

Exploring the Informix Sysmaster Database What is New in IDS 11

Lester Knutsen
Advanced DataTools Corporation

Change Session Code
Day, April 0, 2008 • 00:00 a.m. – 00:00 a.m.

2008 IIUG Informix Conference



Session ###

Exploring the Informix Sysmaster Database
What is New in IDS 11

Lester Knutsen

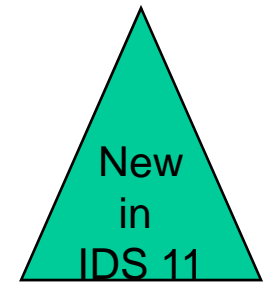
Advanced DataTools Corporation

Lester@advancedatools.com



Presentation Abstract

- What is new in IDS 11 – Cheetah? This presentation is updated for IDS 11
- Performance tuning tips and tricks
- Scripts to monitor the health of your IDS server



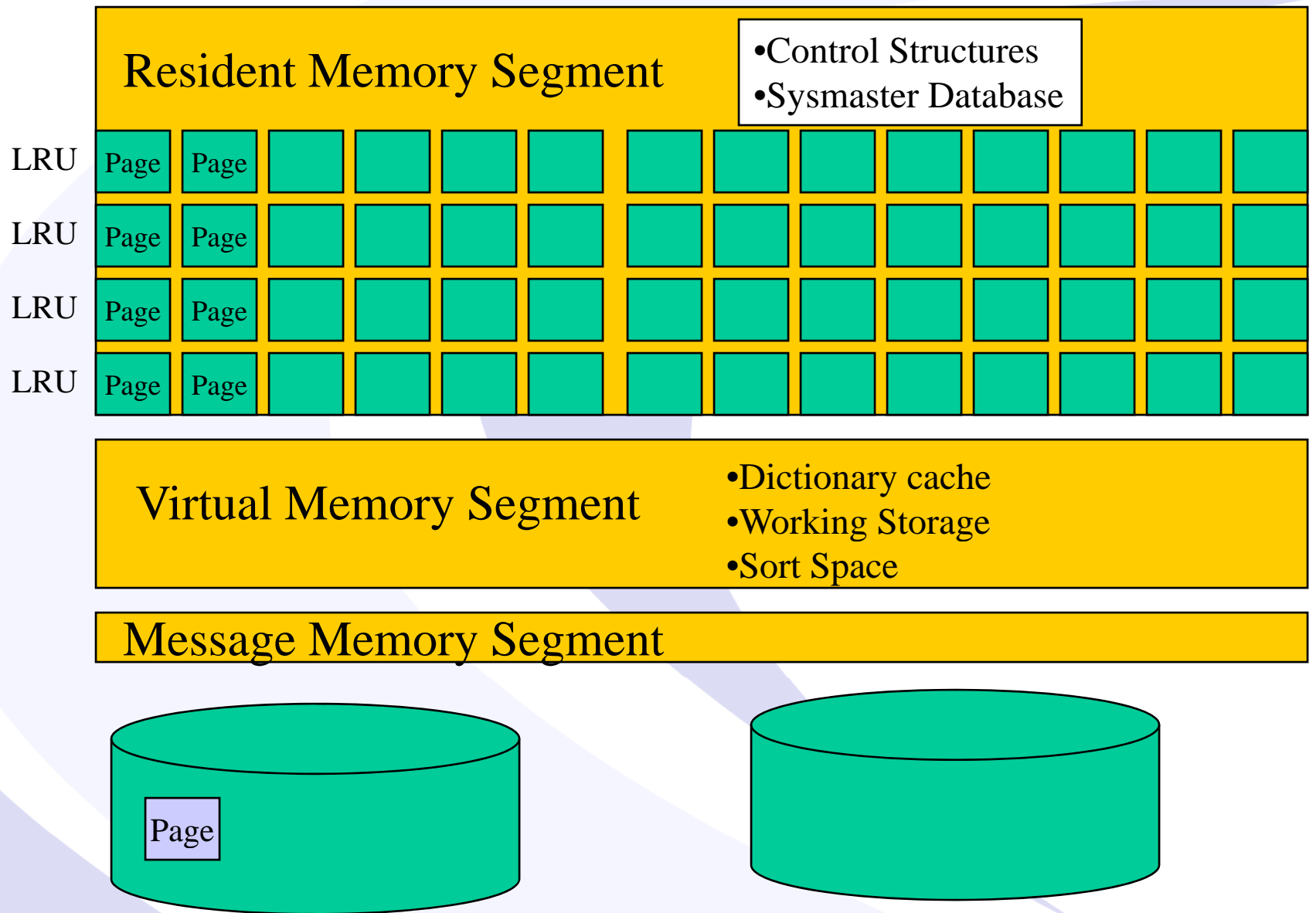
Background

Lester Knutsen has been developing database applications with Informix databases since 1983. He is president of Advanced DataTools, an IBM-Informix Consulting, Training, and Tools Partner specializing in data warehouse development, database design, performance tuning, and Informix training and support. Currently, Lester specializes in developing web-enabled data warehouse systems. He provides training and consulting in database design and performance tuning, and is widely known in the Informix community for his extensive experience and teaching skill. Lester is also president of the Washington D.C. Area Informix Users Group, one of the largest and most active Informix user groups, and is one of the founding members of the International Informix Users Group. Lester is also a member of the IBM Gold Consultant program.

What is the sysmaster database?

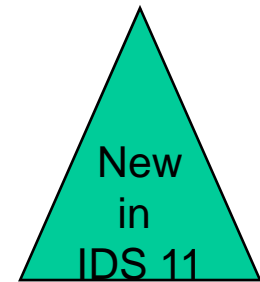
