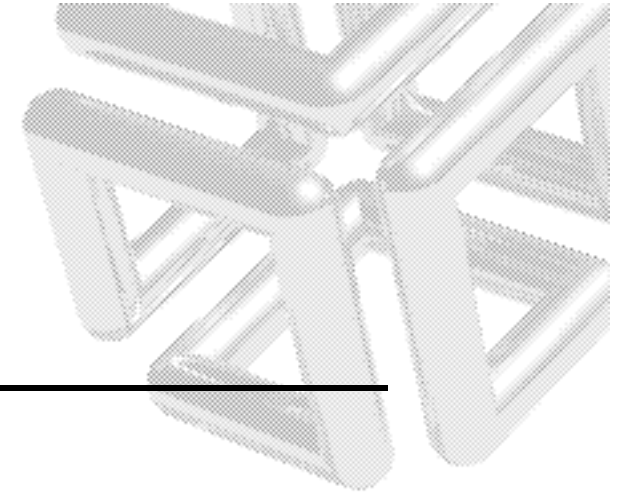




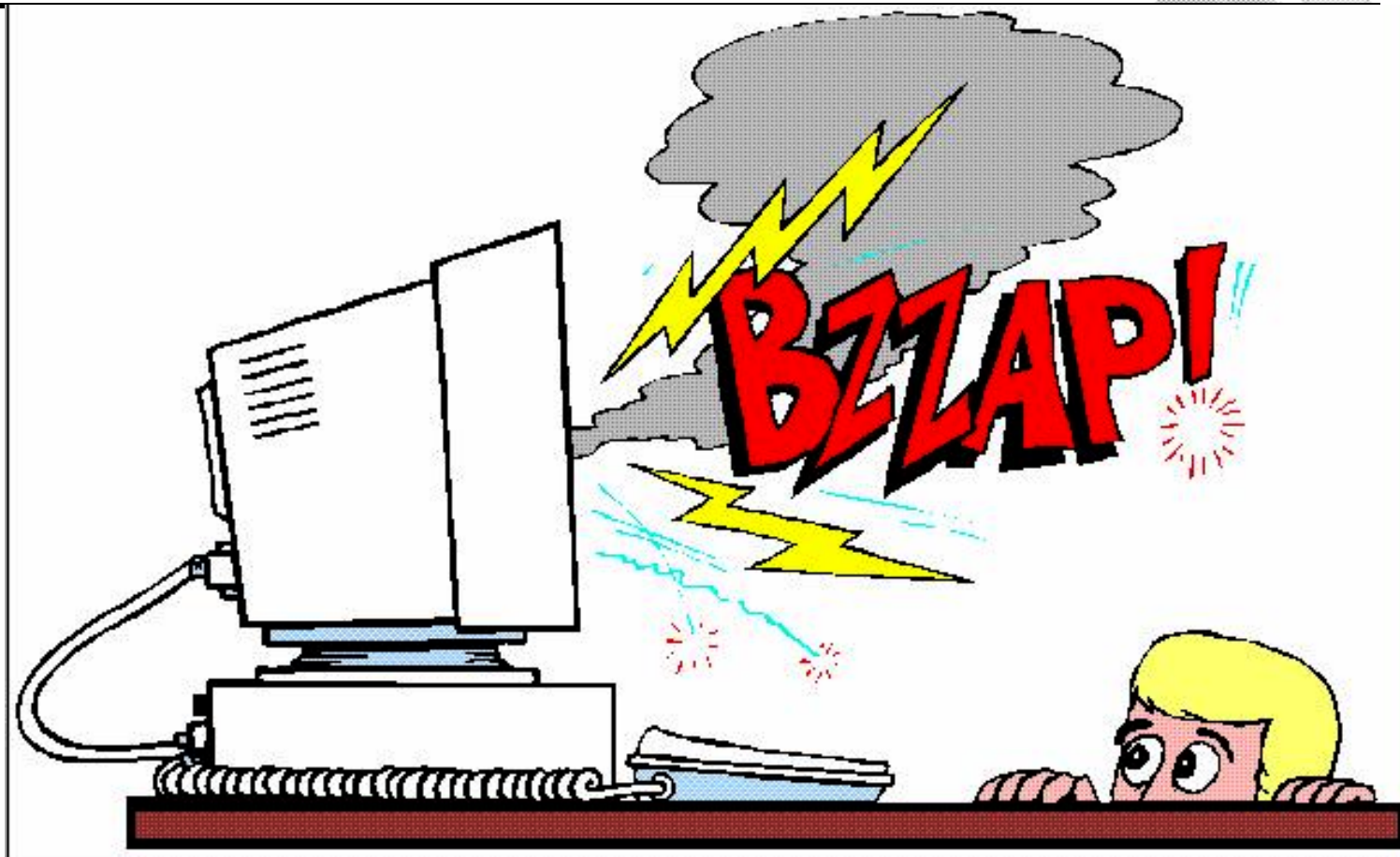
**YEAR**  
**2000**



# Year 2000 Testing

**Dennis Arason**  
**Technical Project Lead of Testing**  
**Software Engineering Services**  
**darason@sgi.com**

YEAR  
**2000**



Year 2000 Compliance for UNICOS & UNICOS/mk

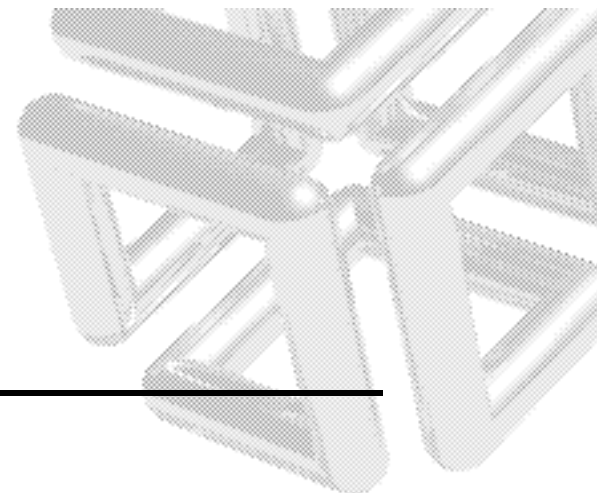
CUG Presentation



YEAR  
**2000**



YEAR  
**2000**



**HAPPY  
NEW YEAR**





YEAR  
**2000**  
Approaches Taken

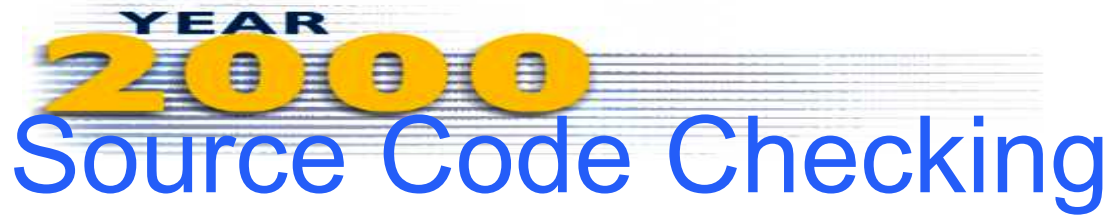
- Source Code Checking
- System Testing

The graphic features the text "YEAR 2000" in a stylized font, with "2000" in large yellow digits and "YEAR" in smaller blue letters above it. Below this, the words "Source Code Checking" are written in a large blue font, followed by "(cont)" in a smaller blue font. The background includes a purple gradient bar at the top and a blue gradient bar on the left side.

