRITE:/ '1 does not equal 2'.
  ELSE.
    WRITE:/ '1 equals 2, and the world is made of snow'.
  ENDIF.
```

Listing 3.22 Using XSDBOOL for Correct Logic Test Results

When you run this code, the output is as follows:

1. This table is empty.
2. 1 does not equal 2.

Even better: if you use the wrong one (BOOLC) in ABAP in Eclipse, you get a warning that tells you to use XSDBOOL instead.

3.4.3 The SWITCH Statement as a Replacement for CASE

How many times have you seen code like that in Listing 3.23? Here you're getting one value and using a CASE statement to translate that value. The problem is that you need to keep mentioning what variable you're filling in every *branch* of your CASE statement.

```
* Use adapter pattern to translate human readable CRUD
standard values to the BOPF equivalent
    DATA: bopf_edit_mode TYPE /bobf/conf_edit_mode.

    CASE id_edit_mode.
      WHEN 'R'."Read
        bopf_edit_mode = /bobf/if_conf_c=>sc_edit_read_only.
      WHEN 'U'."Update
        bopf_edit_mode = /bobf/if_conf_c=>sc_edit_exclusive.
      WHEN OTHERS.
        "Unexpected Situation
        RAISE EXCEPTION TYPE zcx_4_monster_exceptions.
    ENDCASE.
```

Listing 3.23 Filling in Variable Using CASE Statement

As mentioned in the code, this is the adapter pattern, very common in OO programming. In 7.4, this can be slightly simplified by using the new SWITCH constructor operator, as shown in Listing 3.24.

```
* Use adapter pattern to translate human readable CRUD
* standard values to the BOPF equivalent
DATA(bopf_edit_mode) =
SWITCH /bobf/conf_edit_mode( id_edit_mode
WHEN 'R' THEN /bobf/if_conf_c=>sc_edit_read_only  "Read
WHEN 'U' THEN /bobf/if_conf_c=>sc_edit_exclusive  "Update
ELSE THROW zcx_4_monster_exceptions( ) ).         "Unexpected
```

Listing 3.24 Filling in Variable Using SWITCH Statement

As you can see from this example, the data definition for BOPF_EDIT_MODE (/bobf/conf_edit_mode in this case) has moved into the body of the expression, thus dramatically

reducing the lines of code needed. In addition, Java fans will jump up and down with joy to see that instead of the ABAP term RAISE EXCEPTION TYPE we now have the equivalent Java term, THROW. The usage is identical, however; the compiler evaluates the keywords RAISE EXCEPTION TYPE and THROW as if they were one and the same. As an added bonus, this actually makes more grammatical sense, because THROW and CATCH go together better than RAISE EXCEPTION TYPE and CATCH. (It's lucky that exception classes have to start with CX; otherwise some witty programmer at SAP would create an exception class called UP.)

It's important to note that the values in the WHEN statements have to be constants, as in the preceding example. If you put something like MONSTER->HEAD_COUNT after the WHEN statement, then the SWITCH statement as a whole explodes and gives an incorrect error message saying **"HEAD_COUNT" is unknown**, when what it really means is that MONSTER->HEAD_COUNT isn't a constant. If you need a WHEN statement with variables, you have to use the COND statement described in the next section.

To move away from monsters for a second, as painful as that is, here's an example of combing two new ABAP constructs together. Let's say you wanted to merge some values of different lengths into a uniform format. In standard SAP, table VBPA is a good example. It has customer (KUNNR) values, which are 10 characters long, and personnel number (PERNR) values, which are eight characters long. In Listing 3.25, we fill new table LT_VAKPA with the data from VBPA, except the KUNDE field will always come out as a 10-character field no matter if a customer number or personnel number was in VBPA.

```
LOOP AT lt_vbpa ASSIGNING FIELD-SYMBOL(<ls_vbpa>).
  INSERT VALUE #(
  vbeln = <ls_vbpa>-vbeln
  parvw = <ls_vbpa>-parvw
  kunde = SWITCH #( <ls_vbpa>-parvw
          WHEN 'AG' OR 'WE' OR 'RG' OR 'RE'
         THEN <ls_vbpa>-kunnr
          ELSE 'OO' && <ls_vbpa>-pernr )
  adrnr = <ls_vbpa>-adrnr )
  INTO TABLE gt_vakpa.

ENDLOOP.
```

Listing 3.25 Merging Two Formats Using SWITCH

3.4.4 The COND Statement as a Replacement for IF/ELSE

All throughout this book, you'll be reading about how resistance to change is bad. Despite that, let's admit it: Change can be annoying, especially when it affects your code. One great example of this fact involves coding a CASE statement based on the assumption that one value is derived from the value of another—before someone

comes along and tells you that the rules have changed and the last value in the CASE statement is only true if it's a Tuesday. On Wednesday, the value becomes something else.

CASE statements can only evaluate one variable at a time, so in the case of this example you have to change the whole thing into an IF/ELSE construct. That's not the end of civilization as we know it, but the more changes you have to make, the bigger the risk.

Say that you're really scared that the logic you've been given might change at some point in the future, but nonetheless you start off with CASE, such as in the code in Listing 3.26, which is pre-7.4 code that evaluates the description of a monster's sanity based on a numeric value.

```
* Fill the Sanity Description
CASE cs_monster_header-sanity_percentage.
  WHEN 5.
    cs_monster_header-sanity_description = 'VERY SANE'.
  WHEN 4.
    cs_monster_header-sanity_description = 'SANE'.
  WHEN 3.
    cs_monster_header-sanity_description = 'SLIGHTLY MAD'.
  WHEN 2.
    cs_monster_header-sanity_description = 'VERY MAD'.
  WHEN 1.
    cs_monster_header-sanity_description = 'BONKERS'.
  WHEN OTHERS.
cs_monster_header-sanity_description = 'RENAMES SAP PRODUCTS'.
ENDCASE.
```

Listing 3.26 CASE Statement to Evaluate Monster Sanity

In 7.4, you can achieve the same thing, but you can do so in a more compact way by using the COND constructor operator. This also means that you don't have to keep specifying the target variable again and again (see Listing 3.27).

```
"Fill the Sanity Description
cs_monster_header-sanity_description =
COND #(
WHEN cs_monster_header-sanity_percentage > 75 THEN 'VERY SANE'
WHEN cs_monster_header-sanity_percentage > 50 THEN 'SANE'
WHEN cs_monster_header-sanity_percentage > 25 THEN 'SLIGHTLY MAD'
WHEN cs_monster_header-sanity_percentage > 12 THEN 'VERY MAD'
WHEN cs_monster_header-sanity_percentage > 1  THEN 'BONKERS'
ELSE 'RENAMES SAP PRODUCTS' ).
```

Listing 3.27 Using COND Constructor Operator

That looks just like a CASE statement, and the only benefit of the change at this point is that it's a bit more compact. However, when the business decides that you need to take the day into account when saying if a monster is bonkers or not, you can just change part of the COND construct. In the pre-7.4 situation, you had to give up on the whole idea of a CASE statement and rewrite everything as an IF/ELSE construct. The only change needed to the COND logic is shown in Listing 3.28.

```
DATA: day TYPE char10 VALUE 'Tuesday'."Lenny Henry!
* Fill the Sanity Description
cs_monster_header-sanity_description =
COND text30(
WHEN cs_monster_header-sanity_percentage = 5 THEN 'VERY SANE'
WHEN cs_monster_header-sanity_percentage = 4 THEN 'SANE'
WHEN cs_monster_header-sanity_percentage = 3 THEN 'SLIGHTLY MAD'
WHEN cs_monster_header-sanity_percentage = 2 THEN 'VERY MAD'
WHEN cs_monster_header-sanity_percentage = 1 AND
     day = 'Tuesday' THEN 'HAVING AN OFF DAY'
WHEN cs_monster_header-sanity_percentage = 1 THEN 'BONKERS'
ELSE 'RENAMES SAP PRODUCTS' ).
```

Listing 3.28 COND Constructor Operator with Updated Logic

3.5 Internal Tables

Internal tables are the bread and butter of programming in ABAP. A lot of other languages, like Java, can only dream of having such a thing; they have to deal with various sorts of arrays and stacks and hash browns and what have you. In this section, you'll learn about some new ABAP functionalities that relate to internal tables.

3.5.1 Table Work Areas

Some time ago, SAP decreed that header lines in internal tables were the work of the devil. This was because the use of header lines led to the existence of two data objects in your program with the exact same name, and this was viewed as confusing. For example, it wouldn't be uncommon to find a program in which you had an ITAB variable that referred to the internal table as a whole and a work area called ITAB that referred to the current line of the table being processed. Clearly, that's wrong from an academic point of view—but in real life, ABAP programmers were so used to the idea of the header line that it was a hard habit to shake. This was especially true because you had to explicitly declare a variable to act as the header line. For example:

```
DATA: monster_record LIKE LINE OF monster_table.
```

The good news is that now you can avoid having to make that extra variable declaration and still have two differently named variables, one for the table and one for the work area. Listing 3.29 shows the syntax for reading into a work area and looping through a table in release 7.4.

```
DATA: table_of_monsters
TYPE STANDARD TABLE OF z4t_monster_head.

READ TABLE table_of_monsters
WITH KEY color = 'RED'
INTO DATA(red_monster_details).

