

APL-11

Installation Guide/Release Notes

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This document describes Version 2 of APL-11.

SUPERSESSION/UPDATE INFORMATION: This is a new manual

**SOFTWARE VERSION TO
OPERATING SYSTEMS AND VERSION:**

APL-11 V2
• RT-11 V4
• RSX-11M V3.2
• RSX-11M-PLUS V1.0
APL-11 V1
• RSTS/E V7

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PREFACE

STRUCTURE OF THIS DOCUMENT

This manual is organized as follows:

- Section 1 describes the installation procedures.
- Section 2 describes the major differences between versions 1.0 and 2.0 of PDP-11 APL.
- Section 3 describes corrections to the reference manual.
- Section 4, the Release Notes, describes restrictions in the use of APL-11.

INTENDED AUDIENCE

This manual is intended for use by system managers and APL programmers.

APL-11 INSTALLATION GUIDE/RELEASE NOTES

1.0 INSTALLATION PROCEDURE

This section describes the procedures for installing the PDP-11 APL interpreter on the operating systems that support it.

1.1 RSX-11M/M-PLUS Installation

You must complete three steps before you can use APL on the RSX-11M or RSX-11M-PLUS operating system:

1. Build an APL interpreter task from an object module library supplied on magnetic tape (1.1.1) or disk (1.1.2).
2. Make the interpreter task available for use (1.1.3).
3. Invoke the interpreter (1.1.4).

The distribution tape or disk contains sets of files used to build APL systems. These sets are listed in Table 1-1. The specific set used to build your APL system depends on the hardware and precision options you select.

Table 1-1
File Sets Used to Build APL Systems

Hardware Options	Precision	File Set	
none	single	APLRX1.OLB	APLDX1.OBJ
none	double	APLRX1.OLB	APLDX2.OBJ
EIS	single	APLRX3.OLB	APLDX3.OBJ
EIS	double	APLRX3.OLB	APLDX4.OBJ
FIS, EIS	single	APLRX5.OLB	APLDX5.OBJ
FPP, EIS	single	APLRX6.OLB	APLDX6.OBJ
FPP, EIS	double	APLRX6.OLB	APLDX7.OBJ

1.1.1 Installation from Magnetic Tape Distribution - This section tells how to build APL from the magnetic tape distribution.

1.1.1.1 Preparation - Select an unused UIC ([x,y]) to use for building the APL system. Create it on the system device (if it is not already present) by executing the following command:

```
>UFD SY:[x,y]
```

Load the magtape handler (if it is not already resident) as follows:

```
>LOA MT:
```

Allocate magtape drive 0 to prevent another user from using it:

```
>ALL MT:
```

Place the distribution magtape on drive 0 (write-locked).

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On RSX-11M-PLUS, the magtape must be mounted as a foreign device:

```
>MOU MT:/FOR/DENS= { 800 }  
                   { 1600 }
```

NOTE

The device name for some magtape units is MM: If you are using such a device, substitute MM: for MT: in the commands.

1.1.1.2 Building the Interpreter - You build the interpreter from the object module library supplied on the distribution tape. Set the UIC to the [x,y] you chose for building the APL system, and copy the required file from the magtape to the system disk:

```
>SET /UIC=[x,y]  
>FLX SY:[x,y]=MT0:[200,200]BRXAPL.CMD/FA/DO
```

Now execute the command @BRXAPL. You will be asked questions about your machine hardware and the options you want with your APL system. The answers are used to build a runnable interpreter task. The task will be in directory [1,5n]; the task builder map, if requested, will be in directory [1,3n] (the n equals 0 for unmapped systems and 4 for mapped systems).

You may execute the following commands to delete the object library and object file used in the task build:

```
>SET /UIC=[x,y]  
>PIP APLRXn.OLB;*/DE  
>PIP APLDXn.OBJ;*/DE
```

The n is determined from Table 1-1. Retain the build command and overlay description files created in [x,y], for reference.

Figure 1-1 is an example of a build session from the magtape distribution (sample responses are underlined).