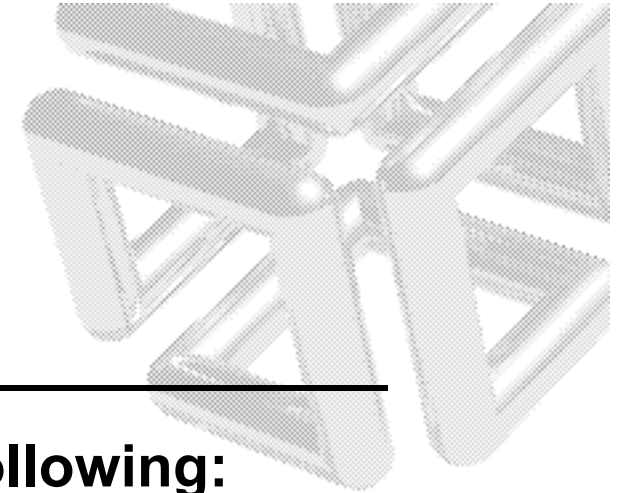
# YEAR 2000 Source Code Checking (cont)

- **Approach**

- Possible coding problem areas were identified
- Scripts were written to find possible problems
  - Scripts used in searches can be found at:
    - [http://www.sgi.com/Technology/year2000/yr2k-scan\\_tool.html](http://www.sgi.com/Technology/year2000/yr2k-scan_tool.html)  
(binary and source checking scripts available)
- Scripts were run against all source code
- Search results were examined
- Problems found were fixed
- Searches were rerun and continue to be rerun



YEAR  
**2000**  
Source Code Checking



- **Source code was searched for the following:**
  - Use of %y in arguments of
    - asctime(3), strftime(3), ctime(3), strptime(3), and date calls
  - Values of 2000, 1900, and 1999
  - Values that match 19%
  - The string tm\_year
  - Values in the format \*.\*.\*
  - Use of date(1) and touch(1) commands in scripts
  - Time/date keywords; “date”, “year”, “time”



# YEAR 2000 System Testing

- **Approach**
  - Define date epochs
  - Define machine resource needs
  - Define areas to be tested
  - Perform tests for **each** date epoch
  - Fix problems found
  - Re-test

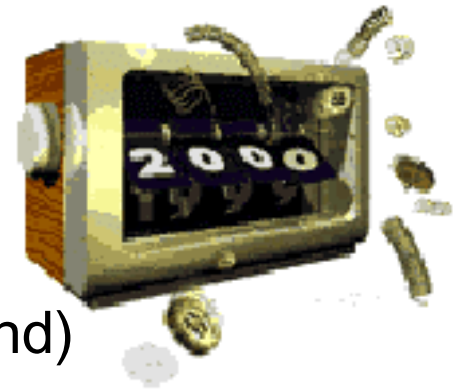


# YEAR 2000 System Testing (cont.)

- **Date Epochs Tested:**

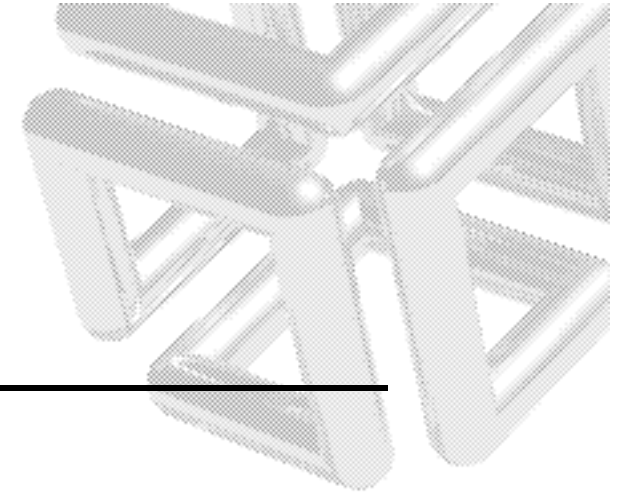
- Pre 2000 (Sept 9th 1999) (i.e. 9999)
- Roll-Over (1999 - 2000)
- Extended Roll-Over (Year 2000 & Beyond)
- Leap Year (Feb 28th 2000 - Feb 29th 2000)

- This is the often missed third rule for leap years, “ $year \% 400$ ”





