99 Ways to Crash

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White Star Software
A Few Words about the Speaker

• Nectar Daloglou; Progress & QAD since 2000.
• Performed specialized services at more than 70 Progress customer sites:
  • Progress Database Administration
  • Install/Upgrades/Migrations of Progress and QAD Applications
  • Technical Audits / Performance Tuning
  • Business Continuity Strategies
99 Ways to CRASH!

• Don’t try this at home!
• Learn from mistakes of others
• Goal: Show you a crash you can prevent
• Crash: DB ceases to respond
• Why 99?
Human error

Human error means that something has been done that was "not intended by the actor; not desired by a set of rules or an external observer; or that led the task or system outside its acceptable limits". In short, it is a deviation from intention, expectation or desirability.

Source: https://en.wikipedia.org/wiki/Human_error
The Human Condition

Human Error

Skill-based errors
- Slips of action
- Lapses of memory

Mistakes
- Rule-based mistakes
- Knowledge-based mistakes

Accidental File Delete

• Delete .d’s (and .db, .d1, etc....whoops!):
  – rm *.d*

• Delete development environment
  – rm -rf /dev*

• Unintentional file redirect
  – > _mprosrv db
Accidental rm

- Use *root* or privileged user only when necessary
- List the files first

  - `ls filestodelete*`
  - `pwd`
  - `/db/prod`

- Extra caution with root or privileged user
Accidental Server Shutdown

• Fat thumb:
Accidental Server Shutdown

- Communication breakdown between teams
  - “Unplanned” planned outage
  - Server decommission
- Point and click VM shut down

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Monitor your servers’ upstatus

- Use monitoring tool or scripts to poll server status and alert/page you (From another server!)

![Monitor your servers' upstatus](image.png)
Proshut User Disconnect

- Disconnect a user safely

```
$ proshut mfgdemo
usr   pid  time of login  user id  tty       Limbo?
 5 13497 Thu Jun 23 19:41:22 2016  APW  /dev/pts/1  no
 6 13500 Thu Jun 23 19:41:22 2016  BIW  /dev/pts/1  no
 7 13503 Thu Jun 23 19:41:22 2016  WDOG  /dev/pts/1  no
 8 13741 Thu Jun 23 19:41:46 2016  nectar  /dev/pts/2  no

1  Disconnect a User
2  Unconditional Shutdown
3  Emergency Shutdown (Kill All)
 x  Exit

Enter choice> 1
```
Avoid Being Prone to Human Error

- Uh-oh!

```
$qaddba@protopdev:/data/eb21/db
$ proshut mfgdemo
usr  pid  time of login  user id  tty   Limbo?
 5  13497 Thu Jun 23 19:41:22 2016  APW  /dev/pts/1  no
 6  13500 Thu Jun 23 19:41:22 2016  BIW  /dev/pts/1  no
 7  13503 Thu Jun 23 19:41:22 2016  WDOG /dev/pts/1  no
 8  13741 Thu Jun 23 19:41:46 2016  nectar /dev/pts/2  no
  1  Disconnect a User
  2  Unconditional Shutdown
  3  Emergency Shutdown (Kill All)
  x  Exit

Enter choice> 2
Shutdown is executing. (1613)
```
Avoid Being Prone to Human Error

1. Remove the “2” key:

2. Or Use:
   _mproshut db –C list
   _mproshut db –C disconnect userid
Agenda

• The “Human” Factor
• Database Management
• Operating System
• Beyond our control
• Questions
Abnormal Shutdown

- Terminating a shared memory process holding latches will crash the database:

  [2016/06/17@11:39:57.214-0400] P-241778    T-1    I WDOG   6: (2522) User 22 died holding 1 shared memory locks.
  [2016/06/17@11:39:57.214-0400] P-241778    T-1    I WDOG   22: (5029) SYSTEM ERROR: Releasing multiplexed latch. latchId: 3096224748304416
  [2016/06/17@11:39:57.347-0400] P-1134704    T-1    I BROKER 0: (2249) Begin ABNORMAL shutdown code 2

- A UNIX kill command or Windows End Task

- An excellent read on safe kill’s & free kill script: “How do I kill thee”:
  http://download.psdn.com/media/exch_audio/2008/OPS/OPS-16_KOUFALIS.pdf
Abnormal Shutdown

- Killing an agent from OpenEdge Management
Abnormal Shutdown

- Closing a shared-memory window or logging off from Windows
Windows Log off

• Logging off / Signing out from Windows will effectively terminate all your Progress running processes:
  – Example: _mprosrv; replserver; prowin32, etc..

