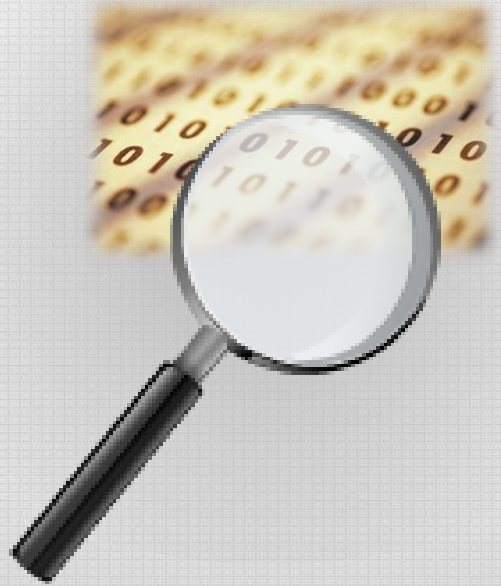


Analyzing and Improving CA 2E/Plex Code Quality

John Rhodes
Charles Wilt

CM FIRST TECHNOLOGIES

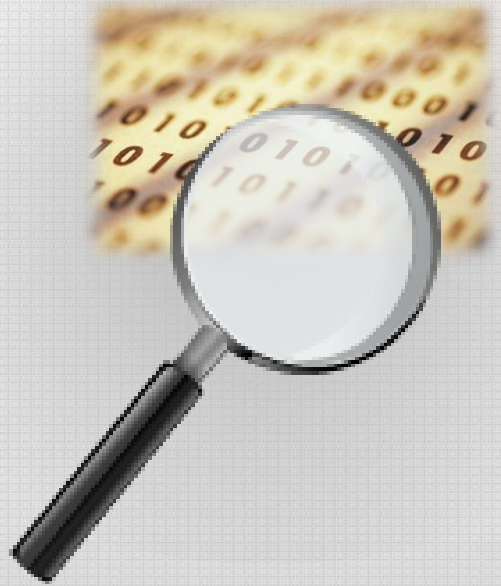
Code Quality in CA Plex/2E

- Discussion on the forums
- Strong interest on very large code bases
- Not so much on CA 2E / Plex – Why?
  - Lack of tools could be the primary reason.
  - Lack of knowledge
- Presenting Ideas and some concrete progress
  - Interested in collaboration

Genesis of the idea

- CA Repository project
  - Code comprehension of 250M source code base
  - Metrics / Clones
- Community Interest
  - Charles Wilt

Warning - work in progress



Why is “code quality” important?

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Basic Premise

- There is a cost to “own” a line of code
  - 60-80% of lifecycle cost
- Complex code costs more to maintain, Duplicate code is a burden
- Shortcuts have costs

The Problem

Code comprehension of complex systems

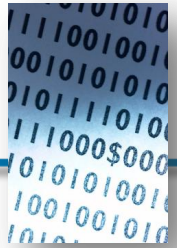
Code

Impossible to manually analyze large software programs:

- How is the maintainability – especially on legacy/old code
- New analysts – don't have the history with the code