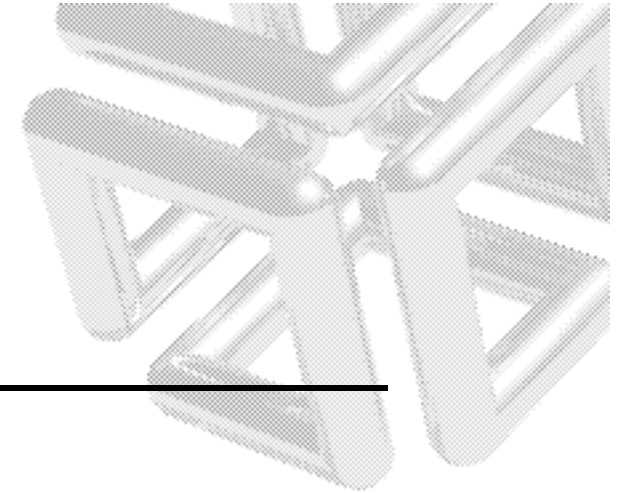
YEAR  
**2000**  
System Testing (cont.)



- **Machines Used:**
  - Cray Systems
    - Cray T90
      - Stand-Alone
        - GigaRing
      - Guested
        - GigaRing
    - Cray T3E
      - System continues to run with date well into the year 2000
    - Cray J90
      - IOS-V Based
      - GigaRing

The graphic features the text "YEAR 2000" in a stylized font, with "2000" in large yellow digits and "YEAR" in smaller blue letters above it. Below this, the words "System Testing" are written in a large blue font, followed by "(cont.)" in a smaller blue font. The background of the graphic consists of horizontal lines and a purple-to-white gradient bar at the top.

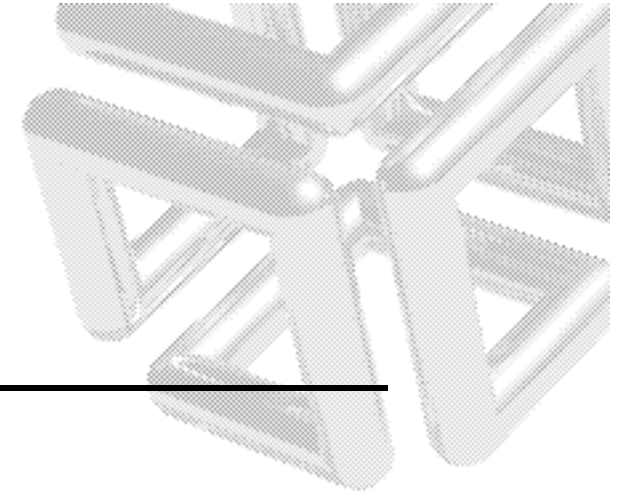
# YEAR 2000 System Testing (cont.)



- **Machines Used:** (cont.)
  - Cray Systems (cont.)
    - Cray T3D
      - Testing here was not as extensive
    - Cray C90
  - Consoles
    - SWS
    - OWS
    - MWS

The graphic features the text "YEAR 2000" in a stylized font, with "2000" in large yellow digits and "YEAR" in smaller blue letters above it. Below this, "System Testing (cont.)" is written in a blue, sans-serif font. The background consists of horizontal lines and a purple-to-white gradient bar at the top.

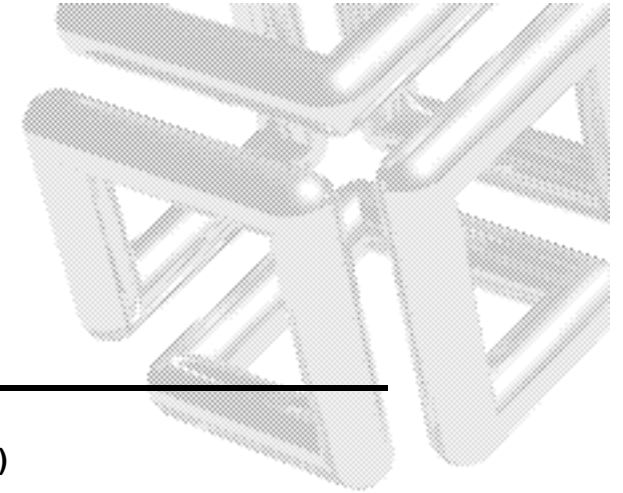
# YEAR 2000 System Testing (cont.)



