

# CA 2E r8.6 Enhanced Array Support

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Session 7B  
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# Abstract

Enhanced Array Support is the marquee feature of r8.6. This session will provide a technical walkthrough of the planned feature: Defining a simple, but powerful, function parameter interface to pass data as a true array (e.g. pass dozens, hundreds or thousands, of customer records, in a single call); the new ARR context, modified \*MOVE built-in function to manipulate and populate arrays, enhanced Impact Analysis ...and see how Enhanced Array Support boosts 2E Web Service Support, simplifying development, improving maintainability and accelerating runtime performance of web services modeled and deployed through 2E.

# Agenda

- Why are we working on Enhanced Array Support?
- Enhanced Array Support: Technical details
- Demonstration (live)
- Summary
- Q&A

# Why are we working on enhanced array support?

WS Support is limited to the parameter interfaces that can be defined in 2E.

Result Sets cannot be defined for parameter interfaces for 2E generated functions

4th Plex 2E Worldwide

Developer conference, Sep 2009.

## Summary

### > r8.5 Web Services: Powerful, Add value

- EJB Option is no longer available
- r8.5 provides the next generation of web service support
- Expose 2E business logic as WS using YCRTWS & WEBSRV
- Model knowledge of web services
- WS can be portably deployed YPOPWSIPDD/YEXCWSIPDD

### > Post 8.5 R&D already started...

- WS\* Specs, MODS/Result sets, meaningful WSDL
- IBM enhancements

### > r8.5 helps to protect your 2E investment

### > r8.5 defends your commitment to 2E

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## Overview



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**Promises made. Promises Kept.**

# CA 2E r8.6 development is happening now...



How we're Doing Agile Development at CA

Simon Cockayne  
Principal Software Engineer & ScrumMaster  
CA 2E Development Team

GENERAL SESSION IN SALON E-F  
Friday June 3rd 2011 (1:15pm -2:00pm)



The slide features a background of orange and red diagonal stripes with white bokeh light effects. A semi-transparent red rectangle contains the title and speaker information. The CA Technologies logo is in the bottom right corner of the slide.