Overall Solution

Automated fact extraction



Management

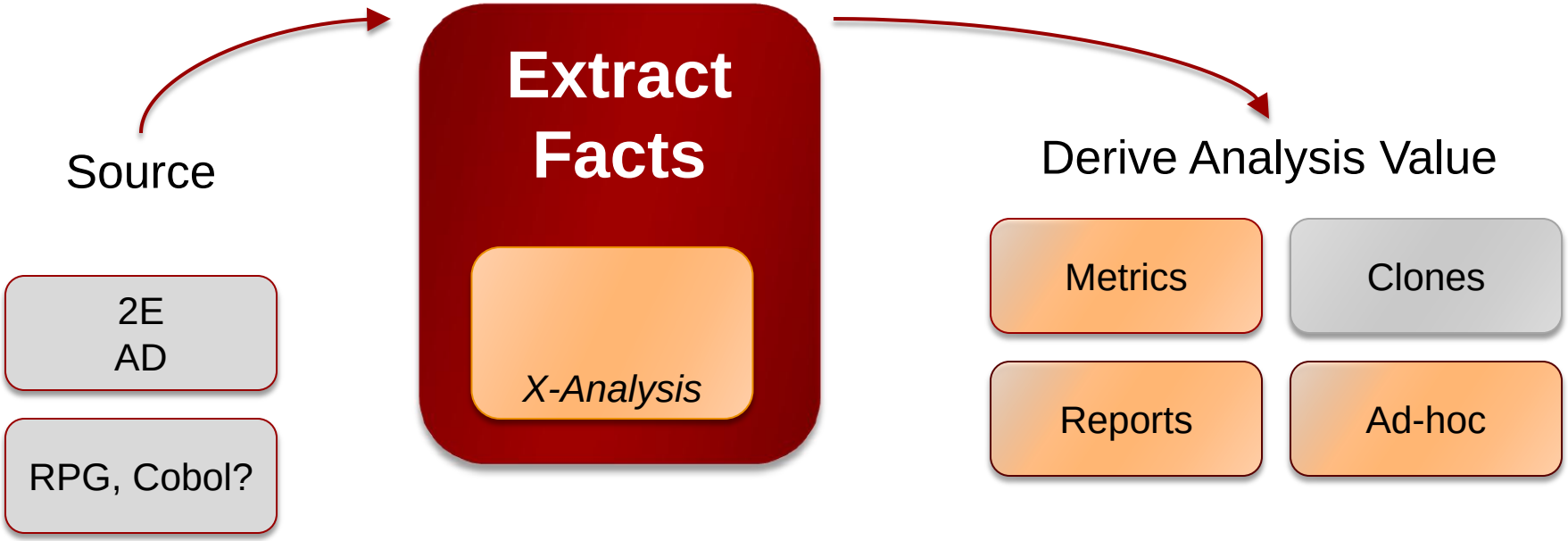
Domain Expert

External Analysis Expert (rules)