- **Highlights Of Testing Performed:**
  - Systems used were on our campus wide network and NFS accessible
  - Verification of machine date
  - Tape Systems
    - Cray/REELlibrian
    - Regression tests run against a number of tape types



YEAR  
**2000**  
System Testing (cont.)



- **Highlights Of Testing Performed:** (cont.)
  - System Logging
    - Logging Examined
      - Accounting
      - System Activity Reporting
      - System Logging
      - Error Logging
      - Security Auditing
      - Automated Incident Reporting (AIR) System
      - NIS+ Log
      - File System Error Logging Daemon
      - mppsyslog
      - mppd.log

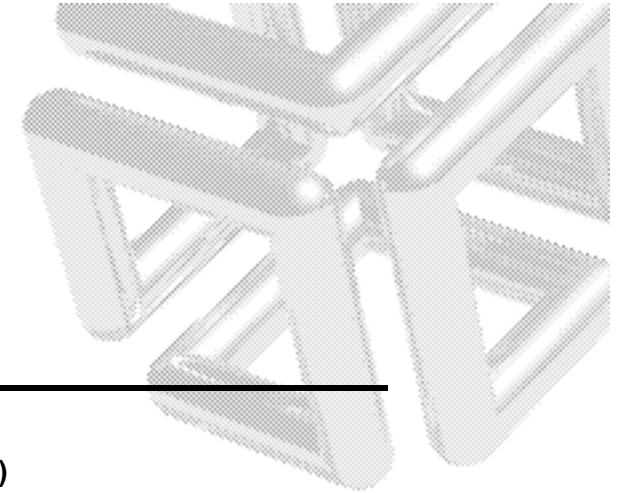
The graphic features the text "YEAR 2000" in a bold, yellow, sans-serif font. The "000" is significantly larger than "YEAR". Below this, the words "System Testing" are written in a blue, sans-serif font, followed by "(cont.)" in a smaller blue font. The background of the graphic consists of horizontal lines that create a sense of motion or a digital interface.

# YEAR 2000 System Testing (cont.)

- **Highlights Of Testing Performed:** (cont.)
  - System Logging (cont.)
    - Log contents were examined
  - make(1)/nmake(1) and cld(1)
  - Cray Standard C Compiler (SCC)
  - Cray Fortran 90 Compiler
  - X/Open test suite was run
  - All regression tests were run
  - chkpnt/restart
  - dump/restore

The graphic features the text "YEAR 2000" in a stylized font, with "2000" in large yellow digits and "YEAR" in smaller blue letters above it. Below this, "System Testing (cont.)" is written in a blue sans-serif font. The background consists of horizontal lines and a purple-to-white gradient bar at the top.

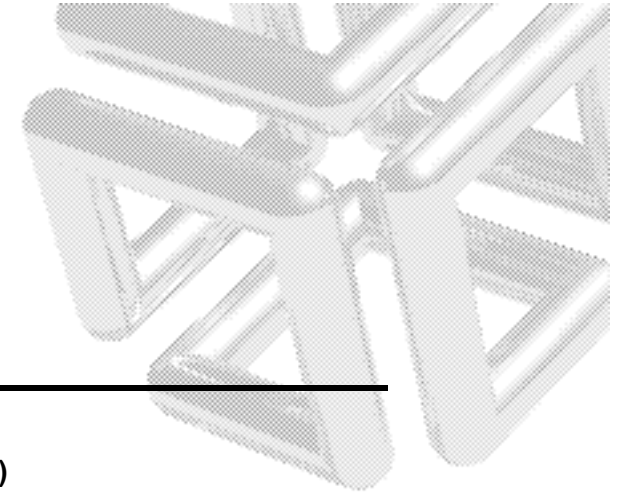
# YEAR 2000 System Testing (cont.)