A database that peeks into the shared memory structures of an INFORMIX-Dynamic Server

IDS Control Structures in Memory are the Sysmaster Database

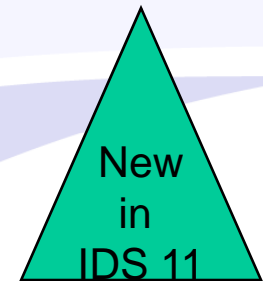


What in the Sysmaster database is new in IDS 11?

- Some of the new Sysmaster tables
 - Syscheckpoint
 - Sysenv
 - Sysenvses
 - Sysmgminfo
 - Sysnetclienttype, Sysnetglobal, Sysnetworkio
 - Sysonlineolog
 - Syssqltrace, Syssqltrace_info, Syssqltrace_iter
 - Systhreads
- New Sysadmin database
- Updated Scripts and notes will be available at my website:
<http://www.advanceddatatools.com>

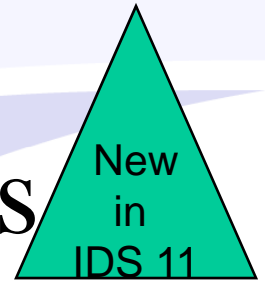


Syscheckpoint table



Intvl	Internal sequence number of the checkpoint
Type	Type of checkpoint, Blocking or Non-Blocking
Caller	Reason for checkpoint, CKPTINT, Physical Log, Logical Log, User ...
clock_time	Time of checkpoint (System time)
crit_time	Time spent performing checkpoint
flush_time	Time spent flushing pages to disk
cp_time	Time spent from checkpoint pending start to complete
n_dirty_bufs	Number of dirty pages to flush
plogs_per_sec	Average number of pages in physical log per second
llogs_per_sec	Average number of pages in logical log per second
dskflush_per_sec	Average number of disk pages flushed per second
ckpt_logid	Logical Log Id of checkpoint
ckpt_logpos	Logical Log position of checkpoint
Physused	Physical Log pages used
Logused	Logical Log pages used
n_crit_waits	Number of critical waiters threads
tot_crit_wait	Time of critical waiters
longest_crit_wait	Longest Time of crtical waiters
block_time	Time checkpoint blocked threads