1.1.2 Installation from the Disk Cartridge Distribution - This section tells how to build APL from the disk cartridge distribution. If the system disk is not the same device type as the distribution disk, place the distribution disk in drive 0. If they are the same device type, use drive 0 for the system disk and drive 1 for the distribution disk.

In the directions that follow, the logical unit assignment DDn:=AP: assigns the logical device name AP: to the drive of the distribution disk. In the assignment, DD can be DK, DM, or DL; and n can be 0 or 1 (depending on the system device type). Use DK0 or DK1 for the RK05 distribution; use DM0 or DM1 for the RK06 or RK07 distribution; and use DL0 or DL1 for the RL01 or RL02 distribution.

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```

>@BRXAFL
>
>; APL-11 V02-00 BUILD COMMAND FILE FOR RSX-11M
>
>* IS THIS SYSTEM MAPPED? [Y/N]:Y
>* DO YOU HAVE A FLOATING POINTING PROCESSOR? [Y/N]:Y
>* DO YOU WANT DOUBLE PRECISION ARITHMETIC? [Y/N]:N
>* DO YOU WANT TO GENERATE A MAP FILE? [Y/N]:Y
>* ENTER THE DIRECTORY UIC (Cm,n) YOU WISH TO USE [S]: [306,36]
>SET /UIC=[306,36]
>* DO YOU WANT TO COPY THE LIBRARY FROM THE DISTRIBUTION MEDIA? [Y/N]:Y
>* WAS THE DISTRIBUTION ON MAG TAPE? [Y/N]:Y
>* ENTER THE DEVICE NAME (DVn:) FOR THE DISTRIBUTION MEDIA [S]: MM0:
>
>; Use FLX to copy the files off the tape
>
>FLX SY:/RS=MM0:[200,200]AFLRX6.OLB/DO/IM
>FLX SY:/RS=MM0:[200,200]AFLDX6.OBJ/DO/FB
>
>; Build the command file for the task builder
>
>; Build the Overlay Descriptor File
>
>; Invoke the task builder
>
>TKB @APL.CMD
>
>; Finished building APL system
>
>@ <EOF>
>

```

Figure 1-1 Sample Build Session from Magnetic Tape

1.1.2.1 **Preparation** - Select an unused UIC ([x,y]) to use for building the APL system. Create it on the system device (if it is not already present) by executing the command:

```
>UFD SY:[x,y]
```

Next, load the disk handler (if not already resident), place the distribution disk cartridge in drive n (write-locked), make the logical assignment, and mount the volume:

```

>LOA DD:          (not needed if the system device is the same
                   device type as the distribution disk)
>ASN DDn:=AP:
MOU AP:APL11

```

1.1.2.2 **Building the Interpreter** - You build the interpreter from the object module library supplied on the distribution disk. Set the UIC to the [x,y] you chose for building the APL system, and copy the required file from the distribution disk to the system disk:

```

>SET /UIC=[x,y]
>PIP SY:[x,y]/FO=AP:[200,200]BRXAFL.CMD

```

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Now execute the command @BRXAPL. You will be asked questions about your machine hardware and the options you want to include in your APL system. The answers are used to build a runnable interpreter task. The task will be in directory [1,5n]; the task builder map, if requested, will be in directory [1,3n] (the n equals 0 for unmapped systems and 4 for mapped systems).

You may execute the following commands to delete the object library and object file used in the task build:

```
>SET /UIC=[x,y]
>PIP APLRXn.OLB;*/DE
>PIP APLDXn.OBJ;*/DE
```

The n is determined from Table 1-1. Retain the build command and overlay description files created in [x,y], for reference.

Figure 1-2 is an example of a build session from the disk cartridge distribution (sample responses are underlined).