# Enhanced Array Support

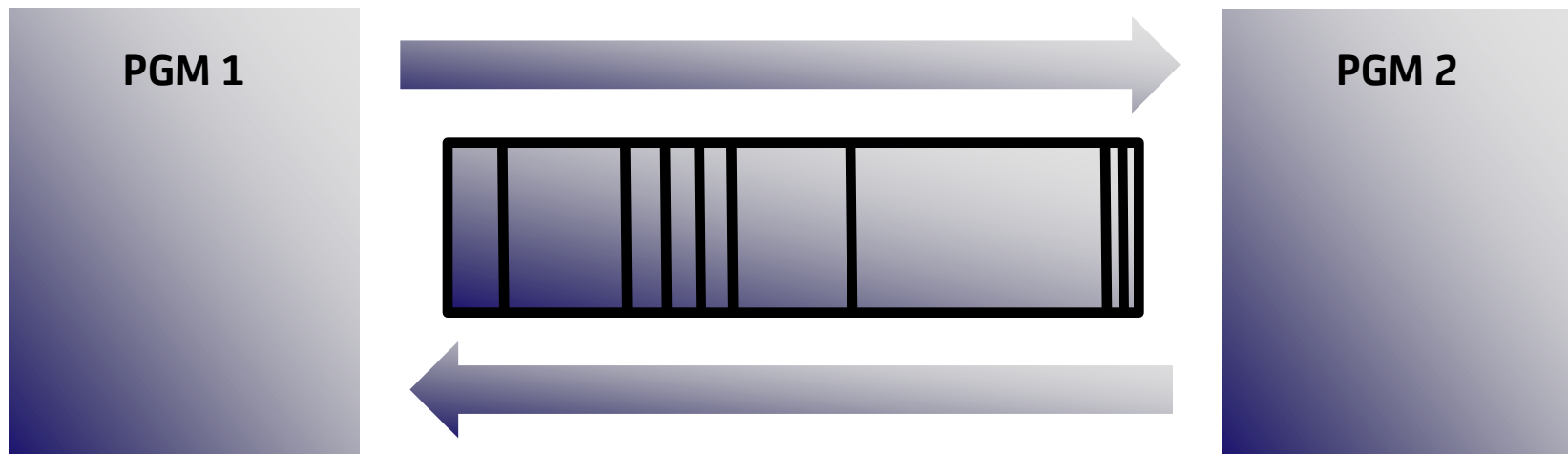


## Enhanced Array Support

- What is Enhanced Array Support
  - Ability to return a result set from a function call
  - Pass multiple records to/from a 2E function
- Key to developing web services
  - Allows complex parameter structure interface
  - Communications bottleneck, so fewer calls = better performance
  - Result set functionality standard in most web languages
  - Many 2E customers have implemented their own version

# existing 'standard' array parameter support

Typical use of passing a RCD parameter

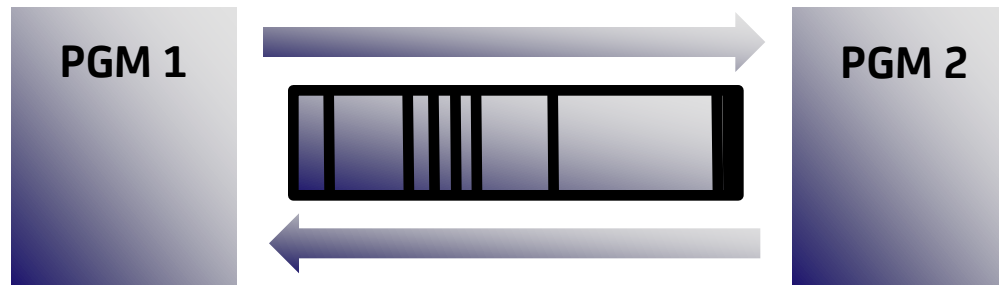


PGM 1 calls PGM 2 passing a RCD parameter

Single parameter composed of a record format or array

May be Input, Output or Both

# existing 'standard' array parameter support

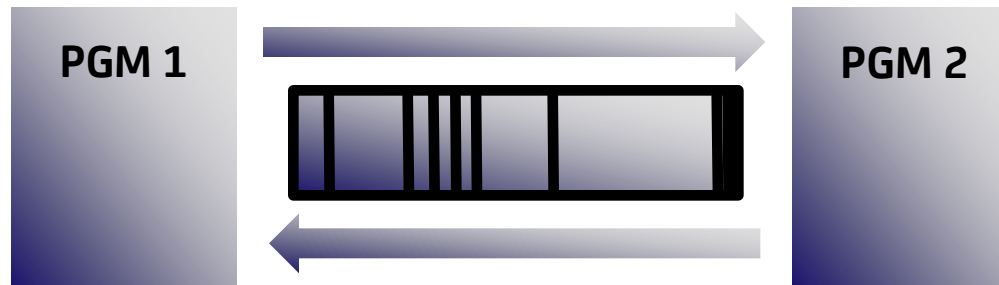


- Allows multiple fields to be passed at once
- Default passing method for e.g. RTVOBJ
- Simple to externalize RTVOBJ inside EXCEXTFUN

But.....