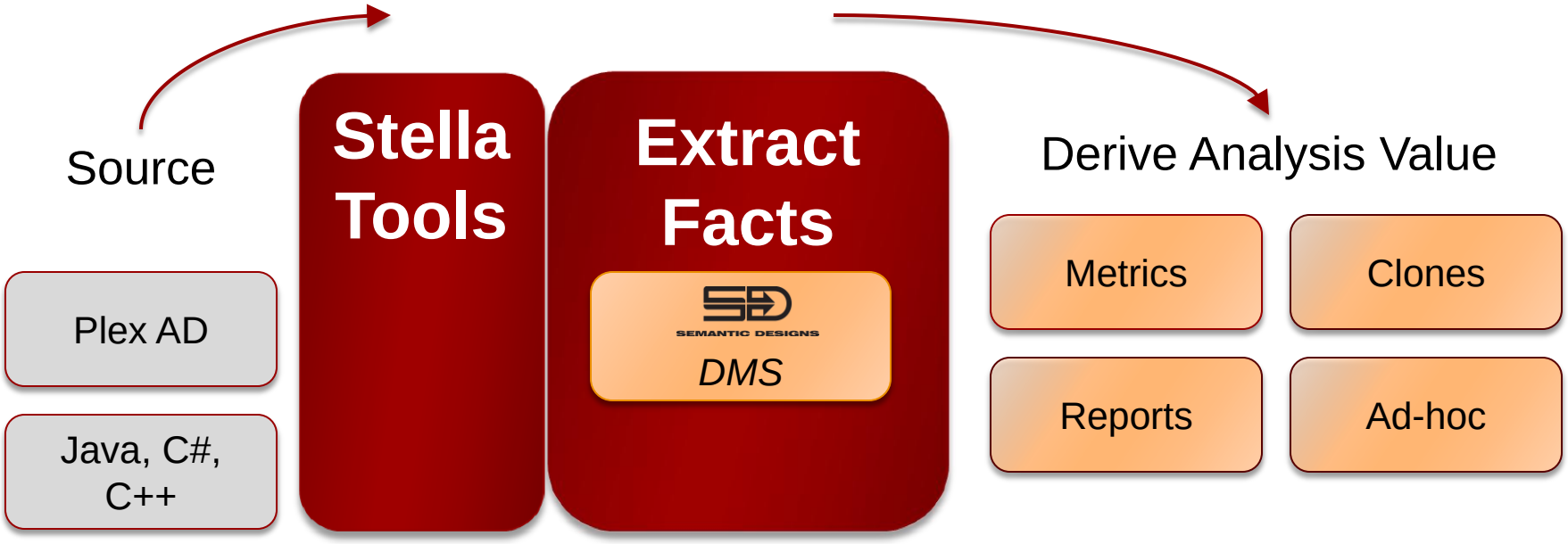
Extract Facts

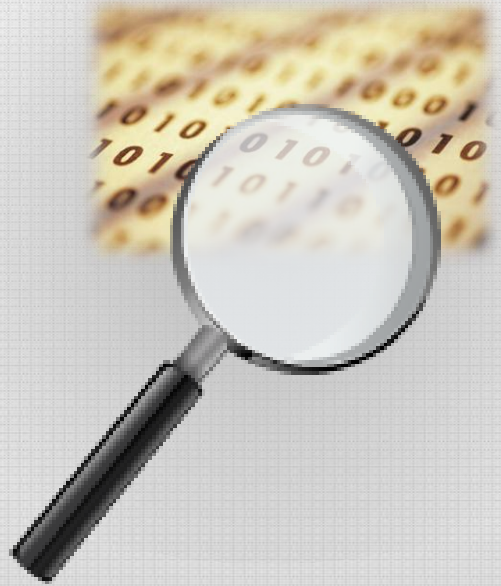
Metadata repository

2E Analysis



Plex Analysis





What do you get?

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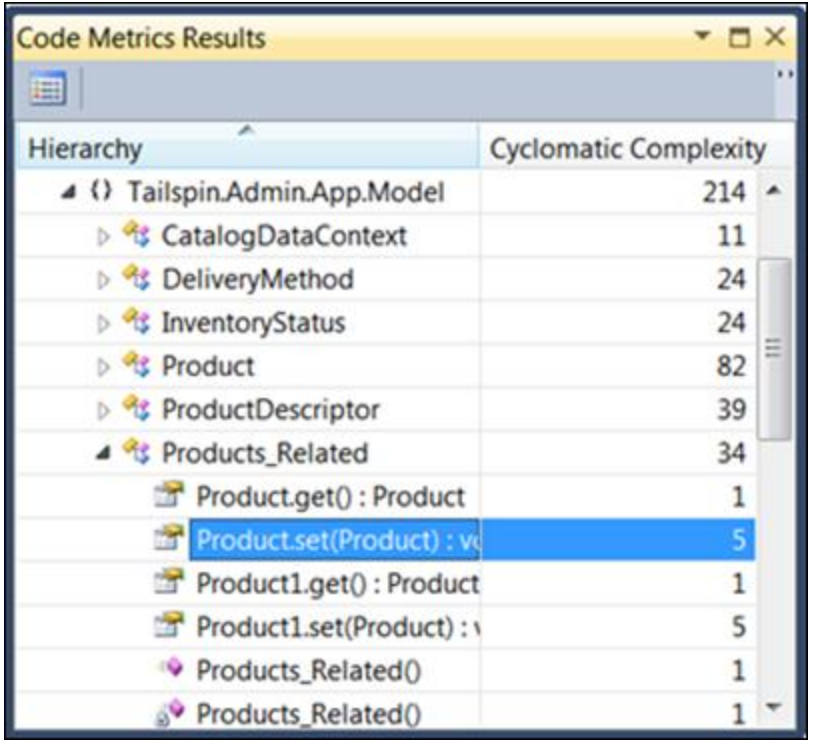
Complexity Metrics

Measure of Maintainability
Calculated in many IDE's

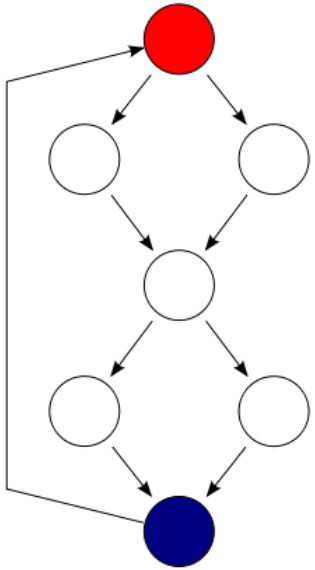
Cyclomatic / Halstead /
Maintainability Index

Visual Studio Example ->



Cyclomatic Complexity Metrics

```
if( c1()
)
f1();
else
f2();
 if( c2()
) f3();
else
f4();
```



The cyclomatic complexity of the program is 3 (as the strongly connected graph for the program contains 9 edges, 7 nodes and 1 connected component) (9-7+1).