LOOP AT table_of_monsters INTO DATA(loopy_monster_details).
ENDLOOP.
```

Listing 3.29 Reading into Work Area and Looping through Table

In Section 3.1.1, you learned that from 7.4 onward you no longer need to perform a DATA declaration for elementary data types. It's exactly the same for the work areas, which are of course structures. If you're looping into a work area called MONSTER_RECORD and the work area structure doesn't match the type of table TABLE_OF_MONSTERS, you'll see a syntax error.

Therefore, the compiler knows the type it wants—so why do you have to tell it that type in an explicit data declaration? The answer is that now you don't, and this change will remove all those extra data declaration lines you had to insert when everyone moved away from header lines (if they ever did) and had to explicitly declare work areas instead.

It's always faster to loop into FIELD-SYMBOL rather than a work area even if you don't want to change any values. Happily, in the same way that you no longer need DATA declarations for table work areas, you also no longer need FIELD-SYMBOL declarations for the (common) situations in which you want to change the data in the work area while looping through an internal table. In release 7.4, if you want to use field symbols for the work area, then the syntax is as shown in Listing 3.30.

```
READ TABLE table_of_monsters
WITH KEY color = 'RED'
ASSIGNING FIELD-SYMBOL(<red_monster_details>).

LOOP AT table_of_monsters ASSIGNING FIELD-SYMBOL(<loopy_monster_details>).
ENDLOOP.
```

Listing 3.30 Field Symbols for Work Area

One vitally important point to note is that if you declare a work area and then loop through an internal area, after the loop is over the work area will be filled with the value of the last row of the internal table that was processed. But if you loop through

an internal table into a work area created via the DATA statement, then you might wonder if the work area ceases to exist after you leave the loop.

From an academic point of view, not being able to access the work area outside of the loop is a Good Thing, because the textbooks all say that variables should not exist outside their scope (the loop, in this case). Indeed, at SAP, this behavior is very much desired. Unfortunately, the fact is that the variable does exist after you leave the loop. SAP has got around this problem by publishing guidelines saying that if you access such a variable outside of its scope, then you are *very naughty*, and the staff at SAP will say "tut, tut" if they find out. (Personally, I'm not convinced that this dire threat will have much effect, but I thought I'd let you know.)

3.5.2 Reading from a Table

If I told you that you would never have to use the READ TABLE statement again to get a line out of an internal table, then perhaps the bottom would drop out of your world. In fact, that's exactly what happens in ABAP 7.4. You can remove the keywords altogether and replace the English phrase READ TABLE with a more computer-like pair of square brackets [].

Prior to ABAP 7.4, calling a line from an internal table would look like Listing 3.31.

```
    DATA: monster_name      TYPE z4de_monster_name VALUE 'JIMMY',
          table_of_monsters TYPE STANDARD TABLE OF z4t_monster_head,
          monster_details   LIKE LINE OF table_of_monsters,
          monster           TYPE REF TO zif_4_monster_model.

    READ TABLE table_of_monsters INTO monster_details
    WITH KEY name = monster_name.

    monster = zcl_4_monster_model=>get_instance( monster_details-monster_
number ).
```

Listing 3.31 Reading Line from Internal Table before 7.4

However, in ABAP 7.4 and up, this is simplified, as shown in Listing 3.32.

```
DATA(monster) = zcl_4_monster_model=>get_instance(
table_of_monsters[ monster_name ]-monster_number  ).
```

Listing 3.32 Reading Line from Internal Table after 7.40

Note

Some would say that making code less like English and more like machine code actually *prevents* clarity. For example, if after reading your internal table line you wanted to

add it to a string and pass the string to a method, then you could go overboard using punctuation marks in your code. The part where you read the internal table gets buried in a morass of code, and someone reading the code might struggle to work out what's happening:

```
zcl_bc_output( |{ monster_name }'s Monster Number is { monster_table
[ monster_name ]-monster_number }| ).
```

Many people have said the same thing about regular expressions: they get the job done in a very small amount of code, but no one can understand that code.

In real life, the most common usage of the new way of reading internal tales is to read the first line of such a table as follows:

```
DATA(selected_monster_line) = selected_monster_lines[ 1 ].
```

What happens if such an expression can't find the internal table line you're looking for? The answer is not good news. An exception is raised, whereas you were probably expecting a blank (initial) value to be returned. SAP must have received a lot of complaints about this, because as of 7.4 (SP 8) SAP delivered a workaround: if you add the word `OPTIONAL` at the end of your query, then suddenly the system doesn't care if no record is found, and an initial value of whatever data type you're looking for is returned. This is exactly what would happen with a traditional `READ TABLE xyz INTO work_area_abc` setup when the read failed and the work area had not yet been filled. An example of this workaround is shown in Listing 3.33.

```
DATA(message1) =
|{ monster_name }{ '''s Monster Number is'(022) } | &&
|{ VALUE #( table_of_monsters[ monster_name ]-monster_number OPTIONAL ) }|.

DATA(message2) =
|{ monster_name }{ '''s Monster Number is'(022) } | &&
|{ VALUE #( table_of_monsters[ monster_name ]-monster_
number DEFAULT '9999999999' ) }|.
```

Listing 3.33 Reading Internal Table with OPTIONAL/DEFAULT

The addition of `DEFAULT` fills in a hard-coded value when the read fails. Then you can check if the read failed by comparing the result with that hard-coded value in the same way you would if `SY-SUBRC` was `4` when checking if a traditional read on an internal table succeeded.

3.5.3 CORRESPONDING for Normal Internal Tables

You no doubt use the ABAP keyword `MOVE-CORRESPONDING` a lot, moving variable values from one structure to another.

What's That Coming over the Hill? Is It a Problem?

In some standard SAP documentation, you're advised never to use `MOVE-CORRESPONDING` at all, most likely to avoid the problem of moving strings into number fields, highlighted at the start of this section. However, if you do use it, then the functionality discussed here should be of help to you.

New in 7.4 is a constructor operator called `CORRESPONDING` without the word *move* in front. This operator takes moving data between two internal tables to a whole new level. Say that you have two internal tables full of monster-related data, but they're defined with a different set of columns. What you want to do is copy over the fields with the same names from one table to the other, with two exceptions:

- You don't want to copy the `EVILNESS` value from one table to the other, even though both tables have an `EVILNESS` column.
- You want to copy the column named `MOST_PEASANTS_SCARED` from one table into a similar column called `PEOPLE_SCARED` in the second table.

Prior to 7.4, you would declare a bunch of helper variables to store the work areas of the two tables and then loop through the first table, moving everything from one table to another. You'd then perform some logic to deal with your exceptions (see Listing 3.34).

```
DATA: green_monsters TYPE STANDARD TABLE OF z4t_monster_head,
      blue_monsters  TYPE STANDARD TABLE OF z4t_monster_head.

FIELD-SYMBOLS:
  <green_monsters> LIKE LINE OF green_monsters,
  <blue_monsters>  LIKE LINE OF blue_monsters.

LOOP AT green_monsters ASSIGNING <green_monsters>.
  APPEND INITIAL LINE TO blue_monsters
  ASSIGNING <blue_monsters>.
  MOVE-CORRESPONDING <green_monsters> TO <blue_monsters>.
  CLEAR <blue_monsters>-evilness.
  <blue_monsters>-early_age_strength =
  <green_monsters>-strength.
ENDLOOP.
```

Listing 3.34 Moving One Table to Another before 7.4

In release 7.4, you can use the constructor operator `CORRESPONDING` to do the exact same thing, but this time you don't have to declare the field symbols. You tell the `CORRESPONDING` operator what the rules are, and it loops through the table for you while executing those rules. Moreover, you don't even need to define the target table; if you put `#` after the `CORRESPONDING` operator, then it creates the target table with the same columns as

the source table, but without the EVILNESS column and with the SCARED column having a different name but the same type as the source column, as shown in Listing 3.35.

```
green_monsters = CORRESPONDING #(
blue_monsters
MAPPING people_scared = most_peasants_scared
EXCEPT evilness ).
```

Listing 3.35 Moving One Table to Another in 7.4

A common problem is that when you try to do use MOVE-CORRESPONDING into a hashed or sorted table, then you get a dump because you can't override the key fields. Using CORRESPONDING and EXCEPT, you can prevent this problem—as shown in Listing 3.36, in which you want to either add a new entry to an internal table or update an existing one.

```
"HASHED table
READ TABLE monster_order_items ASSIGNING FIELD-SYMBOL(<order_item>)
WITH TABLE KEY order_number = id_order_number
               order_item   = id_item_number.

IF sy-subrc = 0.
  "Cannot over-write key fields of a Hashed Table
  <order_item> = CORRESPONDING #( BASE ( <order_item> ) changed_item
  EXCEPT order_number order_item ).
ELSE.
  INSERT changed_item INTO TABLE monster_order_items.
ENDIF.
```

Listing 3.36 Moving Corresponding Fields to Hashed Table

3.5.4 MOVE-CORRESPONDING for Internal Tables with Deep Structures

In ABAP, a deep structure is not a structure that thinks a lot and has a complex personality but rather is a structure that—in addition to elementary data types, such as strings and numbers—has internal tables. Listing 3.37 shows an example of a deep structure. T_RESULTS is defined as a table type, so you have an internal table in which each row has a column that is itself an internal table.

```
TYPES: BEGIN OF l_typ_monsters,
         monster_number TYPE z4de_monster_number,
         monster_name   TYPE z4de_monster_name,
         t_items        TYPE z4tt_monster_items,
       END OF l_typ_monsters.
DATA: monster_table TYPE STANDARD TABLE OF l_typ_monsters.
```

Listing 3.37 Deep Structure

SAP clearly has been thinking about what happens when you perform a MOVE-CORRESPONDING maneuver between two slightly different structures that are both deep but defined slightly differently. As you know, MOVE-CORRESPONDING compares the field names of two structures, and if a field called RESULT is a string in one and a number in another and the value is XYZ in the first structure, then trouble looms (i.e., a short dump). Take this one step further: Say you have two internal tables in two deep structures with the same name but defined differently. What's going to happen when you perform MOVE-CORRESPONDING?

The next examples examine what happens in release 7.02 when moving from one structure to another and then expand to look at how the same process behaves in 7.4. *Spoiler:* In 7.4, you can perform MOVE-CORRESPONDING between internal tables as a whole, which wasn't possible in lower versions.

Say that in Europe it's important to keep track of something called an IBAN code for each monster, which is meaningless anywhere else in the world, and in the United States it's important keep track of a LOCKBOX code for each monster, which likewise is meaningless anywhere else in the world. Listing 3.38 sets up structures to store data for each region and then tries to use MOVE-CORRESPONDING to move some European monster data to the US equivalent.