```
>@BRXAPL
>
> APL-11 V02-00 BUILD COMMAND FILE FOR RSX-11M
>
>* IS THIS SYSTEM MAPPED? [Y/N]:Y
>* DO YOU HAVE A FLOATING POINTING PROCESSOR? [Y/N]:N
>* DO YOU HAVE THE FIS INSTRUCTION SET? [Y/N]:N
>* DO YOU HAVE THE EIS INSTRUCTION SET? [Y/N]:Y
>* DO YOU WANT DOUBLE PRECISION ARITHMETIC? [Y/N]:Y
>* DO YOU WANT TO GENERATE A MAP FILE? [Y/N]:Y
>* ENTER THE DIRECTORY UIC ([m,n]) YOU WISH TO USE [S]: [306,36]
>SET /UIC=[306,36]
>* DO YOU WANT TO COPY THE LIBRARY FROM THE DISTRIBUTION MEDIA? [Y/N]:Y
>* WAS THE DISTRIBUTION ON MAG TAPE? [Y/N]:N
>* ENTER THE DEVICE NAME (DVn:) FOR THE DISTRIBUTION MEDIA [S]: DL2:
>
> Use PIP to copy the files
>
>PIP SY:=DL2:[200,200]APLRX3.OLB
>PIP SY:=DL2:[200,200]APLDX4.OBJ
>
> Build the command file for the task builder
>
>
> Build the Overlay Descriptor File
>
>
> Invoke the task builder
>
>TKB @APL.CMD
>
> Finished building APL system
>
>@ <EOF>
>
```

Figure 1-2 Sample Build Session from Disk Cartridge

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1.1.3 Making the Interpreter Task Available for Use - After the interpreter is created, the task image file must be made available for use. This process is called "installing" the interpreter.

You install the APL interpreter while logged on to a privileged UIC, using the following command:

```
>INS [1,5n]APL [/INC=size]
```

Again, the n is 0 for unmapped systems and 4 for mapped systems.

You can install the APL interpreter either in the saved system image or as part of system startup procedures. To install during system startup, include the appropriate INS command (as shown above) in the system startup file [1,2] STARTUP.CMD. To install APL in the saved system image, consult the RSX-11M System Generation and Management Guide or the RSX-11M-PLUS System Generation and Management Guide.

The optional /INC=size parameter controls the workspace size. The interpreter is built with 10K words of workspace. You can consult the task build map to determine the value you can use in /INC=size to enlarge the workspace.

Figure 1-3 is a sample task build map. The maximum total task size (C in Figure 1-1) is 32K words. That value is the sum of the task image size (A) and the task extension (B); thus, the maximum workspace size that could be specified in /INC= is 32K-A, which in this example is 32K-18K, or 14K.

```
APL.TSK;4    MEMORY ALLOCATION MAP    TKB M37    PAGE 1
              6-MAR-80    07:18
```

```
TASK    NAME    : ...APL
PARTITION NAME : GEN
IDENTIFICATION : V02.03
TASK    UIC     : [306,36]
STACK   LIMITS: 000246 001245 001000 00512.
PRG XFR ADDRESS: 043244
TOTAL ADDRESS WINDOWS: 1.
TASK    EXTENSION : 10240. WORDS ← B
TASK    IMAGE SIZE : 18176. WORDS ← A
TOTAL TASK SIZE : 28416. WORDS ← C
TASK ADDRESS LIMITS: 000000 106773
R-W DISK BLK LIMITS: 000002 000250 000247 00167.
```

APL.TSK;4 OVERLAY DESCRIPTION:

BASE	TOP	LENGTH	
000000	065753	065754 27628.	ACOPY

Figure 1-3 Sample Task Build Map

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1.1.4 Invoking the Interpreter - You can invoke the APL interpreter in one of two ways:

1. If the interpreter is installed as an MCR function, execute:

```
>APL
```

2. If the interpreter is not installed as an MCR function, execute:

```
>RUN [x,y]APL
```

After you invoke the interpreter, it responds with:

```
TERMINAL..
```

When you supply the type of terminal you are using, you gain access to APL and are ready to begin.

1.2 RT-11 V4 Installation

You must complete three steps before you can use APL on the RT-11 operating system.

1. Determine the name of the save file associated with the hardware and precision options you need for your APL interpreter (1.2.1).
2. Copy the save file from the distribution media -- magnetic tape (1.2.2), disk (1.2.3), floppy disk (1.2.4), or DECTape II (1.2.4) -- to your system device.
3. Invoke the interpreter (1.2.5).

1.2.1 Choosing a Save File - Your distribution media contains the save files named in Table 1-2. You will copy APL from the one associated with the hardware options your machine has and the precision you want to use. Remember the digit at the end of the file name; you will substitute it for m in your COPY statement.

Table 1-2
APL Save Files

Hardware Options	Precision	Save File
none	single	APLRT1.SAV
none	double	APLRT2.SAV
EIS	single	APLRT3.SAV
EIS	double	APLRT4.SAV
FIS, EIS	single	APLRT5.SAV
FPP, EIS	single	APLRT6.SAV
FPP, EIS	double	APLRT7.SAV

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1.2.2 Installation from Magnetic Tape Distribution - To copy APL from the distribution magtape to your system device, perform these steps:

1. Place the distribution magtape on drive zero and write-lock it.
2. Copy the save file selected in 1.2.1 to your system device, as follows:

.COPY MT0:APLRTm.SAV/POS:0 SY:APL.SAV

The m is determined from Table 1-2.

NOTE

The device name for some magtape units is MM: If you are using such a device, substitute MM: for MT: in the COPY command.

1.2.3 Installation from Disk Distribution - To copy APL from the distribution disk to your system device, perform the following steps:

1. Place the distribution disk in the appropriate drive and write-lock it.
2. Copy the save file selected in section 1.2.1 to your system device, as follows:

.COPY DVn:APLRTm.SAV SY:APL.SAV

The m is determined from Table 1-2. The DV can be DK for RK05 distribution, or DL for RL01 or RL02 distribution.

1.2.4 Installation from Floppy Disk or DECTape II Distribution - This section tells how to copy APL from a distribution floppy disk or DECTape II.

The storage capacity of these distribution media is limited, so the save files listed in Table 1-2 are divided into two groups. The first floppy or DECTape contains save files APLRT1, APLRT2, and APLRT3; the second contains save files APLRT4, APLRT5, APLRT6, and APLRT7. Once you select the save file you need, determine which floppy disk or DECTape it is on, and place it in the appropriate device.

Copy the save file to your system device, as follows:

.COPY DVn:APLRTm.SAV SY:APL.SAV

The m is determined from Table 1-2. The DV can be DX for RX01 distribution, DY for RX02 distribution, or DD for TU58 distribution (CTG).

1.2.5 Invoking the Interpreter - To invoke the APL interpreter, execute:

```
.R APL
```

After you invoke the interpreter, it responds with:

```
TERMINAL..
```

When you supply the type of terminal you are using, you gain access to APL and are ready to begin.

1.3 RSTS/E V7 Installation

To install APL-11 under RSTS/E V7, perform the following steps:

1. Determine the type of APL run-time system you wish to install, and its corresponding number:

```
nn = 12  SINGLE PRECISION,  NO FPP
nn = 13  DOUBLE PRECISION,  NO FPP
nn = 16  SINGLE PRECISION,  W/ FPP
nn = 17  DOUBLE PRECISION,  W/ FPP
```

2. Mount the distribution media; the device on which it is mounted will be referred to as "dev:".
3. Log into the system on a privileged account (for example, [1,2]).
4. If the distribution media is a disk (Rk05 or RK06), then type "MOUNT dev:APL11/RO".

If the distribution media is a 7- or 9-track tape, then type "ASSIGN dev:.DOS".

If the distribution media is a DEctape, then type "ASSIGN dev:", and change all occurrences of "/CO" to "/CO:T" in step 5.

5. Enter the following commands in the system (machine responses are underlined):

```
OLD dev:[1,2]APL
```

```
Ready
```

```
COMPILE [1,2]APL<104>
```

```
Ready
```

```
RUN $PIP
```

```
#[0,1]APL.RTS/CO/CL:128=dev:[0,1]APLnn.RTS
```

```
#[1,2]APLCLR.APC/CO=dev:[1,2]APLCnn.APC
```

```
#=[0,1]APL.RTS<63>/RE
```

```
#=[1,2]APLCLR.APC<40>/RE
```

```
#[1,2]INVERT.APL=dev:[1,2]INVERT.APL
```

```
#=[1,2]INVERT.APL<40>/RE
```

```
#^Z      (CONTROL-Z)
```

```
Ready
```

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```
RUN $UTILITY
#ADD APL
#^Z      (CONTROL-Z)
```

Ready

6. APL-11 is now installed in your system. To have APL added at the start of RSTS/E time sharing, add a line of the form "FORCE KB0: ADD APL" by editing [1,2]RTS.CMD. (See RSTS/E System Manager's Guide for further information.)