Sysenv and Sysenvses Tables



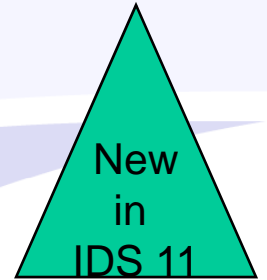
Sysenv

env_id	Unique numeric identifier
env_name	Environment variable name
env_value	Environment variable value

Sysenvses

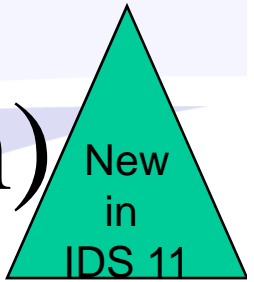
envses_sid	Session ID of user
envses_id	Unique numeric identifier
envses_name	Environment variable name
envses_value	Environment variable value

Sysonlineolog (onstat -m)



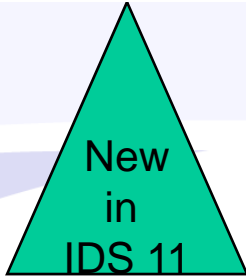
<code>offset</code>	Offset into the online log file
<code>next_offset</code>	Offset to the end of the record in the online log file
<code>line</code>	Online log message text

Sysmgminfo (onstat -g mgm)



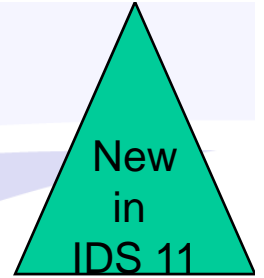
max_query	Current maximum number of active PDQ queries allowed on the server
total_mem	Current total memory for PDQ queries
avail_mem	Free PDQ memory
total_seq	Current number of PDQ sequential scans
avail_seq	Unused sequential scans
active	Number of active PDQ queries
ready	Number of PDQ queries waiting and ready to run
min_free_mem	Minimum free PDQ memory
avg_free_mem	Average free PDQ memory
std_free_mem	Standard free PDQ memory
min_free_seq	Minimum free PDQ sequential scans
avg_free_seq	Average free PDQ sequential scans
std_free_seq	Standard free PDQ sequential scans
max_active	Maximum active PDQ sql operations
cnt_active	Count of active PDQ sql operations
avg_active	Maximum active PDQ sql operations
std_active	Standard active PDQ sql operations
max_ready	Maximum ready PDQ sql operations
cnt_ready	Count of ready PDQ sql operations
avg_ready	Average ready PDQ sql operations
std_ready	Standard ready PDQ sql operations

Results of a Query



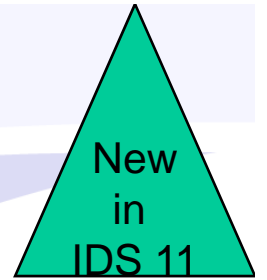
Field	Results	Comments
max_query	32	The max number of PDQ queries that can currently run on my laptop is 32
total_mem	512	There is 512 KB of memory available for PDQ queries
avail_mem	0	No memory is available, because it is all used by the one running query
total_seq	1048576	The max number of sequence scans that can be run
avail_seq	1048575	The number that is currently available
active	1	Number of active PDQ queries currently running
ready	0	Number of PDQ queries waiting to run. This is a key field and will inform you if you have a backlog of queries ready but waiting on a resource to run.
min_free_mem	0	Minimum free memory
avg_free_mem	0	Average free memory
std_free_mem	0	Standard free memory
min_free_seq	1048575	Minimum free scans
avg_free_seq	1048575	Average free scans
std_free_seq	0	Standard free scans
max_active	1	Maximum number of active queries
cnt_active	4	Count of number of queries that have been run since the server was started
avg_active	1	Average number of active queries
std_active	0	Standard number of active PDQ queries
max_ready	0	Maximum number of queries waiting and ready to run
cnt_ready	0	Count of number of queries that have had to wait since the server was started
avg_ready	0	Average number of waiting and ready queries
std_ready	0	Standard number of waiting and ready queries