```
TYPES: BEGIN OF l_typ_european_monsters,
         monster_name      TYPE string,
         monster_iban_code TYPE string,
       END OF l_typ_european_monsters.

TYPES: l_tt_european_monsters
TYPE HASHED TABLE OF l_typ_european_monsters
WITH UNIQUE KEY monster_name.

    DATA: iban_code_record TYPE l_typ_european_monsters.

    TYPES: BEGIN OF l_typ_european_results,
             laboratory TYPE string,
             t_result   TYPE l_tt_european_monsters,
           END OF l_typ_european_results.

TYPES: l_tt_european_results
TYPE STANDARD TABLE OF l_typ_european_monsters.

    DATA: european_result  TYPE l_typ_european_results,
          european_results TYPE l_tt_european_results.

    TYPES: BEGIN OF l_typ_us_monsters,
             monster_name         TYPE string,
```

```
            monster_lockbox_code TYPE string,
          END OF l_typ_us_monsters.

    TYPES: l_tt_us_monsters TYPE HASHED TABLE OF l_typ_us_monsters
                            WITH UNIQUE KEY monster_name.

    TYPES: BEGIN OF l_typ_us_results,
             laboratory TYPE string,
             t_result   TYPE l_tt_us_monsters,
           END OF l_typ_us_results.

 TYPES: l_tt_us_results TYPE STANDARD TABLE OF l_typ_us_results.

 DATA: us_result  TYPE l_typ_us_results,
       us_results TYPE l_tt_us_results.

european_result-laboratory         = 'SECRET LABORATORY 51'.
iban_code_record-monster_name      = 'FRED'.
iban_code_record-monster_iban_code = 'AL47212110090000000235698741'.
INSERT iban_code_record INTO TABLE european_result-t_result.
MOVE-CORRESPONDING european_result TO us_result.
```

Listing 3.38 MOVE-CORRESPONDING Attempt

What do you think happens? In the US monster structure, the results table has the `LOCKBOX` field filled with the `IBAN` code from the European equivalent because there's a `T_RESULT` field in both the European and US structures.

Usually, this isn't what you want. For identical tables, you can always get around this using `TABLE_ONE[] = TABLE_TWO[]`, which changes the first table into an identical copy of the second table. However, this doesn't work in cases in which, say, you have a database table with 10 fields and an internal table with those 10 fields plus five more fields with text descriptions or calculated fields. Instead, you need to read the database table into one internal table with just the 10 fields and loop through this first internal table, moving the corresponding elements to some sort of second output table, where you fill in extra data, such as names for sales offices and the like and calculated fields.

Thus, instead of the code shown in Listing 3.39, you'd use the code shown in Listing 3.40.

```
LOOP AT european_results ASSIGNING FIELD-SYMBOL(<european_result>).
APPEND INITIAL LINE TO us_results ASSIGNING FIELD-SYMBOL(<us_result>).
MOVE-CORRESPONDING <european_result> TO <us_result>.
ENDLOOP.
```

Listing 3.39 Copying between Internal Tables with Different Structures before 7.4


```
MOVE-CORRESPONDING european_results TO us_results.
```

Listing 3.40 Copying between Internal Tables with Different Structures in 7.4

This saves you a few lines of code and is wonderful for when the line structures of the two tables are flat. However, it still doesn't solve the problem for deep structures. As you've seen, `MOVE-CORRESPONDING` on its own will dump the contents of an internal table component, such as `T_RESULT`, into the identically named component in the target structure. If `T_RESULT` in the target has differently named columns, then all sorts of bizarre results might ensue. To counteract this, SAP has come up with two new additions to `MOVE-CORRESPONDING` in release 7.4 (plus a combination of the two), as follows:

- **`MOVE-CORRESPONDING EXPANDING NESTED TABLES`**
  In `MOVE-CORRESPONDING EXPANDING NESTED TABLES`, anything that might happen to be in the target internal table already is deleted. Columns with simple values, like numbers, are copied to their identically named friends. But when it comes to complex columns such as `T_RESULT`, only fields that have the same column name inside the nested tables are copied. For example, `MONSTER_NAME` is copied because there's an equivalently named column in the target, but `MONSTER_IBAN_CODE` is not because there's no column with the same name, only the `LOCKBOX`.
- **`MOVE-CORRESPONDING KEEPING TARGET LINES`**
  What happens in `MOVE-CORRESPONDING KEEPING TARGET LINES` is quite strange; if there's anything already in the target internal table, then it stays there. Then, at the end of the target table, extra rows are added—which is what would happen if you just performed `MOVE-CORRESPONDING` between the two tables. This is rather like `APPEND LINES OF table1 TO table2`, except that the two tables have different structures and only identically named components come across.
- **`MOVE-CORRESPONDING EXPANDING NESTED TABLES KEEPING TARGET LINES`**
  As might be imagined, `MOVE-CORRESPONDING EXPANDING NESTED TABLES KEEPING TARGET LINES` performs both of the previous tasks at once. It acts like `APPEND LINES OF table1 TO table2`, copying only identically named components to the new rows, but it's also a bit clever with any internal table components and only copies identically named components within these structures.

3.5.5 Dynamic MOVE-CORRESPONDING

SAP can be like a dragon with two heads, each head telling you the opposite of the other. In 7.4, the guidance was to not use `MOVE-CORRESPONDING` at all, but you were given new tools with which to do so. In 7.5, this dichotomy becomes more extreme; on the one hand, you're advised not to use dynamic programming (because it's not allowed in some SAP S/4HANA scenarios), and yet a new, dynamic `MOVE-CORRESPONDING` class is given to you.

In the examples in Section 3.5.3, you could hard-code the rules for mapping fields with different names to be copied to one another—like the 12,000 different names SAP gives to SY-MSGNO in different structures.

Now imagine that such a mapping from a really big structure to a smaller one can vary depending on the conditions at runtime. That might seem a rather esoteric requirement, but you won't have to think too hard to find a real-life example; after all, the monster examples are actually real problems people have to deal with, with the names changed to protect the innocent.

In the next example, as always, the task is building a monster. The configuration table has about 24 different sorts of criminal brains you could use to fill the inside of the monster's head. You want to narrow this down to the four best selections, defined at runtime, which are passed into a smaller structure for further processing.

Both structures start with the monster number and name. The larger structure has a list of fields describing the serial numbers of the various brains available, and the smaller structure has fields in the format BEST_BRAIN_XX.

You want to move the identically named fields from the big structure to the small structure and then determine dynamically which of the possible brains from the configuration structure to move to the smaller structure. You'll achieve this by filling a mapping table prescribing which values to copy between differently named fields, calling two methods from CL_ABAP_CORRESPONDING to create a mapping object, and then executing the mapping itself, as shown in Listing 3.41.

```
DATA: mapping_record TYPE cl_abap_corresponding=>mapping_info,
      mapping_table  TYPE cl_abap_corresponding=>mapping_table.

mapping_record-level = 0.
mapping_record-kind  = cl_abap_corresponding=>mapping_component.

mapping_record-dstname = 'BEST_BRAIN_01'.

IF is_customer_requirements-brain_size_desired = 'NORM'."Normal Brain
  mapping_record-srcname = 'BIGGEST_BRAIN'.
ELSE.
  mapping_record-srcname = 'SMALLEST_BRAIN'.
ENDIF.

APPEND mapping_record TO mapping_table.

mapping_record-dstname = 'BEST_BRAIN_02'.

IF is_customer_requirements-usage_desired = 'MORT'."Mortgage Salesman
  mapping_record-srcname = 'EVILEST_BRAIN'.
```



```
ELSEIF is_customer_requirements-usage_desired = 'MORI'."Morris Dancer
  mapping_record-srcname = 'WEIRDEST_BRAIN'.
ENDIF.

APPEND mapping_record TO mapping_table.

TRY.
    DATA(dynamic_mapper) =
    cl_abap_corresponding=>create(
        source            = is_possible_brains
        destination       = rs_best_brains
        mapping           = mapping_table ).

    dynamic_mapper->execute(
      EXPORTING source      = is_possible_brains
      CHANGING  destination = rs_best_brains    ).

  CATCH cx_corr_dyn_error ##NO_HANDLER."In real life you need one
    "Raise a Fatal Error Message
    RETURN.
ENDTRY.
```

Listing 3.41 Dynamic MOVE-CORRESPONDING Usage

You can also use the EXCEPT option as an input to the KIND parameter in a mapping record to stop certain identically named fields being moved; the LEVEL parameter is used when mapping deep structures. In the preceding example, you could have achieved the same thing using direct assignment with fewer lines of code, but this approach only becomes advantageous when you have really complicated structures with loads of fields. Traditionally, this sort of task has been handled using field symbols; I imagine SAP feels that using this new class makes the code easier to read.

3.5.6 New Functions for Common Internal Table Tasks

When working in ABAP code, there are cases in which you want to know exactly in what line of an internal table the data you're interested in lives. To find this information in pre-7.4 ABAP, you would have written code that declared a helper variable to store the row number of the target record, read the table for no other purpose than to find that row number, and then transferred the system variable that contained the result of the table read into your helper variable, as shown in Listing 3.42.

```
DATA:
  start_row         TYPE sy-tabix,
  table_of_monsters TYPE STANDARD TABLE OF z4t_monster_head,
```

```
    monster_number    TYPE z4de_monster_number VALUE '0000000001'.

