

### A Standard Process for Software Code Counting June 2012

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#### Background

- Software Size
- SLOC Types
- Issues
- Unified Code Counter (UCC) and Differencing Capability
- UCC Code Counting Examples
- Graphical User Interface for UCC (GUCC)
  - Why a GUCC?
  - GUCC
  - GUCC Screens
- GUCC Demonstration
- Summary





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# Software size is a critical cost driver for software development cost estimates

#### SLOC is...

- The most easily obtained size metric
- The most mature metric
- Understood by decision makers
- An appropriate size metric when...
  - System is preceded by analogous programs
  - System requires high levels of complex processing





#### Physical SLOC

- Count of end-of-line markers
  - Excluding comments and blanks
  - Characterizes software in terms of physical size
- Programming language syntax independent

#### Logical SLOC

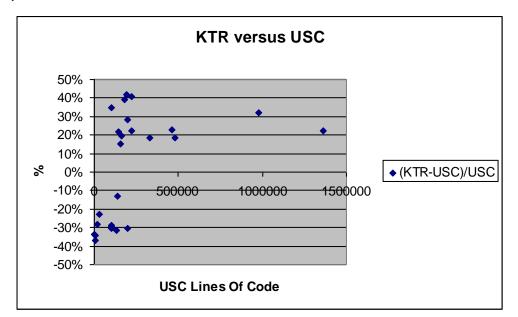
- Count of single instructions
  - Excluding comments and blanks
  - Characterizes software in terms of instructions
- Programming language syntax specific

- Both logical and physical SLOC counts are useful for different parts of a life cycle cost estimate:
  - Logical SLOC is more closely aligned with code functionality and development effort
  - Physical SLOC is useful for sizing maintenance effort



#### No one standard has been universally accepted for defining SLOC

- Every code counter claims to follow the "Software Size Measurement: A Framework For Counting Source Statements" by Robert E. Park
- The problem is how each code counter interprets the definitions
- The following chart (Cymerman 2006) shows +/-40% variance in C/C++ language counts vs. UCC (multiple contractors and programs) :



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## Numerous tools using multiple SLOC definitions are in use today (Jensen 2005):

- SEER-SEM
  - Control, mathematical, conditional, I/O, format JCL, and all other executable statements are included
  - Comments and Begin statements are excluded.
- Price-S
  - Source lines to be developed and/or purchased.
  - Embedded declarations and data statements are included
  - Comments are excluded
- COCOMO
  - All instructions requiring design, documentation, code and test created by programmers and processed into machine code
  - Generally all delivered logical, format and declaration instructions.
  - Comments and COTS are excluded.
  - Debug and test drivers (unless delivered) are also excluded

### Code counting needs to be consistent to be used as an accurate basis for cost estimating

#### The Unified Code Counter is a solution



#### **Unified Code Counter (UCC)**

#### Sponsored by USC

 Uses logical and physical SLOC definition from CMU/SEI-92-TR-020; <u>Software Size Measurement: A</u> <u>Framework for Counting Source Statements</u>

#### Supports multiple software programming languages

- Tecolote developed several prototype counters for 'new' languages (e.g.: PERL, XML)
- USC tested the prototype counters and incorporated them into releases of the UCC
- USC willing to add counters as the need arises
- Non-proprietary solution and FREE!

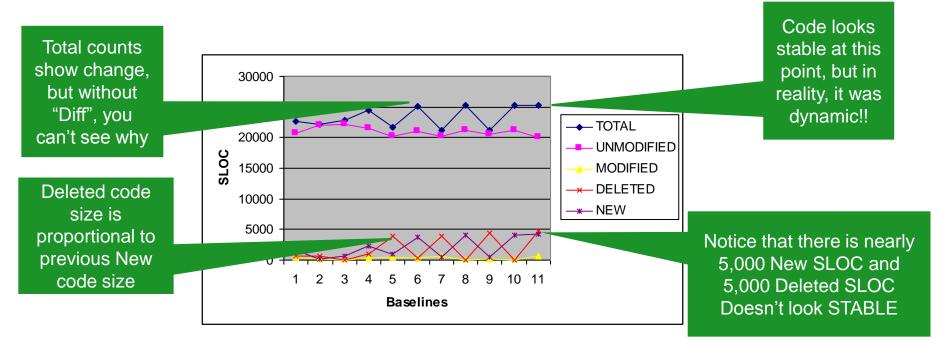
#### http://sunset.usc.edu/research/CODECOUNT/