Still have to call EXCEXTFUN once per record retrieved

# existing 'standard' array parameter support



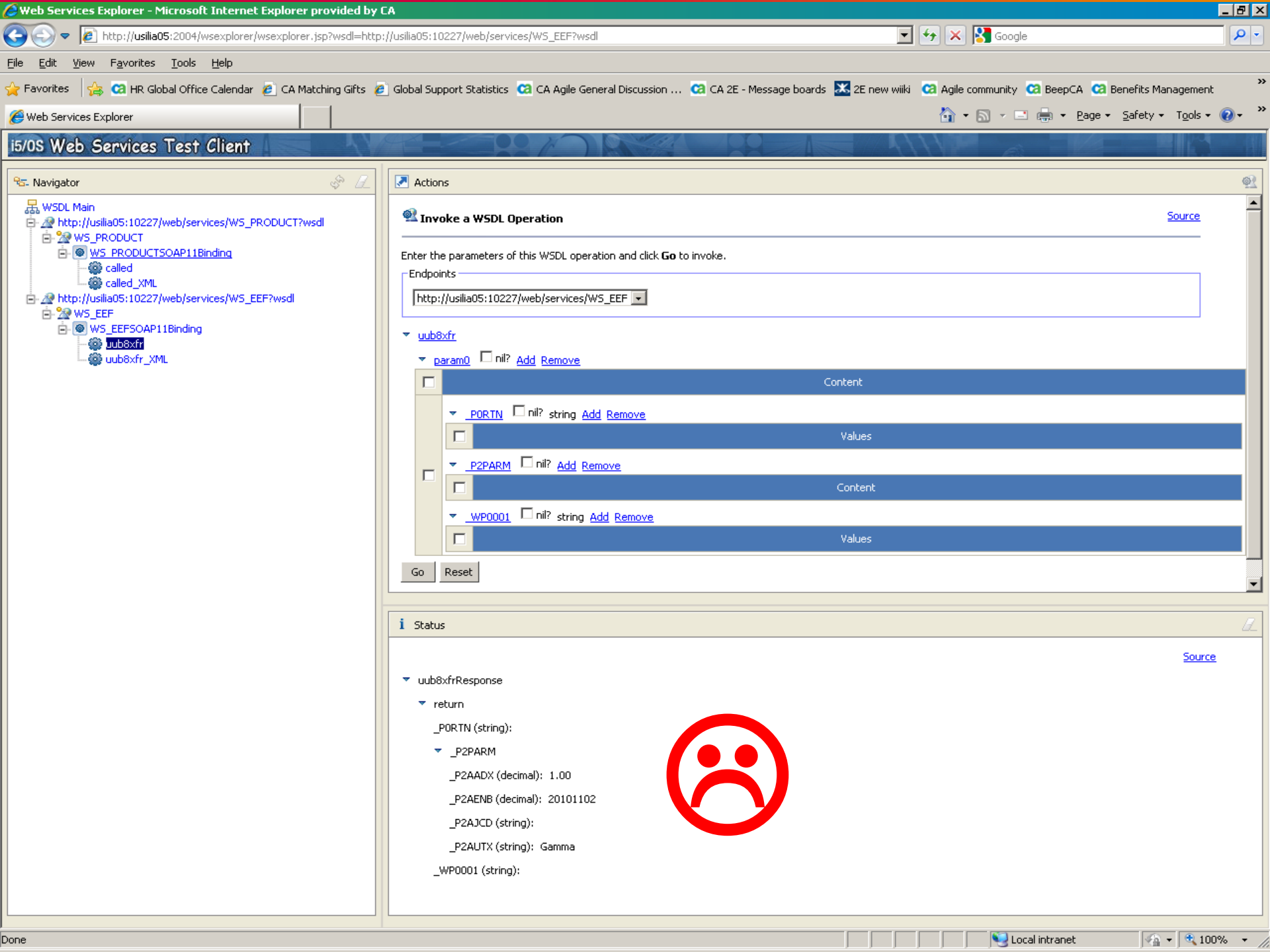
- Allows multiple fields to be passed at once
- Default passing method for e.g. RTVOBJ
- Simple to externalize RTVOBJ inside EXCEXTFUN

But.....

Still have to call EXCEXTFUN once per record retrieved

2E Web Service Support:  
What's bad for the  
goose, is bad for the  
gander...