  READ TABLE table_of_monsters
  WITH KEY monster_number = monster_number
  TRANSPORTING NO FIELDS.

  IF sy-subrc = 0.
    start_row = sy-tabix.
  ENDIF.
```

Listing 3.42 Reading Internal Table to Get Row Number in 7.02

You see the logic in Listing 3.42 a lot when processing nested loops on standard tables—you follow such code with `LOOP AT table_of_monsters FROM start_row`—but also in a myriad of other use cases. In any event, in release 7.4 this can be simplified by using the built-in function `LINE_INDEX`, which does the exact same task but without the need to look at the values of `SY-SUBRC` and `SY-TABIX`. This new approach is shown in Listing 3.43.

```
DATA(start_row) =
line_index( table_of_monsters[ monster_number = monster_number ] ).

LOOP AT table_of_monsters FROM start_row
ASSIGNING FIELD-SYMBOL(<monster_details>).
     "Do Something
ENDLOOP.
```

Listing 3.43 LINE_INDEX

Throughout this chapter, one aim has been to get rid of helper variables. Because `LINE_INDEX` is a *built-in function*, it can be used at operand positions, thus negating the need for the helper variable `START_ROW`. When looping at an internal table from the row formerly stored in `START_ROW` instead, use the code shown in Listing 3.44.

```
  LOOP AT table_of_monsters
    FROM line_index( table_of_monsters[ monster_number = monster_number ] )
    ASSIGNING FIELD-SYMBOL(<monster_details>).
    "Do Something
  ENDLOOP.
```

Listing 3.44 Built-In Function LINE_INDEX at Operand Position

This new built-in function also has a friend: `LINE_EXISTS`. Say you want to see if an internal table already has an entry for the monster at hand. If it does, then you want to modify the existing entry; if not, then you want to add a new entry. The way this was done prior to 7.4 was to first read the internal table to see if there was an existing entry for the

monster. If there was no existing entry, then `SY-SUBRC` would not be zero. You'd react to that by adding a new entry to the table for your monster, as shown in Listing 3.45.

```
  READ TABLE table_of_monsters ASSIGNING <monster_details>
  WITH KEY monster_number = monster_number.

  IF sy-subrc NE 0.
    APPEND INITIAL LINE TO table_of_monsters
    ASSIGNING <monster_details>.
  ENDIF.
  ADD 1 TO <monster_details>-sanity_percentage.
```

Listing 3.45 Checking If Internal Table Line Exists before 7.4

By adding the new built-in function `LINE_EXISTS`, the code can be changed as shown in Listing 3.46.

```
  IF line_exists( table_of_monsters[ monster_number = monster_number ] ).
    READ TABLE table_of_monsters ASSIGNING FIELD-SYMBOL(<monster_details>)
    WITH KEY monster_number = monster_number.
  ELSE.
    APPEND INITIAL LINE TO table_of_monsters
    ASSIGNING <monster_details>.
  ENDIF.
```

Listing 3.46 Checking If Internal Table Line Exists in 7.4

"Why is that better?" I hear you cry. For one thing, it makes it more obvious what you're trying to achieve. In addition, using `LINE_EXISTS` instead of `SY-SUBRC` is more reliable; `SY-SUBRC` can be dodgy because you never know when someone is going to have the bright idea of inserting some code between your `READ` statement and the `IF` statement that evaluates `SY-SUBRC`. If you use `LINE_EXISTS` to have the table read and the evaluation all bundled up in the one statement, as in Listing 3.47, then this means that no one can break the statement with a well-intentioned change.

```
  IF line_exists( table_of_monsters[ monster_number = monster_number ] ).
    "Do Something
  ENDIF.
```

Listing 3.47 Code All in One Line, with No Reliance on SY-SUBRC

3.5.7 Internal Table Queries with REDUCE

In Section 3.1.4, you learned a new way to create internal tables by using a `FOR` loop. After you've filled up your internal tables, though, you often want to query them. Say, for example, that you want to know how many really mad monsters you have. As of 7.4,

you can do this by using a constructor operator called REDUCE, which contains logic to process an internal table and return a single result.

Functional Programming

The REDUCE statement is a watered-down copy of the identically named statement in JavaScript, which is a language that uses functional programming. ABAP uses imperative programming, so these sorts of functional constructs are a brand-new, foreign invasion into ABAP.

In the example in Listing 3.48, you'll first say what variable you want created and what type that variable is going to be, then set an initial value for your result variable, and finally loop over the table, performing assorted logic. That sounds really complicated, but, as you'll see, the code is not.

```
    DATA: neurotic_monsters TYPE STANDARD TABLE OF z4t_monster_head.
*---------------------------------------------------------------------*
* Fill up NEUROTIC_MONSTERS table, then…
*---------------------------------------------------------------------*
    DATA(mad_monsters_count) = REDUCE sy-tabix(
    INIT result = 0
    FOR  monster_details IN neurotic_monsters
    NEXT result = result +
    zcl_4_bc_utilities=>add_1_if_true(
    zcl_4_monster_model=>is_mad( monster_details-monster_number ) ) ).
```

Listing 3.48 How Many Really Mad Monsters?

The SY-TABIX element after the REDUCE statement defines the type of the variable being created, MAD_MONSTER_COUNT. It also defines the type of the temporary variable after the INIT statement, which is going to be the result; both MAD_MONSTER_COUNT and RESULT have the type SY-TABIX. You then loop over your internal table NEUROTIC_MONSTERS into a dynamically created work area called MONSTER_DETAILS, and every time your IS_IT_MAD method comes back with a value of 1 for the monster being processed, you increase the count of the RESULT variable. After the FOR loop is finished, the value of RESULT is copied into MAD_MONSTER_COUNT.

A common use case is where you have a table of (say) 10 monster numbers, and you have to pass that out to an external system as a comma-delimited string. You reduce the table into one big string with the monster numbers separated by commas.

Two negative aspects of the REDUCE statement are that (a) it can be really difficult to understand what's going on and (b), even more importantly, you can't debug the FOR/NEXT loop inside it; the entire statement is processed in one hit.

FOR/NEXT Variations and Their Gotchas

In both VALUE statements and REDUCE statements you can have FOR/NEXT loops, and they come in three flavors:

- IN for looping over internal tables, as you just saw.
- WHILE a logical expression is true, which is rather like the WHILE/ENDWHILE in traditional ABAP. If the logical expression is never true, there will be no loops.
- UNTIL a logical expression is true. There is no equivalent of this in traditional ABAP, though this construct exists in many other languages. There will be always at least one loop, and if the logical condition is never true, there will be an endless loop, just as in a DO/ENDO loop with no exit mechanism, so you have to watch out for that.

The requirement is this: "I want to fill a table of monsters numbers. The first row will have the value 1, and each subsequent row will have a value one higher than the last. When the value gets to 11, do not add that value to the table and stop processing." In a FOR/NEXT loop, that comes out as follows:

```
monster_no_table = VALUE #( FOR m_no = 1 THEN m_no + 1 UNTIL m_no = 11
( m_no ) ).
```

That is quite confusing for the reader. The assignment directly after the FOR statement sets the value of the first row. The assignment after the THEN statement says we are going to start looping, adding 1 to the number each time. The assignment after the UNTIL statement says we are going to stop once the value reaches 11. The final (M_NO) at the end is saying add the current value of the variable to the table during each loop pass.

Just to confuse matters even more, the UNTIL variant automatically increases the loop counter whether you want to or not. As an example, the following two statements are functionally identical. They both fill an internal table with the numbers 1 to 10. In effect, if the THEN statement is missing, then it gets magically added at runtime:

```
monster_no_table1 = VALUE #( FOR m_no = 1 UNTIL m_no = 11 ( m_no ) ).
monster_no_table2 = VALUE #( FOR m_no = 1 THEN m_no + 1 UNTIL m_no = 11
( m_no ) ).
```

The WHILE variation does not have such an automatic "hidden" increment, so the following two statements are *not* functionally identical. The first does nothing at all (there is no THEN statement, so there is no loop), and the second fills an internal table with the numbers 1 to 10:

```
monster_no_table 3 = VALUE #( FOR m_no = 1 WHILE m_no < 11 ( m_no ) ).
monster_no_table 4 = VALUE #( FOR m_no = 1 THEN m_no + 1 WHILE m_no < 11
( m_no ) ).
```

3.5.8 Grouping Internal Tables

You're most likely familiar with the GROUP BY addition you can add to a database SELECT statement, which condenses similar records into a single row. In the past, when you

wanted something similar to an internal table, you'd use the `COLLECT` statement or the very dodgy `AT NEW` statement, which didn't work particularly well in a lot of circumstances. In fact, the `AT NEW` statement was so unpredictable that it was wiser to avoid it altogether and use other means to process related chunks from your internal table.

To be specific, if you said `AT NEW MONSTER` in a loop, you would expect the code within that block to execute when the monster changed. However, it sometimes wouldn't execute, depending on how the table was sorted or if Jupiter was in alignment with Neptune or if the chicken had jumped up and down three times at midnight and laid three addled eggs.

To avoid your program having to depend on such astrological or chicken-related factors, ABAP 7.4 announced good news: a `GROUP BY` option has been added to looping at internal tables.

To understand what this means, let's look at an example. Say that you have a huge table of monsters. There are monsters of various types: some mad, some not. You only want to process one combination of monster type/madness at a time. Somehow, you need to aggregate such records, do something with the result, and move on to the next combination. To do so, you need some sort of nested loop processing.

The usual way to do this is to build a smaller table of all possible combinations found within the main table, do an outer loop on that small table, and for each row of that outer table do an inner loop on the main table, looking for records relating to the combination in the outer loop. There are ways to do this well—for example, by making sure the inner table is a `SORTED` table—but it's still a lot of effort.

Fortunately, `GROUP BY` saves the day. Listing 3.49 demonstrates how applying the `GROUP BY` construct when looping over an internal table lets you look at the aggregate records for each combination one at a time, without having to go through the agony of nested loops. On each pass through the table, you're handed the aggregated data on a plate.