Sysnetclienttype, Sysnetglobal, Sysnetworkio



- Sysnetclienttype - an overview of the network activity for each client type
- Sysnetglobal - provides an overview of the system network
- Sysnetworkio - provides an overview of the system network I/O

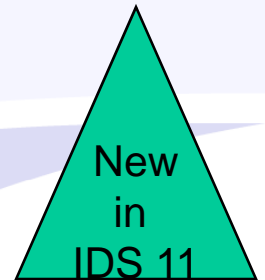
Sysnetclienttype



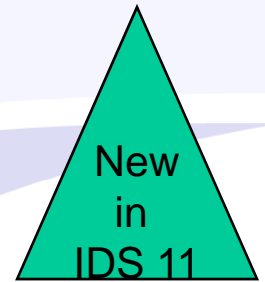
nc_cons_allowed
nc_accepted
nc_rejected
nc_reads
nc_writes
nc_name

Are connections allowed
Number of connections
Number of cons rejected
Number of network reads
Number of network writes
Name

Sysnetglobal



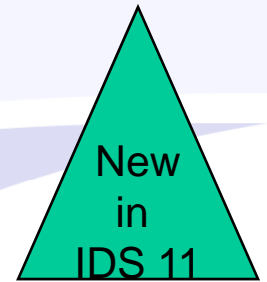
<code>ng_reads</code>	Number of network reads
<code>ng_writes</code>	Number of network writes
<code>ng_his_read_count</code>	Network reads by discon users
<code>ng_his_write_count</code>	Network writes by discon users
<code>ng_his_reads_bytes</code>	Amount of data txfr by discon users
<code>ng_his_writes_bytes</code>	Amount of data txfr by discon users
<code>ng_connects</code>	Number of connections
<code>ng_num_netscbs</code>	Number of netscbs
<code>ng_max_netscbs</code>	Max number of netscbs
<code>ng_free_thres</code>	Free threshold
<code>ng_free_cnt</code>	Free count
<code>ng_wait_thres</code>	Wait threshold
<code>ng_wait_cnt</code>	Wait count
<code>ng_pvt_thres</code>	
<code>ng_netbuf_size</code>	Network buffer size
<code>ng_buf_alloc</code>	
<code>ng_buf_alloc_max</code>	
<code>ng_netscb_id</code>	Next netscb id



Sysnetworkio

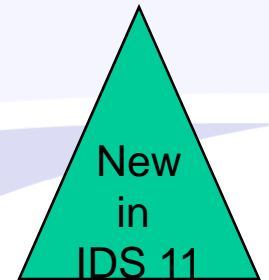
<code>net_id</code>	Network ID
<code>sid</code>	Session id
<code>net_netscb</code>	Address of netscb
<code>net_client_type</code>	Client type
<code>net_client_name</code>	Client protocol name
<code>net_read_cnt</code>	Number of read operations
<code>net_read_bytes</code>	Number of bytes txfr to server
<code>net_write_cnt</code>	Number of write operations
<code>net_write_bytes</code>	Number of bytes txfr to client
<code>net_open_time</code>	Time connection was made
<code>net_last_read</code>	Time of last network read
<code>net_last_write</code>	Time of last network write
<code>net_state</code>	State of network connection
<code>net_options</code>	Sqlhost options
<code>net_prot_id</code>	ID for protocol name
<code>net_protocol</code>	Protocol name
<code>net_server_fd</code>	Poll server fd
<code>net_poll_thread</code>	Poll thread id

Syssqltrace, Syssqltrace_info, Syssqltrace_iter



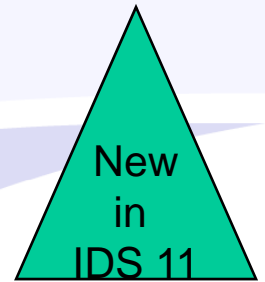
- Syssqltrace - detailed information about a single SQL statement
- Syssqltrace_info - information about the SQL profile trace system
- Syssqltrace_iter - lists the SQL statement iterators.