• Use OpenEdge Explorer, dbman, or Task Scheduler to run server processes in background
Excessive BI Growth

• Oops! No –bistall or -bithold:

```plaintext
[2014/08/14 016:05:03.105+0200] P-2300 T-4592 I ABL 8: (10601) SYSTEM ERROR: Attempted to exceed maximum size on file \prod\prod.b2.
[2014/08/14 016:05:03.120+0200] P-2300 T-4592 F ABL 8: (854) ** Insufficient disk space to extend the before-image file.
[2014/08/14 016:05:03.214+0200] P-2304 T-2312 I SRV 1: (2520) Stopped.
[2014/08/14 016:05:03.320+0200] P-3320 T-776 I SRV 4: (2520) Stopped.
[2014/08/14 016:05:04.261+0200] P-2300 T-4592 I ABL 8: (5028) SYSTEM ERROR: Releasing regular latch. latchId: 4
[2014/08/14 016:05:04.261+0200] P-2300 T-4592 I ABL 8: (5028) SYSTEM ERROR: Releasing regular latch. latchId: 1
[2014/08/14 016:05:04.261+0200] P-2300 T-4592 I ABL 8: (453) Logout by batch on CON:.
[2014/08/14 016:06:05.511+0200] P-2496 T-2500 I BROKER 0: (2249) Begin ABNORMAL shutdown code 2
[2014/08/14 016:06:06.511+0200] P-2496 T-2500 I BROKER 0: (2251) Destroyed user 10 pid 3236.
[2014/08/14 016:06:08.511+0200] P-2496 T-2500 I BROKER 0: (334) Multi-user session end.
```

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Excessive BI Growth

• Possible Causes:
  – Largely scoped transactions
  – Long running transactions
  – Bad Code

• Consider:
  – -bistall -bithold
  – Monitor long transactions and BI size

• 90% Warning in .lg not always enough notice:

  [2015/02/25@12:57:10.468+0800] P-7475       T-140691071489824 I ABL    55: (9240)  BI File size has
grown to within 90 percent of the threshold value of 2.0   GBytes.
[2015/02/25@13:04:21.953+0800] P-21931      T-139708899522336 I ABL    58: (9239)  BI File Threshold
size of 2.0   GBytes has been reached.
[2015/02/25@13:04:21.953+0800] P-21931      T-139708899522336 I ABL    58: (6560)  Forward processing
stalled until database administrator intervention.
Monitor BI Usage
Cannot Switch to Empty AI Extents

- Again no stall (-aistall)

[2008/03/04@18:39:35.796-0500] P-868468 T-1 I Usr 46: (3773) Can't switch to after-image extent /reg04/dbs/ai/qadprd04.ai it is full.
[2008/03/04@18:39:35.799-0500] P-913610 T-1 I FMAGENT11: (453) Logout by DB_Agent on /dev/pts/50.
[2008/03/04@18:35.803-0500] P-868468 T-1 I Usr 46: (5350) Database Server shutting down as a result of after-image extent switch failure.
[2008/03/04@18:39:35.826-0500] P-3633292 T-1 I RPLS 5: (10672) The Source database is crashing. Fathom Replication cannot continue.
Cannot Switch to Empty AI Extents

• Possible Causes:
  – AI management script or AIMGMT process not running
  – Out of disk space
  – OE Replication: Not synced to target DB(s); AI files “Locked”

• Consider:
  – -aistall
  – Use AIMGMT utility
  – Monitor empty extents and AI archive disk space
ProTop AI Alert

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OE Replication: Stall by Full –pica queue

- Communication queue between the RDBMS and the replication server
- Full queue causes a performance stall
- Restarting the replication server will flush queue
- Monitor using Promon:
  - R&D>1>16

10/18/08  Status: Database Service Manager
00:20:44
Communication Area Size : 1000000.00 KB
Total Message Entries : 9142822
Free Message Entries : 914
Used Message Entries : 9141908
Service Latch Holder : -1

- Or get alerted by ProTop

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Calulating -pica

-pica = (Total AI Writes/Block count) * 1.25

Total AI writes can be determined with promon
promon → R&D → Option 2 (Activity) → Option 6 (AI Log)

*Note: Gather Total AI writes at the busiest update portion of the day

Block count in version 10+ = 9.16

When in doubt set it larger (memory is cheap)

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Maximum value for -pica

256 (9.1E, 10.0B, 10.1A),
1024 (9.1E04),
512 (10.0B05),
8192 (10.1A02, 10.1B01),
1000000 (10.2B08, 11.2+)
2GB File Limit

• Large Files Not Enabled:

[2008/11/26 05:42:46-0500] P-2510996 T-1 I Usr 6: (10601) SYSTEM
[2008/11/26 05:42:46-0500] P-2510996 T-1 F Usr 6: (8897) SYSTEM ERROR: Unable to extend database within area HISTORY.
[2008/11/26 05:42:47-0500] P-2510996 T-1 I Usr 6: (439) ** Save file named core for analysis by Progress Software Corporation.
[2008/11/26 05:42:47-0500] P-2211938 T-1 I BROKER 0: (2249) Begin ABNORMAL shutdown code 2