```
*-----------------------------------------------------------*
* In this example we are trying to prove that bonkers
* monsters with bolts through their necks have more heads
* per monster on average compared to bonkers monsters who
* like to ice skate.
* This is most likely a 100% correlation with the business
* problem you are trying to solve at work right at this
* moment.
*-----------------------------------------------------------*
  TYPES: tt_monsters TYPE STANDARD TABLE OF z4t_monster_head
                     WITH DEFAULT KEY.

  DATA: monster_sub_set TYPE tt_monsters,
        total_heads     TYPE i.
```



```
    DATA(table_of_monsters) = VALUE tt_monsters(
    ( monster_number = '1' model = 'BTNK' no_of_heads = 3 )
    ( monster_number = '2' model = 'BTNK' no_of_heads = 4 )
    ( monster_number = '3' model = 'BTNK' no_of_heads = 2 )
    ( monster_number = '4' model = 'ISDD' no_of_heads = 1 )
    ( monster_number = '5' model = 'ISDD' no_of_heads = 1 )
     ).

LOOP AT table_of_monsters ASSIGNING FIELD-SYMBOL(<monster_details>)
GROUP BY ( model         = <monster_details>-model
          is_it_crackers =
zcl_4_monster_model=>is_mad( <monster_details>-monster_number ) )
ASSIGNING FIELD-SYMBOL(<monster_group_record>).

CHECK <monster_group_record>-is_it_crackers = abap_true.

CLEAR monster_sub_set.

LOOP AT GROUP <monster_group_record> ASSIGNING FIELD-SYMBOL(<bonkers_monsters>).
monster_sub_set =
VALUE #( BASE monster_sub_set ( <bonkers_monsters> ) ).
ENDLOOP.

CLEAR total_heads.

LOOP AT monster_sub_set ASSIGNING FIELD-SYMBOL(<sub_set_record>).
  total_heads = total_heads + <sub_set_record>-no_of_heads.
ENDLOOP.

WRITE:/ 'Bonkers Monsters of Type',<monster_group_record>-model,' have ',
total_heads,' heads'.

ENDLOOP.
```

Listing 3.49 GROUP BY

This is complicated and introduces a whole bunch of new concepts all at once, so we need to step through the code bit by bit. Debugging it is the best way to see what is going on.

First, the database read is simulated to fill a table of monsters with three "bolts through neck" monsters and two ice skaters, each of which has one or more heads. The business requirement is going to be an aggregated list of the total number of heads, summarized by type of monster and excluding all monsters who are not mad.

Next is the LOOP AT/GROUP BY construct. What happens here is that every line of the table is looped through before moving onto to the line starting with CHECK. In debugging, you can see that the IS_IT_MAD method is called five times, once for each row in the table. To simplify matters, all the monsters are mad in this example.

Now, there's some sort of invisible nebulous table with two rows, two columns long, which has been built up by a procedure analogous to COLLECT. The first row says BTNK/X and the second row says ISDD/X. This is the table of possible combinations, the table that will be looped through into the <MONSTER_GROUP_RECORD> work area.

A check is performed to ensure we're dealing with a combination that involves mad monsters. Once that's determined, the time has come to create a table that's a subset of the main table, a subset that only includes monsters that match the current combination.

The processing block starting with LOOP AT GROUP performs this task. The individual records from the main table that match the current combination are looped through into the <BONKERS_MONSTERS> work area. At this point, you could just add <BONKERS_MONSTERS>-PEOPLE_SCARED to the TOTAL_SCARED variable, but to prove a point we're going to build up a subset table.

First, we'll look at the line that reads as follows:

```
monster_sub_set = VALUE #( BASE monster_sub_set ( <bonkers_monsters> ) ).
```

This could be translated as "append to table MONSTER_SUB_SET the <BONKERS_MONSTERS> work area."

Now we have a table containing a subset of the main table, and we loop through those records, adding up the total number of heads of the current type of monster and outputting the result.

The result is two written lines saying that (1) the mad monsters with bolts through their necks have nine heads in total and (2) the mad ice skating dead have two heads in total.

Note

As mentioned, we didn't really need to create a subset table in this example, but it's there to show that it's possible.

At this point, you might be thinking this looks just like a geometric loop—but the inner loop is only processed once for each group of similar items that the outer loop finds. Therefore, the runtime only increases in a linear fashion, which means that your program isn't going to get into the situation in which it will be fine for a small number of records but will time out when there's a lot of data.

Tip

In the SQL version of GROUP BY, you can only use column names. Because the internal table version of GROUP BY is processed wholly within ABAP, you can do all sorts of groovy things in addition—comparisons, method calls, and the like—which is why the example included a method call to IS_IT_MAD.

This takes quite a bit of experimentation before you get comfortable with it. The most difficult part, as with all these new constructs, is marrying new abilities to real-world problems. (Of course, some people might say that summarizing open items per customer from an internal table filled with BSID values is more realistic than summarizing head numbers of different types of monsters, but what do they know?)

3.5.9 Extracting One Table from Another

There are two new ways to extract one internal table from another that were introduced with 7.4, and both use the constructor operator FILTER. The next subsection will talk about using the FILTER operator first with conditional logic and then as a FOR ALL ENTRIES operation on an internal table.

FILTER with Conditional Logic

To understand the process of extracting one table from another in ABAP 7.4, return to the monsters example. Once again, you have a big table of all the monsters, and you want to extract a smaller internal table with just the averagely mad monsters. Normally, you would just loop through the big table and append lines to your new table, as shown in Listing 3.50.

```
DATA: "Source Table
      all_monsters
      TYPE SORTED TABLE OF z4t_monster_head
      WITH NON-UNIQUE KEY monster_number
      WITH NON-UNIQUE SORTED KEY bonkers_ness
      COMPONENTS sanity_percentage,
      "Target Table
      averagely_mad_monsters   TYPE STANDARD TABLE OF z4t_monster_head,
      an_averagely_mad_monster LIKE LINE OF averagely_mad_monsters.

"Extract Source to Target
LOOP AT all_monsters ASSIGNING FIELD-SYMBOL(<monster_record>)
  WHERE sanity_percentage < 75.
  CLEAR an_averagely_mad_monster.
  MOVE-CORRESPONDING <monster_record> TO an_averagely_mad_monster.
```

```
  APPEND an_averagely_mad_monster     TO averagely_mad_monsters.
ENDLOOP."All Monsters
```

Listing 3.50 Extracting One Table from Another before 7.4

As of ABAP 7.4 (SP 8), you can do the same thing by using the constructor operator `FILTER` in the fashion shown in Listing 3.51.

```
DATA(averagely_mad_monsters) =
FILTER #( all_monsters USING KEY bonkers_ness
WHERE sanity_percentage < CONV #( 75 ) ).
```

Listing 3.51 Extracting One Table from Another in 7.40

Therefore, in 7.4 you can do something you couldn't do before—but there's a caveat. The problem is that the `FILTER` operation introduced in 7.4 only works if the large table has either a hashed or sorted key. In the preceding example, `ALL_MONSTERS` has a sorted key on `sanity_perecntage`, so the caveat doesn't apply. (If the internal table `ALL_MONSTERS` didn't have a hashed or sorted index, then it wouldn't be such a huge problem; remember that ever since 7.02, internal tables can have several secondary keys, which can be hashed or sorted.)

FILTER Used as FOR ALL ENTRIES on an Internal Table

When reading from the database into an internal table, if you don't want all of your data in one massive table or you can't merge all the tables together by inner joins, the solution has always been—since the year 2000 and still to this day—to perform `FOR ALL ENTRIES`, as shown in Listing 3.52.

```
SELECT *
FROM z4t_deliveries
INTO CORRESPONDING FIELDS OF TABLE monster_deliveries
FOR ALL ENTRIES IN all_monsters
WHERE monster_number = all_monsters-monster_number.
```

Listing 3.52 FOR ALL ENTRIES during Database Read

If earlier in the program you already had read the entire `monster_deliveries` table from the database into an internal table for some reason and wanted to create a subset just for the monsters currently in `ALL_MONSTERS`, then you could now run the equivalent of `FOR ALL ENTRIES`, but on an internal table rather than the database (see Listing 3.53).