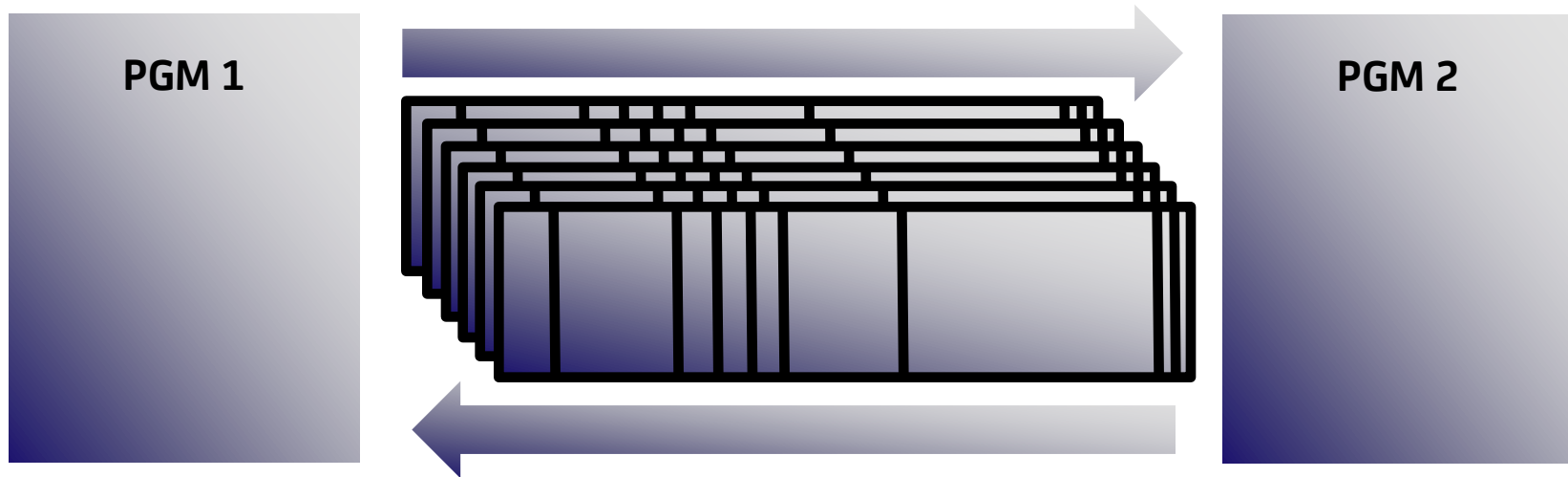
# Enhanced Array Support





# enhanced array support

Pass multiple instances of an array as a single parameter

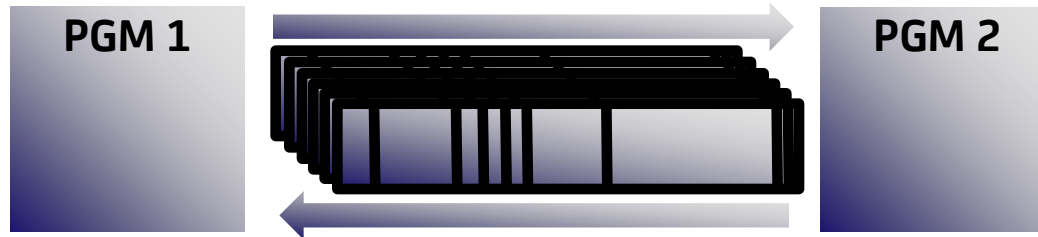


Multiple-instance array passed as a single parameter

Defined as existing 2E array (on \*Arrays file)

Number of instances defined in array definition

# enhanced array support



- Called program (PGM 2) only called once
- Can return/process multiple records (up to 9999)
- Currently available for EXCEXTFUN and EXCUSRPGM

# EAS: criteria and limitations

- Must be defined using an array
  - Not available directly using a file's record format...
  - ...but can define an array like a record format
- Number of instances of array taken from array definition
  - Defaults to 100 (i.e. 100 records passed in parameter)
- All fields in array must be passed (no Dropped fields)
  - Fields can have mix of usages (Input, Output, Both and None)
  - Performance improvements if all fields have same usage