1.4 Testing Installation

To determine whether your interpreter was installed successfully, perform the following steps:

- Invoke APL and set your terminal type.
- Type the underlined commands in the following sample session. APL should return the values shown.

If you have a TT terminal

```
      .DL F ;Y
[1]  X_.BX_0.33#.1010
[2]  Y_.BX_5 10.R0.109
[3]  Y+.#X
[4]  1 0 .FM 3.RV Y
[5]  'END OF TEST'
[6]  .DL
```

If you have an LA terminal

```
      .DL F ;Y
[1]  X+.0+0.33x110
[2]  Y+.0+5 10P19
[3]  Y+.xx
[4]  1 0 + 30Y
[5]  'END OF TEST'
[6]  .DL
```

Either terminal type

```
      F
0.33 0.66 0.99 1.32 1.65 1.98 2.31 2.64 2.97 3.3
  1  2  3  4  5  6  7  8  9  1
  2  3  4  5  6  7  8  9  1  2
  3  4  5  6  7  8  9  1  2  3
  4  5  6  7  8  9  1  2  3  4
  5  6  7  8  9  1  2  3  4  5
97.35 88.77 83.16 80.52 80.85
4567891123
5678912234
6789123345
7891234456
8912345567
END OF TEST
```

```
      )VARS
X
```

```
      X
0.33 0.66 0.99 1.32 1.65 1.98 2.31 2.64 2.97 3.3
```

```
      )OFF
```

2.0 DIFFERENCES BETWEEN APL-11 VERSIONS 1.0 AND 2.0

2.1 New Features in Version 2.0

- APL-11 can run under the RSX-11M and RSX-11M-PLUS operating systems.
- The)READ and)WRITE commands are replaced by)COPY and)PCOPY in conjunction with)SAVE and)LOAD.
- The commands)GROUP,)GRPS, and)GRP are provided to allow grouping of functions and variables.
- The)LIB command is provided.
- The scan operator is provided.
- The format function (thorn) is provided.
- The following set functions are provided: nub, intersection, union, subset, proper subset, containment, strict containment, and set differences.
- Additional system variables and system functions are provided, including:

System Variables

AV -- Atomic Vector
 CT -- Comparison Tolerance
 IO -- Index Origin
 LC -- Line Counter
 PP -- Print Precision
 PW -- Print Width
 RL -- Random Link
 TS -- Time Stamp
 WA -- Workspace Available

System Functions

CR -- Canonical Representation
 EX -- Expunge
 FX -- Fix function
 NC -- Name Classification
 NL -- Name List

- The matrix divide and inverse functions are part of the interpreter; in version 1.0 they are APL user functions.
- Many primitive functions (for instance; grade up, grade down, and inner product) have been reworked to conform to industry conventions.
- Storing numbers in the workspace is more efficient. Booleans require 1 byte, integers 2 bytes, and real numbers 4 or 8 bytes of storage. In version 1.0, all numeric data items are treated as floating-point numbers, requiring 4 or 8 bytes of storage.

2.2 Transferring Files and Workspaces

A procedure is provided to transfer workspaces, or files written using the)WRITE command, from APL-11 version 1.0 to version 2.0. ASCII files you created using the APL file system in version 1.0 can still be accessed by your version 2.0 system.

2.2.1 Transferring Files Written Using the)WRITE Command - To transfer files written using the)WRITE Command:

- Load function READC (2.3) into your version 2.0 system.
- Execute READC, using the file name of the file you wish to transfer as the argument.
- Execute a)SAVE file name command to create a version 2.0 workspace containing the file.

2.2.2 Transferring Workspaces - To transfer workspaces:

- Load the workspace, using APL-11 version 1.0.
- Use the)WRITE command to write the workspace to a file.
- Repeat the instructions given for transferring files (2.2.1).