```
DATA(deliveries_our_monsters) =
FILTER #( monster_deliveries IN all_monsters
WHERE monster_number = monster_number ).
```

Listing 3.53 FOR ALL ENTRIES on Internal Table

Once again, the filter table (`ALL_MONSTERS`, in this case) must have a sorted or hashed key that matches what we're searching for (the monster number, in this case).

3.5.10 Virtual Sorting of Internal Tables

What in the world is virtual sorting? This feature (which arrived in ABAP 7.52) is going to be quite difficult to get your head around. In fact, it could be described as a solution looking for a problem. Nonetheless, even if I can't think of a practical use for it, it's more than possible that you're currently sitting at work grappling with a seemingly insoluble problem that it might just solve. It's almost impossible to explain without an example, so let's walk through one.

Say you have an existing report that's displayed in the form of an ALV tree. The header table contains a list of customer disputes, cases in which a customer has complained to the baron that the monster didn't scare the peasants enough and they want a partial refund. In the early days, the baron used to respond by sending round a monster to kill and eat the complaining customer, but this didn't do much in the way of encouraging repeat business, so these days he often raises credit notes for valid claims.

Thus, in the ALV dispute report, each dispute line can be expanded to show the credit note raised against the dispute or an entry saying the dispute has been rejected. So there are two internal tables, a header one for the disputes and an item one linking disputes to credit notes. The two tables are the same size, but the data is split so that all columns can be viewed on one screen without scrolling to the right. Everything had worked fine for ages; everything in the garden was rosy.

Then last week the chief accountant came to Inga, the head developer. In this case, the chief accountant told her that he was investigating some sort of fraud possibly being perpetrated against the baron and needed an ABAP2XLSX export of the data in the dispute report. All he needed was a list of the dispute details, sorted so that the ones relating to high-value credit notes were at the top.

This initially appeared to be a simple task (adding a spreadsheet export option to a report is so easy), but the fact that there are two tables complicates matters. Should Inga make it so that each table is on a separate worksheet? That would work, but then the user would have to do some manual work to link the two together, thus rather defeating the purpose of computer automation.

After mulling it over, Inga realized she wanted to keep the header table and the item table exactly as they are—sorted by `DISPUTE NUMBER`—so that the report would look like it always did. To do so, she would have to create a new table with the data from the dispute plus the credit note value, sort that, and use it for export to a spreadsheet.

That isn't actually too difficult, but just for giggles, let's do it using virtual sorting. In Listing 3.54, you'll see that there's a new method of `CL_ABAP_ITAB_UTILITIES`, into which are passed references to the two source tables (they have to be the same size, and you

can pass in as many source tables as you want). For each table, you pass in the sort criteria. Ascending is the default, as usual; there's a parameter to be filled if you want the sort to be descending.

```
DATA(dispute_indexes) = cl_abap_itab_utilities=>virtual_sort(
im_virtual_source =
VALUE #(
( source = REF #( credit_note_table )
components =
VALUE #( ( name = 'credit_value'
descending = abap_true ) ) )
( source = REF #( dispute_table )
components =
VALUE #( ( name = 'dispute_number' ) ) ) ) ).
```

Listing 3.54 Virtual Sorting

The result, `DISPUTE_INDEXES`, is a table that's one-column wide and contains what the index numbers would have been had you actually created a new table with the columns from both tables and then sorted it by value descending and dispute number ascending.

Then a new table is declared for the purposes of output to Excel, and it gets filled using the indexes, as demonstrated in Listing 3.55.

```
DATA top_disputes TYPE STANDARD TABLE OF l_typ_disputes.

LOOP AT dispute_indexes ASSIGNING FIELD-SYMBOL(<index>).
  APPEND dispute_table[ <index> ] TO top_disputes.
ENDLOOP.
```

Listing 3.55 Using Virtual Sort Result

It's possible to do the previous two steps in one big statement that's so complicated that no one could ever be expected to understand it—but we're not going to demonstrate that.

To my mind, this isn't an easier way to achieve a task, just a different way. Nonetheless, now you know about it, just in case it's exactly the sort of thing you're looking for.

3.6 Object-Oriented Programming

SAP introduced the concept of OO programming in ABAP in the year 2000. Since then, it's been the recommended method of programming. This section will describe the new features of ABAP that relate to OO programming.

Before we jump in, I have a burning need to mention that in ABAP 7.5, Transaction SE24 (Maintain Class) has been changed so that the full width of the screen is used. This is such a simple fix, but so useful, and long, long overdue. Maybe one day the same streak of common sense will be applied to SE93, which is one of the most cramped screens around—and, as of ABAP 7.55, still hasn't been fixed!

3.6.1 Upcasting/Downcasting with CAST

In OO programming, a *downcast* is a process in which you turn a generic object, like a monster, into a more specific object, like a green monster. An *upcast* is the reverse. This functionality has been available in ABAP for a long time, but it gets a lot easier in 7.4.

To take a non-monster-related example for once, consider a situation in which you need to get all the components of a specific dictionary structure. Listing 3.56 shows how you would do this prior to ABAP 7.4. First, call a method of `CL_ABAP_TYPEDESCR` to get metadata about a certain structure. But to get the list of components of that structure into an internal table, you need an instance of `CL_ABAP_STRUCTDESCR`; this is a subclass of `CL_ABAP_TYPEDESCR`. Thus you need to perform a downcast to convert the instance of the parent class into an instance of the subclass.

```
DATA structure_description TYPE REF TO cl_abap_structdescr.
structure_description
?= cl_abap_typedescr=>describe_by_name( 'Z4SP_MONSTER_HEADER_D' ).
DATA structure_components TYPE abap_compdescr_tab.
structure_components = structure_description->components.
```

Listing 3.56 Components of Specific Dictionary Structure without CAST

In 7.4, you can do this all in one line by using the `CAST` constructor operator (see Listing 3.57).

```
DATA(structure_components) = CAST cl_abap_structdescr(
cl_abap_typedescr=>describe_by_name( 'Z4SP_MONSTER_HEADER_D' ) )->components.
```

Listing 3.57 Components of Specific Dictionary Structure with CAST

The code in Listing 3.56 and Listing 3.57 performs exactly the same function, but in the latter case you no longer need the `STRUCTURE_DESCRIPTION` helper variable and you also don't need the line in which you define the `STRUCTURE_COMPONENTS` type.

3.6.2 Finding the Subclass of an Object Instance

In many other programming languages, it's possible to work out, given an object reference, what precise subclass that instance is. Prior to 7.5, the ABAP team at SAP resisted this, but after unceasing demand from the online SAP Community, SAP provided the new `IS_INSTANCE_OF` statement.

Just to rain on SAP's parade even more—and this is very cruel, considering that it only added this new feature due to popular demand—some purists would say that any subclass should be able to impersonate its parent without any program knowing the difference, and thus a calling program wouldn't need to know the exact subclass. However, the ABAP world isn't as pure as everyone would like, and sometimes knowing this information is actually quite useful—as in the following example.

In Chapter 10 on ALV, there's an example in which we try to get an ALV grid reference and try one subclass after another until the assignment succeeds (which we repeat here in Listing 3.58).

```
DATA: full_screen_adapter TYPE REF TO cl_salv_fullscreen_adapter,
       container_adapter   TYPE REF TO cl_salv_grid_adapter.
    TRY.
      "Presume full screen mode (No Container)
      "Fullscreen Adapter (Down Casting)
      "Target FULL_SCREEN_ADAPTER = CL_SALV_FULLSCREEN_ADAPTER
      "CL_SALV_FULLSCREEN is a subclass of CL_SALV_ADAPTER
      full_screen_adapter ?= io_salv_adapter.
      "Get the Grid
      ro_alv_grid = full_screen_adapter->get_grid( ).
    CATCH cx_sy_move_cast_error.
      "We must be in container mode
      "CL_SALV_GRID_ADAPTER is a subclass of CL_SALV_ADAPTER
      container_adapter ?= io_salv_adapter.
      ro_alv_grid = container_adapter->get_grid( ).
  ENDTRY.
```

Listing 3.58 Trying to Find Subclass before 7.5

In 7.5, life becomes much easier, as shown in Listing 3.59. By using the `IS_INSTANCE_OF` construct, the purpose of the code becomes much clearer to the reader.

```
IF io_salv_adapter IS INSTANCE OF cl_salv_fullscreen_adapter.
  full_screen_adapter ?= io_salv_adapter.
  ro_alv_grid = full_screen_adapter->get_grid( ).
ELSEIF io_salv_adapter IS INSTANCE OF cl_salv_grid_adapter.
  container_adapter ?= io_salv_adapter.
  ro_alv_grid = container_adapter->get_grid( ).
ENDIF.
```

Listing 3.59 Trying to Find Subclass in 7.5

The same task can be achieved in a slightly different way by using the `TYPE OF` construct in conjunction with `CASE`. In the code in Listing 3.60, the exact subclass is determined, and the respective branch of the `CASE` statement ensures that the created instance has the correct subclass by using another new construct: `INTO DATA`.


```
CASE TYPE OF io_salv_adapter.
   WHEN TYPE cl_salv_fullscreen_adapter
   INTO DATA(full_screen_adapter2).
   ro_alv_grid = full_screen_adapter2->get_grid( ).
   WHEN TYPE cl_salv_grid_adapter
   INTO DATA(container_adapter2).
   ro_alv_grid = container_adapter2->get_grid( ).
  WHEN OTHERS.
    RETURN.
ENDCASE.
```

Listing 3.60 Another Way to Find Subclass in 7.50

The way you have to write the code in examples such as the one in Listing 3.60 isn't particularly clear; the phrase `INTO DATA` doesn't read much like an English sentence and thus could be confusing. Nonetheless, you need to know that the option is available.

3.6.3 CHANGING and EXPORTING Parameters

In ABAP, a *functional method* has until now been defined as a method with one returning parameter and zero to many importing parameters, such as the following:

```
monster_header = monster->get_details( monster_number ).
```

Many ABAP programmers liked the fact that you could put the result variable at the start rather than having to put that variable in an `EXPORTING` parameter. But they wanted to be able to have `CHANGING` and `EXPORTING` parameters as well—that is, to have their cake and eat it too.

In 7.40, SAP has waved its magic wand, and now you can have it both ways. An example is shown in Listing 3.61.

```
* Local Variables
DATA: monster_number TYPE zde_monster_number VALUE '0000000001',
      something_spurious  TYPE string,
      something_unrelated TYPE string.