## EAS: array definition (no change)

```

Op: 5/23/11 19:32:04
EDIT ARRAY DETAILS
Array . . . . . : Product Array
Number of elements : 100   (1 - 9999)
Sequence . . . . . : A (A=Ascending, D=Descending)
Unique . . . . . : Y (Y=Unique, N=non-unique)

? File/*FIELD      Access path/Field/Array    Seq
_ Product         Retrieval index          1
_ 
_ 
_ 
_ 
_ 
_ 
_ 
_ 
_ 
_ 
_ 
_ 
_ 

SEL: Z-Parameter details  X-Object Details  N-Narrative
F3=Exit  F5=Reload  F7=Array keys  F8=Change Name  F20=Narr.  F22=File Locks

```

# EAS: parameter options

Op: 5/23/11 19:17:00

EDIT FUNCTION PARAMETERS

Function name. . : Called program      Type : Execute external function  
Received by file : Product              Acpth: \*NONE

?	File/*FIELD	Access path/Field/Array	Passed	Seq	Pgm Ctx	Par Ctx	A
-	*FIELD	Product code	FLD	1			-
-	*Arrays	Product Array	RCD	2			Y
-							-
-							-
-							-
-							-
-							-
-							-
-							-
-							-

Product Array defined as parameter to EXCEXTFUN with 'Pass as Array' flag set to 'Y'

Values

One parameter per field: FLD  
One parameter for all fields: RCD Pass as Array: Y  
One parameter for key fields only: KEY Pass as Array: Y

SEL: Z-Parameter details   X-Object details   D-Delete parameter   N-Narrative  
F3=Exit   F5=Reload   F22=File locks   F23=More options

# EAS: parameter options

```
Op: 5/23/11 19:23:40
EDIT FUNCTION PARAMETER DETAILS
Function name. . : Called program      Type : Execute external function
Received by file : Product             Array: Product Array
Parameter (file) : *Arrays             Passed as: RCD (ARRAY)
                                       Number of elements : 100

? Field      Usage  Role  Flag error
- Product code      0    MAP
- Product description 0    MAP
- Product price date 0    MAP
- Product price      0    MAP
```

Number of elements  
taken from array  
definition

SEL: Usage: I-Input, O-Output, B-Both, N-Neither, D-Drop.  
Role: R-Restrict, M-Map, V-Vary length, P-Position, Error: E-Flag Error.  
F3=Exit

- In Action Diagram Editor, appears as single parameter
  - Don't specify separate fields within array
  - Specified using new ARR context
  - If also passed in to calling PGM, can be specified using PAR
    - 'Throughput' parameter – passed from PGM1 through PGM2 to PGM3
- Very simple interface
  - Limited changes to visible interface
  - Simple to understand

# EAS: action diagram editor

EDIT ACTION DIAGRAM

Edit

Product

FIND=>

Calling program

I (C,I,S)F=Insert co

I (A,E,Q,\*,+,-,=,=A)

EDIT ACTION - FUNCTION NAME

EDIT ACTION - FUNCTION DETAILS

Function file : Product

Function. . . : Called program

IOB	Parameter	Use	Obj Typ	Ctx	Object Name
I	Product code		FLD	LCL	Product code
A	Product Array		ARR	<u>ARR</u>	Product Array

Object name is not  
editable – only  
context

d F9=Edit parms

ious F15=Undefined parms only



- Can't use array subfields directly using existing BIF's
  - New built-in function specifically for EAS
- \*MOVE ARRAY
  - Allows multiple different types of array move
  - Allows user to specify array index (i.e. array element)
    - From WRK field to array subfield in specified array element
    - From array subfield in specified array element to WRK field
    - From subfield in one array to a subfield in another array
  - Works with all field types (TXT, NBR, DT#, TS# etc.)
- Once copied to WRK field, normal processing

# EAS: \*MOVE ARRAY built-in function (IN DEVELOPMENT)

EDIT ACTION DIAGRAM      Edit      Product

FIND=>      Calling program

I (C,I,S)F=Insert co

I (A,E,Q,\*,+,-,=,=A)      EDIT ACTION - FUNCTION NAME

EDIT ACTION - FUNCTION DETAILS

Function file :