2.3 READC Function

Following is the function READC, which you can use to transfer APL-11 version 1.0 files to your version 2.0 system.

```

▽READC ZZ0;ZZ1;ZZ2;ZZ3
[1]  ZZ1←x16
[2]  →(2=ffε')ASSIGN 1',ZZ0,'/FA')/Z4
[3]  →(2=ffZZ1←ε'1B[0]1')/Z3
[4]  →(0=ffZZ1←(v\ZZ1≠' ')ZZ1)/Z1
[5]  →('v'=1↑ZZ1)/Z5
[6]  →('f'=-1↑ZZ1)/Z6
[7]  ⍝ INPUT LINE IS A SIMPLE ASSIGNMENT
[8]  Z2;ZZ1←0fεZZ1
[9]  →Z1
[10] Z3;'READ COMMAND FINISHED'
[11] →(2=ffε')CLOSE 1')/0
[12] Z4;'FATAL READ COMMAND ERROR'
[13] →0
[14] ⍝ INPUT LINE IS A FUNCTION DEFINITION
[15] Z5;→(2=ffZZ2←ε'1B[0]1')/Z4
[16] ZZ2←(φv\φZZ2≠' ')/ZZ2
[17] →('v'≠-1↑ZZ1←ZZ1,⍱AV[⍱IO+13 10],ZZ2)/Z5
[18] →Z2
[19] ⍝ INPUT LINE IS A MULTI-LINE VARIABLE
[20] ⍝ GET THE SHAPE INFO
[21] Z6;ZZ2←x/ε(ZZ1\'+')↓(-⍱IO-L/ZZ1\'+')↑ZZ1
[22] ⍝ DELETE CHARACTER SENTIAL
[23] ZZ3←(ZZ1≠''')/ZZ1
[24] ZZ1←0fεx15
[25] →(''εZZ1)/Z8
[26] ⍝ VARIABLE IS A NUMERIC ARRAY
[27] Z7;→(ZZ2)ffZZ1,ZZ1,ε1B[0]1)/Z7
[28] →Z10
[29] ⍝ VARIABLE IS A CHARACTER ARRAY
[30] Z8;ZZ1←''
[31] Z9;→(ZZ2)ffZZ1←ZZ1,1B[0]1)/Z9
[32] Z10;ZZ1←0fεZZ3,'ZZ1'
[33] ZZ2←x16
[34] →Z1

```

3.0 CORRECTIONS

Please make the following corrections in the APL-11 Programmer's Reference Manual:

- Change section 2.1.3 to indicate that comments may appear at the end of lines containing APL statements; they do not have to be on separate lines.
- Change section 6.3.1 to indicate that if the)ASSIGN command is specified for an open file, it returns the error message "channel already open." It does not automatically close the currently assigned file.
- The infinite loop example in section 1.5.1 is incorrect. To suspend execution of a function, such as the infinite loop illustrated, you must use two Control-C's. No number of Control-C's will return you to RT-11 command level; to do that, you must execute the)OFF command.

4.0 RELEASE NOTES

The following are restrictions affecting the use of the APL-11 interpreter.

4.1 Control-C Usage

Under the RSX-11M and RSX-11M-PLUS operating systems, a Control-C entry is not recognized unless followed by a carriage return. Thus, to stop execution, you must enter both a Control-C and a carriage return.

4.2 Wildcard Usage

Under the RSX-11M and RSX-11M-PLUS operating systems, the use of wildcards in the file specification for the)LIB command is restricted. If you use a wildcard for the file name or file type, you must use a wildcard for the version; otherwise, the results are unpredictable.

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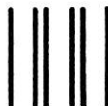
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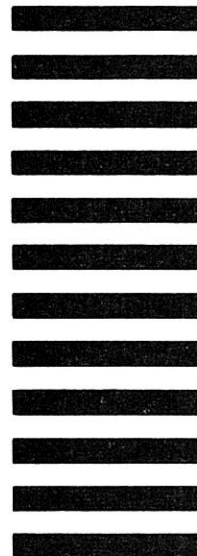
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