    DATA(monster_header_record) = lcl_monster=>get_details(
    EXPORTING id_monster_number      = monster_number
    IMPORTING ed_something_spurious  = something_spurious
    CHANGING  cd_something_unrelated = something_unrelated ).
```

Listing 3.61 CHANGING and EXPORTING Parameters

There is no doubt that many people will be happy with this, but purists who are used to other languages will be *horrified*. (Although I don't feel quite that strongly, I can see their point.) Good OO design leads you toward small methods that do one thing, and

the one thing for functional methods is to output one result. If a functional method suddenly starts giving you back all sorts of other exporting parameters and changes something else, then the method is clearly doing more than one thing, and that's probably bad design. (For example, there are methods designed to return four values of a polynomial equation, and you could use the new design to put the first value in the RETURNING parameter and the last three values in EXPORTING parameters, but that seems a bit silly. You could just return a structure of four values instead.) Nonetheless, because this is a new feature of 7.4 that you might occasionally find useful, it was important to mention it here.

Fun Fact about Functional Methods

If you have a functional method that returns a structure, but you only want one field of that structure, you can write the following code:

```
DATA(sanity) = lcl_monster=>get_details( monster_number)-sanity_percentage.
```

The result will be a `sanity` variable typed as `Z4DE_MONSTER_SANITY_PERCENTAGE`. This is because both at compile time and at runtime, a call to a functional method is interpreted as a variable of whatever type it returns.

3.6.4 Changes to Interfaces

This section discusses how SAP has tried to take some of the pain out of your daily usage of interfaces in OO programming in 7.4. As you know, an *interface* is a collection of data declaration and method names and signatures. If a class implements any given interface, then it has to redefine all the interface methods. This is all good, but prior to 7.4 the problem was that some standard interfaces had a really big list of methods, only some of which were relevant, so you had to go through the irrelevant methods and redefine them to have blank implementations.

As of 7.4, if you create an interface and think that some of the methods might not be needed by all classes that implement the interface, then you can say so in the interface definition, as shown in Listing 3.62.