Good Score < 10-15

Complexity Metrics

http://en.wikipedia.org/wiki/Cyclomatic_complexity

Enerjy analyzed classes of open-source Java applications and divided them into two sets based on how commonly faults were found in them. They found strong correlation between cyclomatic complexity and their faultiness, with classes with a combined complexity of 11 having a probability of being fault-prone of just 0.28, rising to 0.98 for classes with a complexity of 74.[

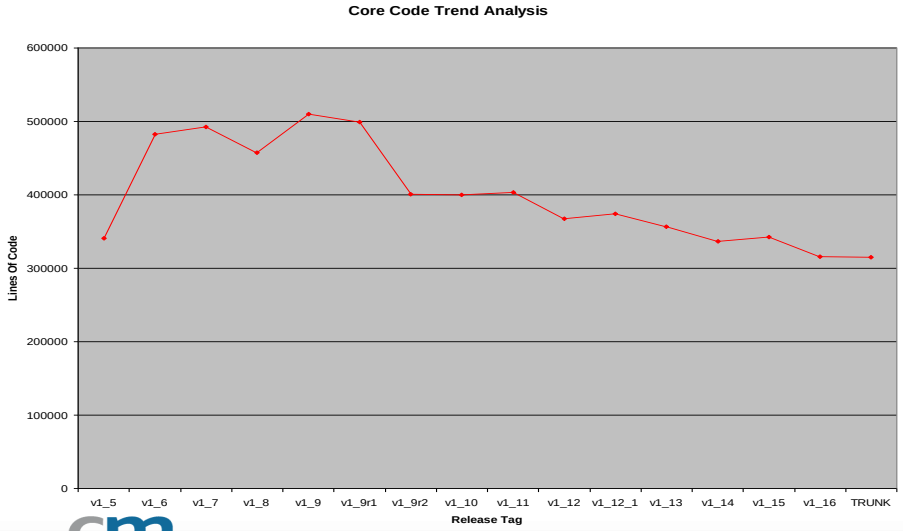
Clone Detection and Removal

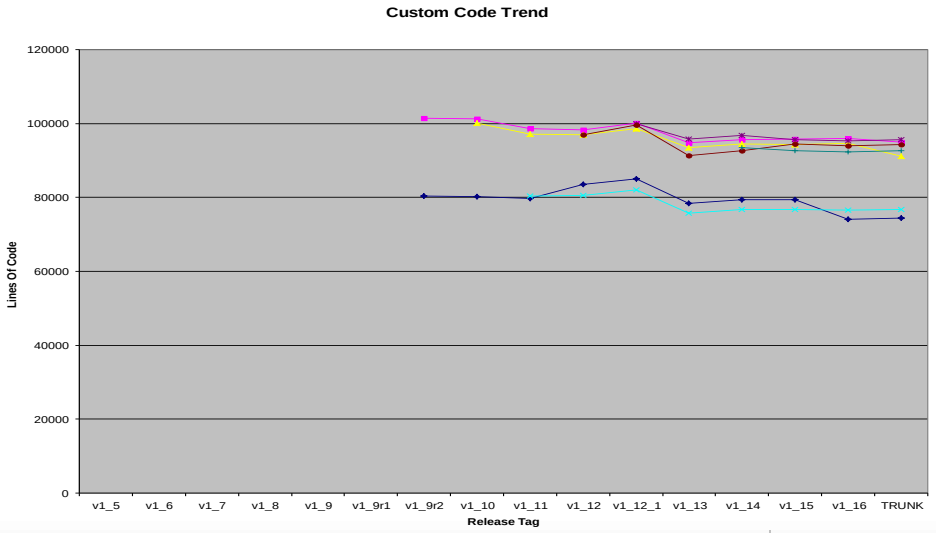
- Programmer productivity: Copy/paste/edit
  - (everybody does it)
  - typical program > 10% cloned code
- Long term maintenance problem
  - bug reuse
  - Did I change all the copies? (“What copies?”)
- Need to manage clones
  - locate them
  - revise/remove