SysSQLTrace -1 of 2



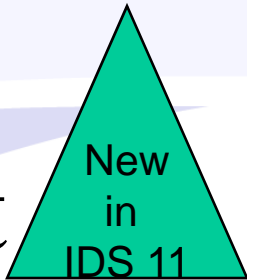
sql_id	Unique SQL execution ID
sql_address	Address of the statement in the code block
sql_sid	Database session ID of the user running the SQL statement
sql_uid	User ID of the statement running the SQL
sql_stmtype	Statement type
sql_stmname	Statement type displayed as a word
sql_finishtime	Time this statement completed (UNIX)
sql_begintxtime	Time this transaction started
sql_runtime	Statement execution time
sql_pgreads	Number of disk reads for this SQL statement
sql_bfreads	Number of buffer reads for this SQL statement
sql_rdcache	Percentage of time the page was read from the buffer pool
sql_bfidxreads	Number of index page buffer reads
sql_pgwrites	Number of pages written to disk
sql_bfwrites	Number of pages modified and returned to the buffer pool
sql_wrcache	Percentage of time a page was written to the buffer pool
sql_lockreq	Total number of locks required by this SQL statement
sql_lockwaits	Number of times the SQL statement waited on locks
sql_lockwtttime	Time the system waited for locks during SQL statement
sql_logspace	Amount of space the SQL statement used in the logical log
sql_sorttotal	Number of sorts that ran for the statement
sql_sortdisk	Number of sorts that ran on disk
sql_sortmem	Number of sorts that ran in memory
sql_executions	Number of times the SQL statement ran
sql_totalltime	Total amount of time spent running the statement
sql_avgtime	Average amount of time spent running the statement
sql_maxtime	Maximum amount of time spent executing the SQL statement

SysSQLTrace - 2 of 2



<code>sql_numioawaits</code>	Number of times an I/O operation had to wait
<code>sql_avgiowaits</code>	Average amount of time that the SQL statement had to wait
<code>sql_totaliowaits</code>	Amount of time that the SQL statement had to wait for I/O.
<code>sql_rowspersec</code>	Average number of rows (per second) produced
<code>sql_estcost</code>	Cost associated with the SQL statement
<code>sql_estrows</code>	Estimated number of rows returned for the SQL statement
<code>sql_actualrows</code>	Number of rows returned for the SQL statement
<code>sql_sqlerror</code>	SQL error number
<code>sql_isamerror</code>	RSAM/ISAM error number
<code>sql_isollevel</code>	Isolation level of the SQL statement.
<code>sql_sqlmemory</code>	Number of bytes needed to execute the SQL statement
<code>sql_numiterators</code>	Number of iterators used by the statement
<code>sql_database</code>	Database name
<code>sql_numtables</code>	Number of tables used in executing the SQL statement
<code>sql_tablelist</code>	List of table names directly referenced in the SQL statement.
<code>sql_statement</code>	SQL statement that ran

Systhreads – View of systcblst



th_id	thread id
th_addr	thread address
th_joinlist	head of joined threads list
th_joinnext	next thread of joined threads list
th_joinee	thread this thread joined
th_name	thread name
th_state	thread state
th_priority	thread priority
th_class	thread class
th_vpid	VP where thread is running
th_mtxwait	pointer to mutex thread is waiting on
th_conwait	pointer to condition thread is waiting on
th_waketime	seconds slept + start time
th_startwait	sleep start time
th_startrun	total time thread has run

Sysmaster database contains:

- Server information
- Dbspace & chunk information
- Database & table information
- User session information