```
INTERFACE scary_behavior.
 METHODS: scare_small_children,
      sells_mortgages   DEFAULT FAIL,
      hide_under_bed    DEFAULT IGNORE,
      is_fire_breather
        DEFAULT IGNORE
        RETURNING rf_yes_it_is TYPE abap_bool.
ENDINTERFACE. "Scary Behavior
```

Listing 3.62 Defining Interface with Optional Methods

This is an interface all monster classes should implement. Naturally, all monsters should be able to scare children—so don't put any additions after that method definition. This means that each class implementing that interface is forced to redefine the method by the syntax check. On the other hand, most monsters will *not* sell mortgages (just the worst of the worst monsters), so don't force all the classes to implement this method. Because you've added DEFAULT FAIL, if a program using an instance of a monster that implements this interface tries to make the monster sell mortgages, and the method hasn't been implemented, then a runtime error occurs (CX_SY_DYN_CALL_ILLEGAL_METHOD).

Similarly, don't force all monster classes to hide under beds; obviously, the ones that are a thousand feet tall have problems in this area. By adding DEFAULT IGNORE to the end of the definition, we can make sure these classes aren't forcibly implemented. If the program tells such a monster to hide under the bed, then nothing will happen—just as if a call had been made to an implemented method with no lines of code inside it.

In the same way, not all monsters breathe fire. For the ones that do, the IS_FIRE_BREATHER method can be implemented to return ABAP_TRUE. If the method is not implemented in any given monster class, then the DEFAULT IGNORE addition is used, and the RETURN parameter will bring back an initial value, which in this case is ABAP_FALSE.

3.7 Search Helps

Search helps are one of the strengths of the SAP system. You can define one and attach it to a data element, and then all throughout the system wherever that data element is referenced, an F4 dropdown of possible values is available instantly. In release 7.4, things even have become slightly better, and this section will explain how.

3.7.1 Predictive Search Helps

If you've read anything in the IT media in the last few years, then you'll be sick to death of writers saying that business users now expect at work the same level of usability they get in their spare time. At this point, you've probably seen children with iPads; they swipe away at the screen, calling up this and that, already more adept at this than many adults. If that's the level of user-friendliness children are exposed to, then what are they going to expect from enterprise software like SAP when they grow up and get jobs? What would someone who had just left school expect from an SAP system they were being shown how to use on their first day of work?

For one thing, they would expect that when they start typing something in a search field—a customer or material name, for example—after a letter or two has been typed, a dropdown box of potential candidates would appear for them to choose from. That's what happens on Google and many other websites, and you can see why recent students would be shocked when this doesn't happen on an SAP screen.

The good news is that if your SAP system is 7.4 SP 3 or above and SAP GUI is 7.31 patch level 5 or above, then you'll find that such predictive search helps are now possible in SAP. Half of the functionality is in the backend, and half is in SAP GUI, which is why you need both to be on the correct level. (In fact, you really need to be on 7.4 SP 6 for this to work automatically; otherwise, you have to fluff around manually with the `CL_DSH_DYNPRO_PROPERTIES` class, as described in SAP Note 1861491.)

Assuming you're on the right version, open Transaction SE11 and go into the **Search Help** option about halfway down the screen. There, you'll see the **Data Collection** area (see Figure 3.2).

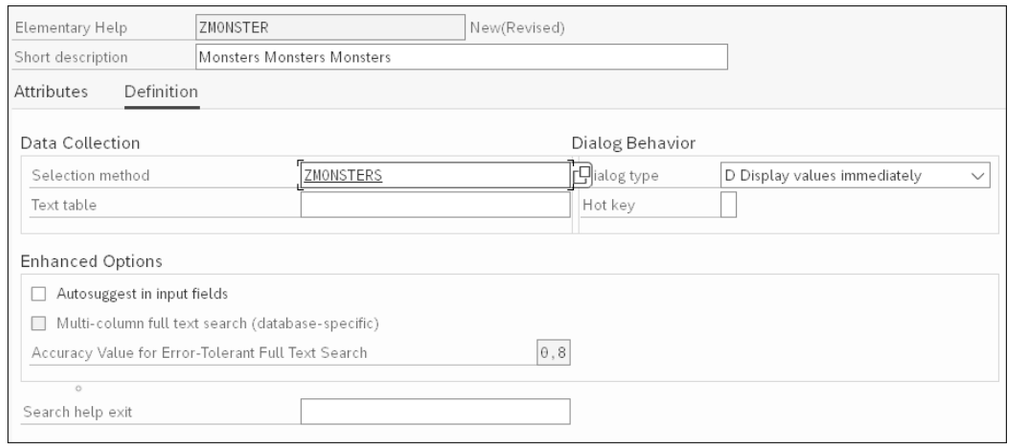


Figure 3.2 Search Help Definition

In release 7.4, directly above the **Search Help Exit** box is a new box called **Enhanced Options**, in which you have two checkboxes and an input field. The second checkbox and the input field are to do with fuzzy text searches on an SAP HANA database and are grayed out, but the first checkbox says **Autosuggest in Input Fields**.

If you select that checkbox, then your search help will magically start behaving differently—not quite like Google, but a popup list of candidates will appear as the user types, which is a step up from before.

3.7.2 Search Help in SE80

You may have noticed, and been bothered by, the fact that when you're in SE80 and can't remember the name of your program, you can't just press F4 and see the result list. You have to press the dropdown arrow to the right of the input field, which presumably is why that dropdown arrow's there in the first place. (After all, if F4 worked, then you wouldn't need a separate dropdown arrow.)

So you can imagine my delight when I was playing around in one of the latest SAP releases and was in SE80 and had typed in half of my program name and pressed F4

by reflex. I hadn't even put in a wildcard asterisk, but what should I see but a dropdown list of results (see Figure 3.3).

Mere words cannot explain how happy this made me. It must be true that little things please little minds. It turns out that this function was available as of release 7.31—but not everyone knows about it, so it's worth calling out here.

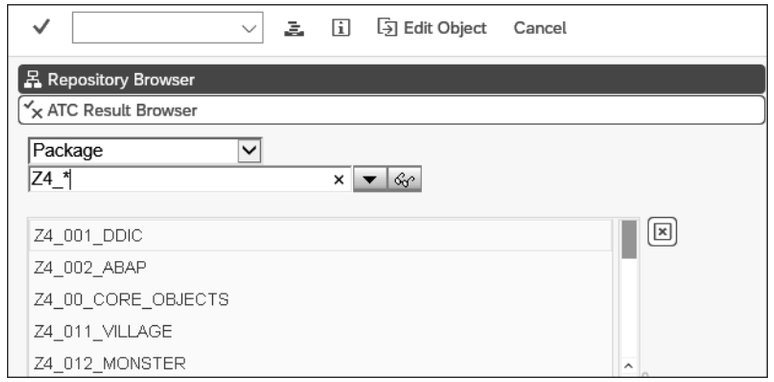


Figure 3.3 F4 Search Help in SE80: Working at Long Last

3.8 Assorted

Much as I try to fit all the new ABAP topics into round holes, there are some square pegs that don't fit neatly anywhere but are still worth a mention. We'll look at those square pegs in this section.

3.8.1 Unicode

One change in 7.5 that doesn't fit into any category is that now if you create a program or class or what have you and check the **Unicode** checkbox, the system lets you create the object, but then you get a fatal error in the syntax check until you switch it back off again. I can see why you need the box, to change the setting for old programs, but if I ruled the world, I'd have the system not even let you create the object unless the box was checked—and likewise for **Fixed Point Arithmetic**, which the 7.5 system doesn't complain about at all if it's off.

3.8.2 ABAP Language Versions

When you create a program, one setting you probably never even look at is the **ABAP Language Version** in the attributes section of an executable program or a class. It defaults to **X (Standard ABAP Unicode)** and you think nothing of it. In fact, if you were to select the dropdown, you would see a whole bunch of options, as shown in Figure 3.4.

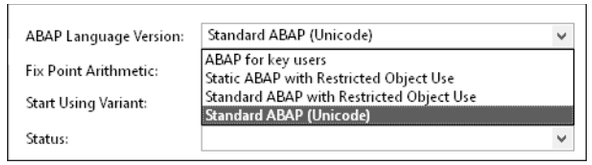


Figure 3.4 ABAP Language Version Dropdown

The exact list you get varies with the version; Figure 3.4 shows version 7.2. In SAP BTP, ABAP environment, you only get one option, which is **ABAP for Cloud Development**.

In any event, what this is all about is that outside of SAP BTP, ABAP environment, you can change the default setting in order to make the syntax check stricter for an individual program or class or even an entire package. The standard SAP program `ABAP_DOCU_VERSION_WHITELIST` will tell what objects (classes, data elements, etc.) are allowed for the nonstandard language versions.

You may wonder why you would want to do such a strange thing (i.e., limit what's available to you in a certain program). There are two use cases, one of which makes sense:

- You are creating a class (or whatever) in an on-premise system that you intend to migrate to SAP BTP, ABAP environment at some stage. Therefore, you limit yourself to only elements that are actually available in SAP BTP, ABAP environment. That way, you won't get any syntax errors when you copy the object over.
- For a long while now, every so often, SAP comes out with the idea that you can let some of your cleverer end users do some basic programming in the SAP system without having to get IT involved. There have been many iterations of this: the pseudo programming languages in SAP ERP HCM and Variant Configuration, validations and substitutions in SAP ERP Finance and Controlling, ECATT, and more recently SAP Intelligent Robotic Process Automation (SAP Intelligent RPA). This approach has never worked and never will; IT always ends up clearing up the mess thus created. ABAP for Key Users is the latest attempt at this: a very restricted set of ABAP commands intended for programs (enhancements to standard SAP) written by end users. Will the idea work this time? What's that they say about doing the same thing again and again and expecting different results?

3.8.3 Deprecation Concept

With ABAP 1908, something that should have happened long ago has started to occur. Obsolete statements like `STATICS` now give a warning. The remote call statement `PERFORM xyz in PROGRAM 123` now gives a syntax error as it should.

Eventually—in about 15 ABAP versions' time—these obsolete statements will all give syntax errors, so that's a wonderful reason to not only not ever use them again but also remove them whenever you see them in existing code.

Apart from the two mentioned just now, the other deprecated statements are as follows:

- **`AT END, AT FIRST, AT LAST, AT NEW, ENDAT`**
  These statements have never worked. I have not used them for 20 years.
- **`ADD, DIVIDE, MULTIPLY, SUBTRACT`**
  I will actually miss these. I thought they made the code look clearer. I think `ADD 1 TO MONSTER_COUNT` reads more like plain English than the new `MONSTER_COUNT =+1` equivalent, though the latter does sound like something from the novel 1984 mentioned at the start of the chapter.
- **`RAISE, MESSAGE RAISING`**
  We're talking about "classical" exceptions here. Only class-based exceptions will be allowed going forward.
- **`FORM, ENDFORM, PERFORM`**
  This news will give old-school ABAPers who have been doing things the exact same way for 20 years a heart attack. No more `FORM` routines! That's almost as bad as having to stop riding horses and drive cars instead!

3.8.4 Clean ABAP

Let's discuss three open-source projects, all to do with improving the quality of your ABAP code. All three live on GitHub, and you'll find links to all three in the Recommend Reading section at the end of the chapter:

- **Clean ABAP**
  First up is the most wonderful ABAP-language open-source project ever created: Clean ABAP, which was started by SAP but which anyone can contribute to. This is a set of ABAP programming guidelines based on the *Clean Code* book by Robert Martin. That was one of the best programming books ever written, but a lot of ABAP people ignored it because all the examples were in Java. This is not to do with functional correctness like traditional ABAP Test Cockpit checks but rather clarity: the easier your code is to understand, the easier (and cheaper) it is to make corrections and changes.

  This takes the form of an ABAP programming style guide. In essence, there are about 10 billion rules, with explanations of why each rule is a Good Thing, coupled with good and bad examples. Naturally, not everyone will agree with everything (monsters don't generally like being clean, for example), but most programmers will agree with the vast majority of the suggested guidelines.
- **ABAP Test Cockpit checks**
  In addition, you can download from the GitHub URL special ABAP Test Cockpit checks created by SAP that you can add into your default Code Inspector check variant, so you can see how "clean" your code really is.

- **ABAP code review guide**
  If that wasn't enough, there's yet another open-source project in this area—this time to do with ABAP code reviews. You probably already have a formal or informal process whereby one of your colleagues looks over your code before it goes to QA; this project seeks to compile a list of best practices (and helpful tools) to boost your efforts in this area.

3.9 Summary

In this chapter, you read about the somewhat radical changes that have been introduced in the ABAP language in recent years, starting with 7.02 but most notably in releases 7.4 and above. This chapter cataloged the vast array of new language constructs that have been introduced into ABAP and showed examples of where they might be useful in your day-to-day work, broken into several categories.

Now that you've learned about the development environment (Eclipse), the version-management control coming in the future (abapGit), and the increased capabilities of the language you program in, it's time to move on to how to handle cases where everything falls in a heap—in other words, exceptions.

Recommended Reading

- **Clean ABAP style guide**
  https://github.com/SAP/styleguides/blob/main/clean-abap/CleanABAP.md
  (Klaus Haeuptle et al.)
- **Clean ABAP ATC checks**
  https://github.com/SAP/code-pal-for-abap
- **ABAP code review guide**
  https://github.com/SAP/styleguides
- **Clean ABAP**
  https://www.sap-press.com/clean-abap_5190/
  (Klaus Haeuptle et al., SAP PRESS, 2021)

Contents

Index

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

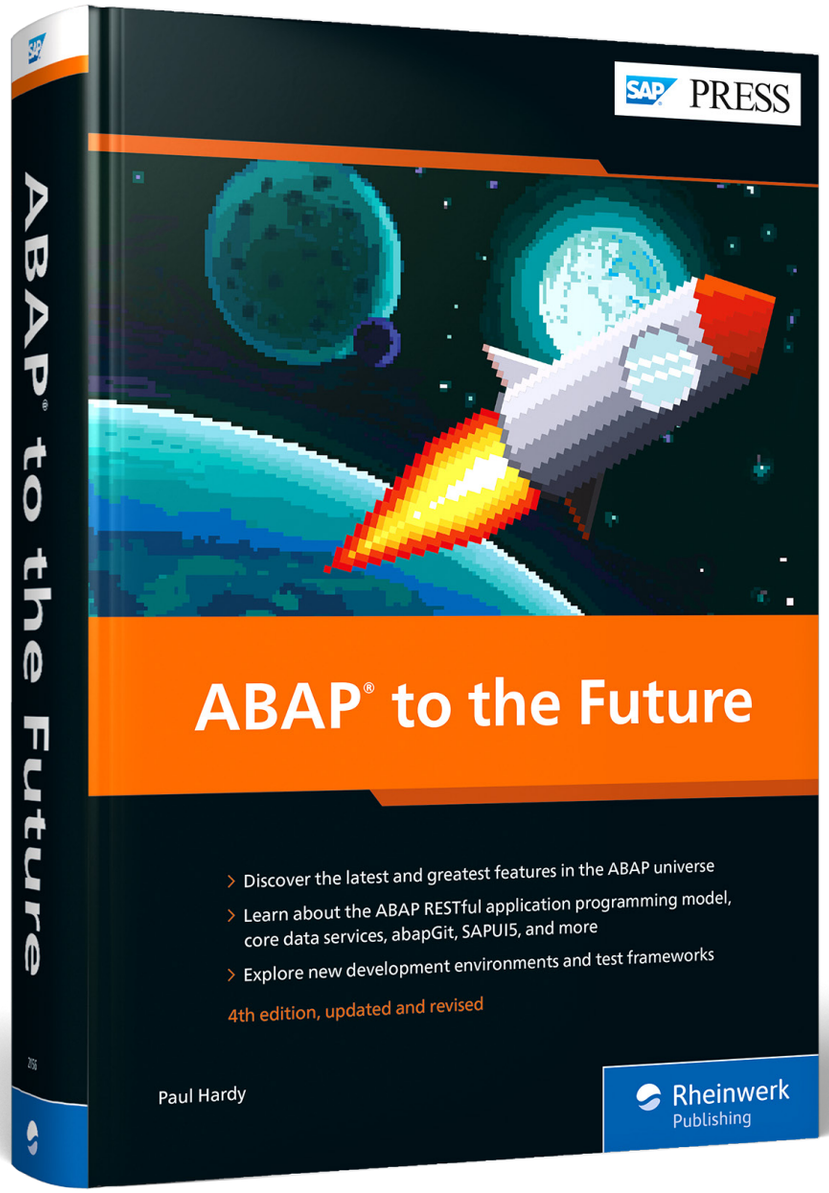
V

W

X

Y

Z



Paul Hardy is a senior ABAP developer at Hanson and has worked on SAP rollouts at multiple companies all over the world. He joined Heidelberg Cement in the UK in 1990 and, for the first seven years, worked as an accountant. In 1997, a global SAP rollout came along; he jumped on board and has never looked back since. He has worked on country-specific SAP implementations in the United Kingdom, Germany, Israel, and Australia.

After starting off as a business analyst configuring the good old IMG, Paul swiftly moved on to the wonderful world of ABAP programming. After the initial run of data conversion programs, ALV reports, interactive Dynpro screens, and (urrggh) SAPscript forms, he yearned for something more and since then has been eagerly investigating each new technology as it comes out. Particular areas of interest in SAP are business workflow, B2B procurement (both point-topoint and SAP Ariba-based), logistics execution, and variant configuration, along with virtually anything new that comes along.

Paul can regularly be found blogging away on SAP Community and presenting at SAP conferences in Australia (Mastering SAP Technology and the SAP Australian User Group annual conference). If you happen to ever be at one of these conferences, Paul invites you to come and have a drink with him at the networking event in the evening and to ask him the most difficult questions you can think of (preferably SAP-related).

Paul Hardy

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