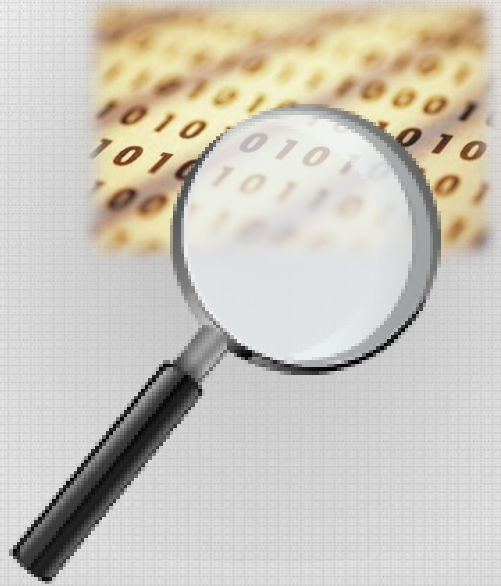
Case Study: Salion (CRM)

- *Java Application: Core + 6 Customer variants*
- *CloneDR runs every quarter; active clone removal by development team*
- *Total SLOC reduction over time: ~40%*

"Most of the drop in the source code graph (core) is due to clone detection removal."
Dale Churchett, Architect







Initial Results

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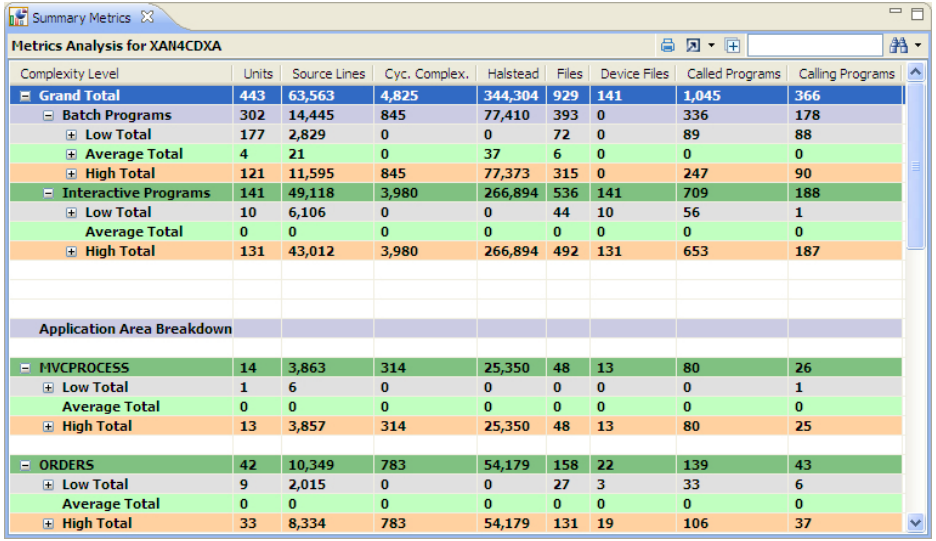
2E Analysis


Summary Metrics

Metrics Analysis for XAN4CDXA

Complexity Level	Units	Source Lines	Cyc. Complex.	Halstead	Files	Device Files	Called Programs	Calling Programs
Grand Total	443	63,563	4,825	344,304	929	141	1,045	366
Batch Programs	302	14,445	845	77,410	393	0	336	178
Low Total	177	2,829	0	0	72	0	89	88
Average Total	4	21	0	37	6	0	0	0
High Total	121	11,595	845	77,373	315	0	247	90
Interactive Programs	141	49,118	3,980	266,894	536	141	709	188
Low Total	10	6,106	0	0	44	10	56	1
Average Total	0	0	0	0	0	0	0	0
High Total	131	43,012	3,980	266,894	492	131	653	187
Application Area Breakdown								
MVCPROCESS	14	3,863	314	25,350	48	13	80	26
Low Total	1	6	0	0	0	0	0	1
Average Total	0	0	0	0	0	0	0	0
High Total	13	3,857	314	25,350	48	13	80	25
ORDERS	42	10,349	783	54,179	158	22	139	43
Low Total	9	2,015	0	0	27	3	33	6
Average Total	0	0	0	0	0	0	0	0
High Total	33	8,334	783	54,179	131	19	106	37