Function. . . : \*MOVE ARRAY

IOB	Parameter	Use	Obj Typ	Ctx	Object Name
0	*Array		FLD	ARR	Product Array
0	*Array field		FLD	ARR	Product price
0	*Array index		FLD	WRK	Current line
I	*Array		FLD		
I	*Array field		FLD	WRK	Current price
I	*Array index		FLD		

F3=Exit      F5=Reload      F9=Edit parms

F10=Default parms      F12=Previous      F15=Undefined parms only

ARR.Product Array(WRK.Current line).Product price = WRK.Current price

# EAS: \*MOVE ARRAY built-in function (IN DEVELOPMENT)

EDIT ACTION DIAGRAM

Edit

Product

FIND=>

Calling program

I (C,I,S)F=Insert co

I (A,E,Q,\*,+,-,=,=A)

EDIT ACTION - FUNCTION NAME

EDIT ACTION - FUNCTION DETAILS

Function file :

Function. . . : \*MOVE ARRAY

IOB	Parameter	Use	Obj Typ	Ctx	Object Name
0	*Array		FLD		
0	*Array field		FLD	WRK	Current price
0	*Array index		FLD		
I	*Array		FLD	ARR	Product Array
I	*Array field		FLD	ARR	Product price
I	*Array index		FLD	WRK	Current line

F3=Exit

F5=Reload

F9=Edit parms

F10=Default parms

F12=Previous

F15=Undefined parms only

WRK.Current price = ARR.Product Array(WRK.Current line).Product price

# EAS: \*MOVE ARRAY built-in function (IN DEVELOPMENT)

EDIT ACTION DIAGRAM      Edit      Product

FIND=>      Calling program

I (C,I,S)F=Insert co

I (A,E,Q,\*,+,-,=,=A)      EDIT ACTION - FUNCTION NAME

EDIT ACTION - FUNCTION DETAILS

Function file :

Function. . . : \*MOVE ARRAY

IOB	Parameter	Obj	Use	Typ	Ctx	Object Name
0	*Array		FLD		ARR	Product Array
0	*Array field		FLD		ARR	Product price
0	*Array index		FLD		WRK	Current line
I	*Array		FLD		ARR	Bulk Items
I	*Array field		FLD		ARR	Bulk discount price
I	*Array index		FLD		WRK	Input line

F3=Exit      F5=Reload      F9=Edit parms

F10=Default parms      F12=Previous      F15=Undefined parms only

ARR.Product Array(WRK.Current line).Product price =  
ARR.Bulk Items(WRK.Input line).Bulk discount price

# EAS: generation details (IN DEVELOPMENT)

- EAS parameters generated in RPG as MODS
  - Multiple Occurrence Data Structures
  - Fewest changes to underlying generation programs
    - Faster development/test cycle
  - Simplest implementation – 2E handles all the low-level stuff
- EAS parameters generated in COBOL as array
  - Significantly more complex than RPG

# EAS: model areas affected

- Model interaction
  - YCPYMDLOBJ
  - YCHKFUNACT
  - YCHKMDL
  - Impact analysis
  - Action diagram error scanning
  - CM
  - Web Services

# Demonstration

# 2E Web Service Support: Enhanced 'Hurray' Support! (sic)





# Remember: Only ILE languages can be deployed as a Web Service using 2E.

Language	Enhanced Array Support?	Deploy as Web Service?
RPG	YES	NO
RPG ILE	YES	YES
COBOL	YES	NO
COBOL ILE	YES	YES

Web Services Explorer - Microsoft Internet Explorer provided by CA

http://usilia05:2004/wsexplorer/wsexplorer.jsp?wsdl=http://usilia05:10227/web/services/WS\_PRODUCT?wsdl

File Edit View Favorites Tools Help

Favorites HR Global Office Calendar CA Matching Gifts Global Support Statistics CA Agile General Discussion ... CA 2E - Message boards 2E new wiki Agile community BeepCA Benefits Management

Web Services Explorer

### i5/OS Web Services Test Client

Navigator

- WSDL Main
  - http://usilia05:10227/web/services/WS\_PRODUCT?wsdl
    - WS\_PRODUCT
      - WS\_PRODUCTSOAP11Binding
        - called
        - called\_XML
    - http://usilia05:10227/web/services/WS\_EEF?wsdl
      - WS\_EEF
        - WS\_EEFSOAP11Binding
          - uub8xfr
          - uub8xfr\_XML
    - http://usilia05:10227/web/services/WS\_PRODUCT?wsdl
      - WS\_PRODUCT
        - WS\_PRODUCTSOAP11Binding
          - called
          - called\_XML

Actions

**Invoke a WSDL Operation** [Source](#)

Enter the parameters of this WSDL operation and click **Go** to invoke.