Performance of queries on sysmaster database

The data is in shared memory but:

- Views used by tables require disk access and may be slow
- Complex views used to hid complex data
- Some tables are large (250,000 locks)
- Unbuffered logging of temp tables

Differences from other databases

- Do not update sysmaster tables as this may corrupt the server
- Cannot use dbschema on pseudo tables
- Cannot drop pseudo tables or the sysmaster database

Isolation level is Dirty Read

- Data is dynamic and can change as you retrieve it (Dirty Read)
- Dynamic nature may return inconsistent results
- However, it uses Unbuffered logging and temp tables are logged

Using Triggers and Stored Procedures

- Can create triggers and Stored Procedures
- Triggers will never be execute because tables do not change using normal SQL updates
- Use “polling” to check for changes
- Stored Procedures can be executed in the sysmaster database

Sysmaster database may change

- Some undocumented tables and columns may change in future versions
- Scripts in this presentation using undocumented features may not work on all versions of Informix IDS
- Scripts have been run on versions 7.2 to 11.X
- Sysmaster has changed in IDS 11.X

Creating the sysmaster database

When OnLine is first initialized the sysmaster database is created using the script in \$INFORMIXDIR/etc/sysmaster.sql

- Create real tables with the structures of the pseudo tables
- Copy the structure of the real tables to temp tables
- Drop the real tables
- Update the systables.partnum to point to pseudo tables in shared memory
- Create the flags_text table which has the interpretations for flags used in the tables
- Create stored procedures used in the views, two of which are interesting:
 - bitval() is a stored procedure for getting the boolean flag values
 - l2date() is a stored procedure for converting unix time() long values to dates
- Create the sysmaster views
- This process requires 2000KB of Logical Logs

Interesting table flags_text

```
table flags_text  
  tabname char(128), -- sysmaster table  
  flags int, -- flag  
  txt char(50) -- description of flag
```

Server configuration and statistics tables:

- sysconfig - ONCONFIG File
- syslogs - Logical Logs
- sysprofile - Server Statistics
- sysvpprof - Virtual Processors

Sysconfig (onstat -c)

View sysconfig: Configuration information from the IDS server. This information was read from the ONCONFIG file when the server was started.

```
cf_id          integer, -- unique numeric identifier
cf_name        char(128), -- config parameter name
cf_flags       integer, -- flags, 0 = in view sysconfig
cf_original    char(513), -- boottime value in ONCONFIG
cf_effective   char(513), -- value effectively in use
cf_default     char(513) -- value by default
```

What is the current server configuration?

```
select
  cf_name           parameter,
  cf_effective      effective_value
from sysconfig
```

SQL output

parameter	effective_value
ROOTNAME	rootdbs
ROOTPATH	/u3/dev/rootdbs1
DBSERVERNAME	train1
MIRRORPATH	/u3/dev/rootdbsm1
PHYSDBS	rootdbs
MSGPATH	/u3/informix7/online1.log
CONSOLE	/u3/informix7/console1.log
TAPEDEV	/dev/null
LTAPEDEV	/dev/null
ROOTOFFSET	0
ROOTSIZE	400000

Syslogs (onstat -l)

View syslogs: Logical logs status

number	smallint,	logfile number
Uniqid	integer,	logfile uniqid
Size	integer,	pages in logfile
Used	integer,	pages used in logfile
is_used	integer,	1 for used, 0 for free
is_current	integer,	1 for current
is_backed_up	integer,	1 for backedup
is_new	integer,	1 for new
is_archived	integer,	1 for archived
is_temp	integer,	1 for temp
Flags	smallint	logfile flags

What is the status of the logical logs?

```
-- List Logical Logs
select
    uniqid,
    used      size_used,
    is_used,
    is_current,
    is_backed_up,
    is_archived
from syslogs
order by uniqid
```