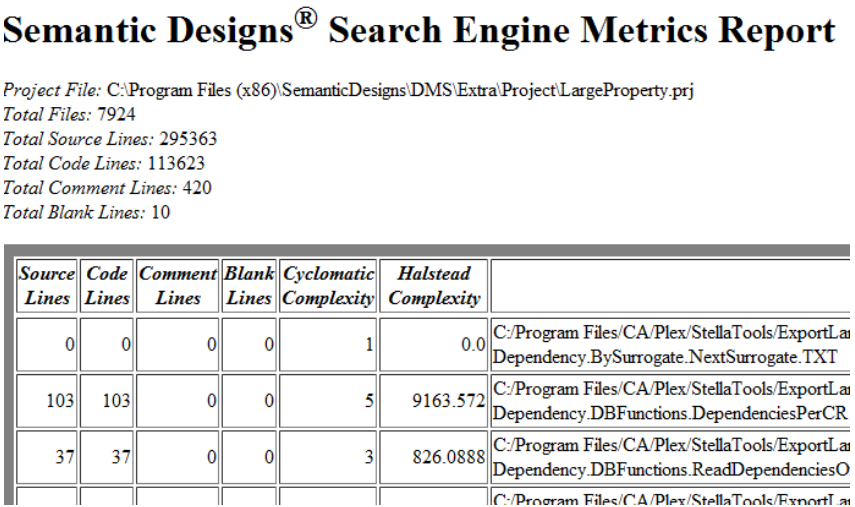
- Metrics Possible
- Internal Functions / SCM Correlation?

2E Analysis

```
Position to line  . . . . .  _______
....+....1....+....2....+....3.
OBJNAM       OBJTYP          CYC
RSYYXFR      *PGM            613
RCALXFR      *PGM            594
RSAQXFR      *PGM            513
RCBOXFR      *PGM            434
RSU9E3R      *PGM            392
RSNUXFR      *PGM            355
RSYMXFR      *PGM            354
RSBJPRR      *PGM            301
RSY5XFR      *PGM            238
RSRNXFR      *PGM            212
RCBGXFR      *PGM            184
RCBHXFR      *PGM            178
RCPDXFR      *PGM            175
RS06XFR      *PGM            159
RSB7XFR      *PGM            153
RCBTXFR      *PGM            152
RSDEXFR      *PGM            150
RS7PXFR      *PGM            144
RSM5EFR      *PGM            138
```

```
Position to line  . . . . .  ______
....+....1....+....2....+....3.
OBJNAM       OBJTYP          CYC
RSZCXFR      *PGM              7
********  End of data  ********
```

Plex Analysis



Semantic Designs® Search Engine Metrics Report

Project File: C:\Program Files (x86)\SemanticDesigns\DMS\Extra\Project\LargeProperty.prj
Total Files: 7924
Total Source Lines: 295363
Total Code Lines: 113623
Total Comment Lines: 420
Total Blank Lines: 10

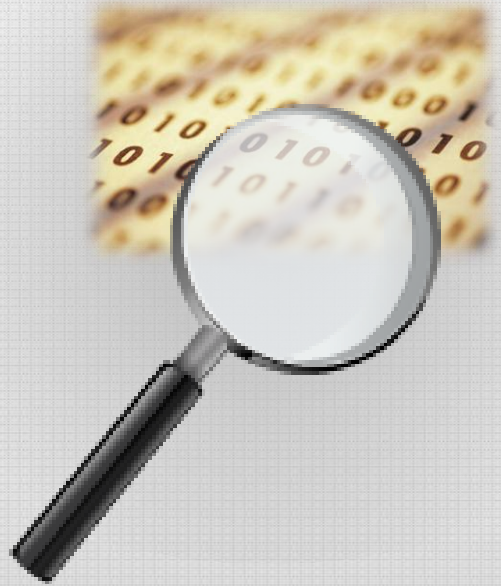
Source Lines	*Code Lines*	*Comment Lines*	*Blank Lines*	*Cyclomatic Complexity*	*Halstead Complexity*	
0	0	0	0	1	0.0	C:/Program Files/CA/Plex/StellaTools/ExportLa Dependency.BySurrogate.NextSurrogate.TXT
103	103	0	0	5	9163.572	C:/Program Files/CA/Plex/StellaTools/ExportLa Dependency.DBFunctions.DependenciesPerCR
37	37	0	0	3	826.0888	C:/Program Files/CA/Plex/StellaTools/ExportLa Dependency.DBFunctions.ReadDependenciesO
						C:/Program Files/CA/Plex/StellaTools/ExportLa

- Metrics Demonstrable
- Internal Functions and correlation to SCM?
- Clones – Future