Use: proutil <DB> -C EnableLargeFiles
No variable extent

- Similar issues when fixed extent fills up:

  [2008/11/26@05:58:42.874-0500] P-2510996  T-1  F Usr  6: (8897) SYSTEM ERROR: Unable to extend database within area HISTORY.
  [2008/11/26@05:58:43.710-0500] P-2510996  T-1  I Usr  6: (2252) Begin transaction backout.
  [2008/11/26@05:58:43.710-0500] P-2510996  T-1  F Usr  6: (2255) SYSTEM ERROR: Incomplete microtransaction.
  [2008/11/26@05:58:43.711-0500] P-2510996  T-1  I Usr  6: (439) ** Save file named core for analysis by Progress Software Corporation.
  [2008/11/26@05:58:43.888-0500] P-2211938  T-1  I BROKER 0: (2249) Begin ABNORMAL shutdown code 2

- Ensure every area has a variable extent:

  d "TRGLDET":27,64 ./db f 512000
  d "TRGLDET":27,64 ./db
  #
  d "TRGLDET_IDX":28,32 ./db f 512000
  d "TRGLDET_IDX":28,32 ./db

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Infinite (-l) increases

• Process eventually consumed all the memory

[2014/03/17@12:02:46.754-0400] P-8573096 increasing from 3323700 to 3323710.
[2014/03/17@12:02:46.760-0400] P-8573096 increasing from 3323710 to 3323720.
[2014/03/17@12:02:46.767-0400] P-8573096 increasing from 3323720 to 3323730.
[2014/03/17@12:02:46.773-0400] P-8573096 increasing from 3323730 to 3323740.

• Monitor and consider -hardlimit
Lock Table Overflow (-L)

- Hitting the max will eventually consume all shared memory

Begin transaction backout. (2252)
Lock table overflow, increase -L on server (915)
Out of free shared memory. Use -Mxs to increase. (6495)
SYSTEM ERROR: mtlatch <latch-num>, holding <lock>. (3712)
SYSTEM ERROR: Releasing regular latch. latchId:<latch-num> (5028)
SYSTEM ERROR: Releasing multiplexed latch. latchId:<latch-num> (5029)
User <num> died holding <num> shared memory locks. (5026)

- Monitor open transactions and record lock counts
- Use: proutil db –C increaseto –Mxs #
Failed DB File Move

• mv /db/prod.d1 /db1/prod.d1
• prostrct repair prod
• Oops! What happened?

<table>
<thead>
<tr>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last open date mismatch. (9215)</td>
</tr>
<tr>
<td>Extent has a different last opened date Fri Jun 24 00:40:39 2010, (9213)</td>
</tr>
<tr>
<td>Control Area has a last open date of Fri Jun 24 00:41:08 2010. (9217)</td>
</tr>
<tr>
<td>Probable backup/restore error. (605)</td>
</tr>
<tr>
<td>Database is damaged, see documentation. (1486)</td>
</tr>
</tbody>
</table>

• Rename .db before and after, to prevent accidental logins
No integrity (-i) crash

• Prepare to restore
Using proutil –F Forced Access

- Back up DB beforehand
- Should be used as a last resort
- Used to extract and salvage as much data as possible
- Use ASCII Dump/Load
Agenda

• The “Human” Factor
• Database Management
• Operating System
• Beyond our control
• Questions

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Linux Out of Memory Killer

- A self-preservation mechanism that terminates a process when memory is over committed.
- OOM will kill the most memory consuming process

/var/log/messages:
Oct 22 16:05:48 s619784dc3v142 kernel: Out of memory: Kill process 5995 (_mprosrv) score 421 or sacrifice child
Oct 22 16:05:48 s619784dc3v142 kernel: Killed process 5995, UID 65535, (_mprosrv) total-vm:34767444kB, anon-rss:12680kB, file-rss:31617936kB

- Can control likelihood by setting oom_adj (Valid range -16 to +15; -17 to exempt):
  – Example: echo -17 /proc/5995/oom_adj
Host name Change

• A simple host name change:

> hostname slv8002

[2008/09/24@08:28:48.790-0400] P-10817782 T-1 I BROKER 0: (4192) /reg01/dbs/qaddb/qadprd01.lk:
HOSTNAME is slv8002, expected slv8000.

[2008/09/24@08:28:48.790-0400] P-10817782 T-1 I BROKER 0: (4196) /reg01/dbs/qaddb/qadprd01.lk is not a valid .lk file for this server.