SQL output

uniqid	size_used	is_used	is_current	is_backed_up	is_archived
32	1000	1	0	1	1
33	1000	1	0	1	1
34	1000	1	0	1	1
35	1000	1	0	1	0
36	1000	1	0	1	0
37	1000	1	0	1	0
38	1000	1	0	1	0
39	1000	1	0	1	0
40	1000	1	0	1	0
41	1000	1	0	1	0
42	1000	1	0	1	0

Sysprofile (onstat -p)

View sysprofile: Current statistics and performance information of the server.

name	char(16),	profile element name
value	integer	current value

The values are re-set to 0 when IDS is shutdown and started and when the command “onstat -z” is used.

Sysprofile – Profile Names

dskreads
isamtot
iswrites
isrollbacks
latchwts
ckptwts
plgpagewrites
llgwrites
compress
btradata
seqscans
maxsortspace

bufreads
isopens
isrewrites
ovlock
buffwts
deadlks
plgwrites
pagreads
fgwrites
btraidx
totalsorts

dskwrites
isstarts
isdeletes
ovuser
lockreqs
lktouts
llgreCs
pagwrites
lruwrites
dpra
memsorts

bufwrites
isreads
iscommits
ovtrans
lockwts
numckpts
llgpagewrites
flushes
chunkwrites
rapps_used
diskSorts

Sysprofile - onstat -p

Informix Dynamic Server Version 9.30.TC2-- On-Line -- Up 00:10:24 -
58496 Kbytes

Profile

dskreads	pagreads	bufreads	%cached	dskwrits	pagwrits	bufwrits	%cached
350	372	2108	83.40	10	11	1	0.00
isamtot	open	start	read	write	rewrite	delete	commit
2839	94	122	457	0	0	0	0
0							
rollbk							
gp_read	gp_write	gp_rewrt	gp_del	gp_alloc	gp_free	gp_curs	
2	0	0	0	0	0	2	
ovlock	ovuserthread	ovbuff	usercpu	syscpu	numckpts	flushes	
0	0	0	3.93	0.87	2	6	
bufwaits	lokwaits	lockreqs	deadlks	dltouts	ckpwaits	compress	
67	0	966	0	0	0	0	4
	seqscans						
ixda-RA	idx-RA	da-RA	RA-pgsused	lchwaits			
5	0	247	252	0			

What are some of the key server statistics?

```
-- Select key Profile values
select name, value from sysprofile
where name in
( "ovlock", "ovuser", "ovtrans",
  "latchwts", "buffwts", "lockwts",
  "ckptwts", "deadlks", "lktouts",
  "fgwrites", "lruwrites", "chunkwrites"
)
```

SQL output

name	value
ovlock	0
ovuser	0
ovtrans	0
latchwts	41
buffwts	1617
lockwts	0
ckptwts	12
deadlks	0
lktouts	0
fgwrites	1190
lrwrites	21430
chunkwrites	4648

What percent of I/O is from buffers?

```
-- Get % read cached
select
    dr.value dskreads, br.value bufreads,
    round ((( 1 - ( dr.value / br.value ) ) *100 ), 2) cached
from sysprofile dr, sysprofile br
where dr.name = "dskreads"
and    br.name = "bufreads";

-- Get % write cached
select
    dw.value dskwrites, bw.value bufwrites,
    round ((( 1 - ( dw.value / bw.value ) ) *100 ), 2) cached
from sysprofile dw, sysprofile bw
where dw.name = "dskwrites"
and    bw.name = "bufwrites"
```

SQL output

dskreads	bufreads	cached
29209	1489235	98.04
dskwrites	bufwrites	cached
56228	414748	86.44

Sysvpprof (onstat -g)

View sysvpprof: Current statistics on IDS Virtual Processors

```
vpid      integer, -- VP id
txt       char(128) -- VP class name
usecs_user float, -- number of unix secs of user time
usecs_sys float  -- number of unix secs of system
           time
```