Endpoints

▼ **called**

param0 ☐ nil? [Add](#) [Remove](#)

<input type="checkbox"/>	Content
▼ <b>_PORTN</b> <input type="checkbox"/> nil? string <a href="#">Add</a> <a href="#">Remove</a>	
<input type="checkbox"/>	Values
▼ <b>_P2PARM</b> <input type="checkbox"/> nil? <a href="#">Add</a> <a href="#">Remove</a>	
<input type="checkbox"/>	Content
▼ <b>_WP0001</b> <input type="checkbox"/> nil? string <a href="#">Add</a> <a href="#">Remove</a>	
<input type="checkbox"/>	Values

Status [Source](#)

▼ **calledResponse**

▼ **return**

\_PORTN (string):

▼ **\_P2PARM**

\_P2ABDX (decimal): 20101102

\_P2ACNB (decimal): 1.00

\_P2AECD (string): ALPHA

\_P2AFTX (string): Alpha

▼ **\_P2PARM**

\_P2ABDX (decimal): 20101102

\_P2ACNB (decimal): 1.00

Done

Local intranet 100%

Web Services Explorer - Microsoft Internet Explorer provided by CA

http://usilia05:2004/wsexplorer/wsexplorer.jsp?wsdl=http://usilia05:10227/web/services/WS\_PRODUCT?wsdl

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Benefits Management

Web Services Explorer

Page Safety Tools

i5/OS Web Services Test Client

Navigator

WSDL Main

http://usilia05:10227/web/services/WS\_PRODUCT?wsdl

WS\_PRODUCT

WS\_PRODUCTSOAP11Binding

called

called\_XML

http://usilia05:10227/web/services/WS\_EEF?wsdl

WS\_EEF

WS\_EEFSOAP11Binding

uub8xfr

uub8xfr\_XML

http://usilia05:10227/web/services/WS\_PRODUCT?wsdl

WS\_PRODUCT

WS\_PRODUCTSOAP11Binding

called

called\_XML

Status

Source

calledResponse

return

\_PORTN (string):

\_P2PARAM

\_P2ABDX (decimal): 20101102

\_P2ACNB (decimal): 1.00

\_P2AECD (string): ALPHA

\_P2AFTX (string): Alpha

\_P2PARAM

\_P2ABDX (decimal): 20101102

\_P2ACNB (decimal): 1.00

\_P2AECD (string): BETA

\_P2AFTX (string): Beta

\_P2PARAM

\_P2ABDX (decimal): 20101102

\_P2ACNB (decimal): 1.00

\_P2AECD (string): CHI

\_P2AFTX (string): Chi

\_P2PARAM

\_P2ABDX (decimal): 20101102

\_P2ACNB (decimal): 1.00

\_P2AECD (string): DELTA

\_P2AFTX (string): Delta

\_P2PARAM

\_P2ABDX (decimal): 20101102

\_P2ACNB (decimal): 1.00

\_P2AECD (string): EPSILON






\_P2AFTX (string): Epsilon

\_P2PARAM

Done

Local intranet

100%



“Cool stuff!”

Crispin Bates,  
CPU, Inc.

**Promises made. Promises kept.**

**When we say we are going to try...we really do try.**

**Enhanced Array Support is being actively developed in CA 2E r8.6**

**Enhanced Array Support:**

**Simplifying design, development and implementation**

**Improving maintainability**

**Accelerating runtime performance**

# Q&A

thank you

Backup demo  
screenshots...