- **Highlights Of Testing Performed:** (cont.)
  - cron(8) and at(1)
  - Date and Time commands
  - DMF
  - NFS
  - NQE
  - NQS
    - Job Submission in 1999/Execution in 2000
    - Job Submission/Execution in 2000
    - Job Submission on Feb 28th 2000/Execution on Feb 29th 2000

The graphic features the word "YEAR" in a small, dark font above the large, bold, yellow "2000". Below "2000" is the text "System Testing" in a blue, sans-serif font, followed by "(cont.)" in a smaller blue font. The background of the graphic consists of horizontal lines and a purple-to-white gradient bar at the top.

# YEAR 2000 System Testing (cont.)



- **Highlights Of Testing Performed:** (cont.)
  - FLEXIm License Manager
    - Keys with no expiration date
    - Keys expiring before/after year 2000
  - MPP Apprentice performance tool
  - Offline diagnostics
  - SWS/OWS/MWS Commands/Utilities
    - Boot and Dump commands
    - I/O Commands (e.g. bootion(8) and dumpion(8))
    - Diagnostic Utilities
    - Console Tools





YEAR  
**2000**  
Problems Found (cont.)

Most frequent problem found: Use of **tm\_year** directly

Year 2000 date printed as '100' instead of '00' or '2000'

Example of how **tm\_year** was used improperly:

```
printf("%02d/%02d/%02d", tm->tm_mon+1, tm->tm_mday, tm->tm_year);
```

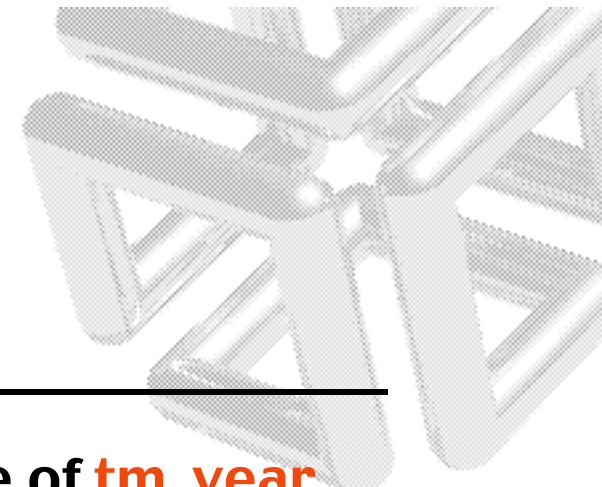
Should be:

```
printf("%02d/%02d/%02d", tm->tm_mon+1, tm->tm_mday,  
tm->tm_year%100);
```

Or:

```
printf("%02d/%02d/%04d", tm->tm_mon+1, tm->tm_mday,  
tm->tm_year+1900);
```

# YEAR 2000 Problems Found



## Areas found with problems related to use of **tm\_year**

- CBP
- SCE
- HPM
- NQE
- NFS
- CRL
- CCMT
- SMARTE
- GUEST
- sfrecover
- Kerberos
- at(1)
- bftp(1)
- bscan(1)
- builddefs(1)
- cf77(1)
- cpp(1)
- crypt(1)
- Emacs(1)
- fttp(1)
- ftua(1)
- ja(1)
- mppcmd(1)
- prs(1)
- sar(1)
- udbsee(1)
- xterm(1)
- acct(8)
- cpdmp(8)
- crash(8)
- csafef(8)
- csafef2(8)
- csaocket(8)
- dtu(8)
- errpt(8)
- fta(8)
- ftpd(8)
- nispaswd(8)
- nu(8)
- olhpa(8)
- olnet(8)
- ops(8)
- slogdemon(8)
- tic(8)
- unitap(8)
- urmdaemon(8)
- xadmin(8)
- xsnmpmon(8)
- Fddi
- Tapes
- dglib
- mfinit
- AIR
- USM
- DMF



**YEAR**  
**2000**  
Summary

- We have been working on the Year 2000 problem since early 1997
- We have run in-house systems with dates well into the year 2000 (June of 2000 and still counting)
- We have rolled the system date hundreds of time (without problem)
- The systems used (Cray, Console, File systems) were connected to our entire campus (Not isolated)
- All known epoch related problems have been fixed
- Some limited testing was done for January 18th, 2038