#### **UCC Differencing Capability**

#### Prototype differencing capability implemented by Tecolote and incorporated into UCC by USC

- It compares source code from two versions of a software development
- "Diff" tool example (Cymerman 2006) shows the usefulness to breakout the New and Deleted code from the total code counts:







- Mid Late 1990s: NRO CAIG identified need for consistent code counts
- 2002: Tecolote (Cymerman) identified USC Code Counter as potential solution
- 2003-2005: Tecolote (Cymerman and Legg) developed prototype counters and differencing capability; worked with USC in support of NRO CAIG
- 2008 present: NRO and NGA form a joint working group using UCC (renamed in 2009)
- 2011: GUCC developed, tested, and briefed to Intelligence Community
- 2012: GUCC in use at NAVAIR; requested by Pt. Magu customer

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### Graphical User Interface for the UCC (GUCC)

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- The UCC provides credible and consistent counts across programs but can be labor intensive to implement
  - Requires UCC knowledge of command line options
  - Requires MS DOS or Unix knowledge

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- More suited for developers and not analysts
- The Graphical User Interface for the UCC (GUCC) was developed by Tecolote on internal research and development funding
- It operates in a Windows OS environment and reports the results of the UCC in a single consolidated MS **Excel output**



## User friendly GUCC allows wider use with little to no training

- One GUI window
- Browse mechanism
- Click options
- Execute button

#### GUCC shows

- Totals on one tab of excel output
- Files not counted
- All output from the UCC

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### **GUCC Input Screen**

Graphical Universal Code Counter		Simply locate the folder
Project Selection Select folder containing source code to count or difference.	Target files are from ClearCase ( c)	where the
Project Folder (-dir): C:\Demo_UCC\1_Demo	Browse	code is
File Filter: *.*		i
Perform a difference count against alternate project (-d):		
Alternate Folder: C:\Demo_UCC\2_Demo	Browse	Add another
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Maximum characters per SLOC (-trunc): 10000 😂		difference
⊂ Reporting		tool
Report Destination (-outdir): C:\Documents and Settings\elegg\Lo	ocal Settings\Temp Browse	
<ul> <li>Create consolidated report in Excel</li> </ul>	Options	
Additionally, write UCC reports (in CSV format)	Exclude complexity statistics (-nocomplex)	
<ul> <li>Write ASCII reports instead of CSV (-ascii)</li> </ul>	Report All files found in project folder (-all)	
<ul> <li>Write legacy reports instead of CSV (-legacy)</li> </ul>	Unified report file (-unified)	
About	Execute Close	Press 'Execute' to start the GUCC

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#### **Summary Results Screen**

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#### TECOLOTE <u>RESEARCH, INC.</u> Bridging Engineering and Economics Since 1973 GUCC Detailed Report Screen

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GUCC Detailed Report Screen

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#### The GUCC operates in a Windows OS environment and reports results in MS Excel

• Analyst/tester comment: "Ok, the results are in: GUCC is pretty fantastic. You can count all languages by using the generic file filter of "\*.\*" so that you don't have to count each language discretely. Plus, it makes you a nice automated summary tab that shows counts per language, while including all of the output files so that you can go back and look at details for each count."

Many software development efforts operate in a UNIX environment

- UNIX GUI for the UCC reportedly developed by NG
- Working with Intelligence Community to share information and demo tools
- Scheduling a demonstration to USC for possible incorporation in future UCC versions