[2008/09/24@08:28:48.790-0400] P-10817782 T-1 I BROKER 0: (2249) Begin ABNORMAL shutdown code 2

• .lk file contains host

> cat qadprd01.lk

slv8000
Out of disk space

- Out of disk space

  [2016/05/04 00:31:35.563+0800] P-14609  T-139953801205536 I ABL  23: (9450)  bkioWrite:Insufficient disk space during write, fd 119, len 16384, offset 13520, file /reg12/dbs/ai/r12prd3.a1.
  [2016/05/04 00:31:35.563+0800] P-14609  T-139953801205536 I ABL  23: (4163)  Insufficient disk space.

- Monitor disk space

- Track database growth rate

- Segregate DB files from application, home/work directories

- Do not store anything under / <root> or C:\
Unintended Java update

• A Linux Kernel patch updated java
  – Used to be: /usr/java/jdk1.5.0_22/
  – Now /usr/java/jdk1.6.0_10
  – Progress likes its java a certain way
Agenda

• The “Human” Factor
• Database Management
• Operating System
• Beyond of our control
• Questions
Hardware Failure

- Disk Subsystem
  - SAN Controller
  - RAID Controller
- CPU
- RAM
- Power Supply
- Motherboard
- UPS
- Network
Other Disasters

- Natural Disaster/Extreme Weather
- Power outage
- Flood
- Fire
- Utility outage (Excluding Fire)
- Cyber attack
- Supply chain distribution
- Terrorist event
- Employee health and safety incident
- Epidemic/Pandemic
- Sabotage
- Environmental accident
- Others...
Progress Bugs

• Database crash after Lock Table Overflow

  Lock table overflow, increase -L on server (915)
  Begin transaction backout. (2252)
  Transaction backout completed. (2253)
  SYSTEM ERROR: mtlatch <latch-num>, holding <lock>. (3712)
  SYSTEM ERROR: mtlatch 7, holding 0x40. (3712)
  ** Save file named core for analysis by Progress Software Corporation. (439)

• Truncate after Emergency Shutdown corrupts BI

  rmUndoLogicalChange: recid <RECID> area <Areanum> txn <Transnum> updctr <n>
  rmFetchRecord returns <n1> expected <n2>

• LKRELS Errors in 10.1B

  SYSTEM ERROR: lkrels record <recid> not locked. (435)
Stay current

- Stay current with your OpenEdge version:

<table>
<thead>
<tr>
<th>Product Version &amp; Current Service Pack (SP)</th>
<th>Life Cycle by Product Release</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
</tr>
<tr>
<td>OpenEdge 11.7.3</td>
<td>2017-Mar</td>
</tr>
<tr>
<td>OpenEdge 11.6.4</td>
<td>2015-Oct</td>
</tr>
<tr>
<td>OpenEdge 11.5.1</td>
<td>2014-Dec</td>
</tr>
<tr>
<td>OpenEdge 11.4.0</td>
<td>2014-Aug</td>
</tr>
<tr>
<td>OpenEdge 11.3.3</td>
<td>2013-Jul</td>
</tr>
<tr>
<td>OpenEdge 11.2.1</td>
<td>2013-Feb</td>
</tr>
<tr>
<td>OpenEdge 11.1.0</td>
<td>2012-Jun</td>
</tr>
<tr>
<td>OpenEdge 11.0.0</td>
<td>2011-Dec</td>
</tr>
<tr>
<td>OpenEdge 10.2B.08</td>
<td>2009-Dec</td>
</tr>
<tr>
<td>OpenEdge 10.2A</td>
<td>2008-Nov</td>
</tr>
<tr>
<td>OpenEdge 10.1C</td>
<td>2008-Feb</td>
</tr>
<tr>
<td>OpenEdge 10.1B</td>
<td>2006-Dec</td>
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<tr>
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<td>2005-Dec</td>
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<tr>
<td>OpenEdge 10.0B</td>
<td>2004-Aug</td>
</tr>
<tr>
<td>OpenEdge 10.0A</td>
<td>2003-Dec</td>
</tr>
<tr>
<td>Progress V9.1D</td>
<td>2002-May</td>
</tr>
<tr>
<td>Progress V8.3E</td>
<td>2001-Dec</td>
</tr>
<tr>
<td>Progress V8.3D</td>
<td>2000-Jan</td>
</tr>
</tbody>
</table>

BONUS!

• Ensure you have a valid backup
• Not valid if it’s not tested
Conclusion

• Human errors can be managed with some situational awareness and behavior change
• A good monitoring and alerting tool can help avoid outages
• Stay current and learn to avoid DB crashes
• Have an up-to-date disaster recovery plan (And good backup!)
Questions?
Questions

• Questions or comments? Feel free to e-mail me:

Nectar Daloglou: nd@wss.com
Thank You!
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