Plex Analysis - Cintas

Source Lines	Code Lines	Comment Lines	Blank Lines	Cyclomatic Complexity	Halstead Complexity	Filename
1884	1884	0	0	497	4595350.5	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid Divisional KPI.Divisional KPI Report.Print Divisional KPI Report.TXT
4618	4616	2	0	214	1.34E+07	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid Fire Invoice.Data.Header.Print Customer Invoice.TXT
2487	2479	7	2	204	4713399.5	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid Invoice Header.Print attributes.Invoice Print.TXT
3161	3158	3	0	199	7425025	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid Work Order Header.Customer Service Sheets.Print Customer Service Sheets.TXT
1173	1172	1	0	184	1837039.2	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid Divisional KPI.Divisional KPI Report.Pmt Divisional KPI Report.TXT
1430	1414	29	5	173	4855147.5	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid New Business Report.TSR Sales and Commission Report.Print Fire Sales and Commission.TXT
2247	2241	6	0	170	3829034.5	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid Customer.Data.Master.Maintenance suite.Change user interface.TXT
2747	2732	14	1	166	8507429	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid Customer.Data.Delivery Information.Maintenance suite.Change user interface.TXT
1318	1316	2	0	165	2103735	C:/Documents and Settings/C1162332/My Documents/Plex/StellaTool Exports/ExportLargeProperty/Function/Function FirstAid Fire Invoice.UI.DetailMaint.Change Service Visit Item.TXT


Post Point 0 Process instance before print
+For Each Field Invoice Totals
Call Location.Services.Get Location Info
Set Details<Location Description> = Location.Services.Get Location Info/Output<Location Description>
Set Work<Substring Start> = <Substring Start.02>
Set Work<Substring Length> = <Substring Length.04>
Substring Details<Location Number 2>, Details<Location Number>, Work<Substring Length>, Work<Substring Start>
Location Address:
... Seq Old Remit to Address Logic
Call Common.Get Remit to Address
Set Details<Location Address 1> = Common.Get Remit to Address/Output<Remit to Address 1 (36)>
Set Details<Location Address 2> = Common.Get Remit to Address/Output<Remit to Address 2 (36)>
Set Details<Location Address 3> = Common.Get Remit to Address/Output<Remit to Address 3 (36)>
Set Details<Location Address 4> = Common.Get Remit to Address/Output<Remit to Address 4 (36)>
Set Details<Phone Alpha 15> = Common.Get Remit to Address/Output<Remit to Address 5 (36)>
Call Customer.Data.Master.Location Customer Number.Get One Instance
Bill To Address (not in Preview mode unless it is the PRC batch run):
If Input<Preview flag> != <Preview flag.*Yes> OR Input<Fire Invoice Process Type> == <Fire Invoice Process Type.PDA Batch>
Service Address:
Call Address Information.All attributes.Get one instance
Set Details<Customer Address Line 1 (36)> = Customer.Data.Master.Location Customer Number.Get One Instance/Output<Customer Name>
Set Details<Customer Address Line 2 (36)> = Address Information.All attributes.Get one instance/Output<Address Line 1>
Set Details<Customer Address Line 3 (36)> = Address Information.All attributes.Get one instance/Output<Address Line 2>
Format Message Message: Concat city state - zip, Details<Customer Address Line 4 (36)>
If Details<Customer Address Line 3 (36)> == <Customer Address Line 3 (36).*Blank>
If Details<Customer Address Line 2 (36)> == <Customer Address Line 2 (36).*Blank>
If Details<Customer Address Line 1 (36)> == <Customer Address Line 1 (36).*Blank>
May 07 Maintenance Release Check PO # in header First
Cast Details<Blanket PO Number>, Fire Invoice.Data.Header.Print Customer Invoice.Print invoice Get sequential/Output<Customer PO Number>
If Details<Blanket PO Number> == <Blanket PO Number.*Blank>
Invoice Copy
If Input<Invoice Copy> == <Invoice Copy.Customer>
Else
Find service manager and Calculate period dates
Ready. Messages:0
Wilt, Charles
FW: Order Confirmation for 5th CA 2E/Plex Worldwide Developer Conference



Demo of process

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Interested?

- Trial / Alpha version of CA Plex tool
- Databorough Trial Version
- Thread on CA Forum
- Ideas?

jdrhodes@cmfirsttech.com
Charles.wilt@gmail.com