What is the status of the virtual processors?

```
-- Select VP Statistics
select
    vpid,
    pid,
    txt[1,5] class,
    round( usecs_user, 2) usercpu,
    round( usecs_sys, 2) syscpu
from    sysvplst a, flags_text b
where   a.class = b.flags
and     b.tabname = "sysvplst"
```

SQL output

vpid	pid class	usercpu	syscpu
1	295 cpu	309.26	23.58
2	296 adm	0.14	0.36
3	297 lio	0.27	5.57
4	298 pio	0.15	1.49
5	299 aio	5.00	46.16
6	300 msc	0.04	0.24
7	301 aio	4.65	43.75
8	302 tli	0.14	0.30
9	305 pio	0.22	1.56

Interesting undocumented table – Sysshmvls*

sh_mode	int, turbo mode number	sh_optstgbsnum	int, Subsystem Staging Blobspace
sh_boottime	int, boot time of day	sh_cpflag	int, TRUE => doing checkpoint
sh_pfcrltime	int, time profilers were last clr	sh_rapages	int, Number of pages to read ahead
sh_curtime	int, current mt_time	sh_rathreshold	int, When to start next read ahead
sh_bootstamp	int, boot time stamp	sh_lastlogfreed	int, last log (id) written to tape
sh_stamp	int, current time stamp	sh_rmdlktout	int, max timeout when distributed
sh_mainlooptcb	int, address of main daemon thread	sh_narchivers	int, number of active archives
sh_sysflags	int, system operating flags	sh_maxpdqpriority	int, max pdqpriority
sh_maxchunks	int, size of chunk table	sh_fuzcpflag	int, fuzzy checkpoint flag
sh_maxdbspaces	int, size of dbspace table	sh_needcpsyn	int, hard checkpoint
sh_maxuserthreads	int, max # of user structures	sh_nfuzzy	int, # buffers marked fuzzy
sh_maxtrans	int, max # of trans structures	sh_nfuzzyprev	int, # buffers marked fuzzy in last ckpt
sh_maxlocks	int, # of locks total	sh_oldestlsnuq	int, lsn of oldest update not
sh_maxlogs	int, size of log table	sh_oldestlsnpos	int, flushed to disk
sh_nbufs	int, # of buffers total	sh_builddpt	int, building DPT necessary
sh_pagesize	int, buffer size in bytes	sh_ndptentries	int, #entries in DPT
sh_nlrus	int, # of lru queues	sh_dptsize	int, size of DPT
sh_maxdirty	float,LRU can have this % dirty pages	sh_curmaxcons	int, max #connections in this run
sh_mindirty	float,LRU has % dirty pages after clean	sh_ovlmaxcons	int max #connections since server init
sh_ncleaners	int, # of cleaning/flushing procs		
sh_longtx	int, the long transaction flag		

Using DBINFO with sysmaster

Time of Server startup:

```
Select DBINFO ('utc_to_datetime', sh_boottime )  
from sysshmvals;
```

Time Statistics were last cleared (onstat -z) or
startup:

```
Select DBINFO ('utc_to_datetime', sh_pfclrtime)  
from sysshmvals;
```

DbSPACE & chunk tables:

- sysdbspaces - DB Spaces
- syschunks - Chunks
- syschkio - I/O by Chunk
- syschfree* - Free Space by Chunk

Sysdbspaces (onstat -d)

View sysdbspaces: List all dbspaces on the server

dbsnum	smallint, -- dbspace number,
name	char(128), -- dbspace name,
owner	char(32), -- dbspace owner,
pagesize	int, -- page size in IDS 10.X
fchunk	smallint, -- first chunk in dbspace,
nchunks	smallint, -- number of chunks in dbspace,
is_mirrored	bitval, -- dbspace mirrored, 1=Yes, 0=No
is_blobspace	bitval, -- dbspace a blob space, 1=Yes
is_temp	bitval, -- dbspace temp, 1=Yes, 0=No
flags	smallint -- dbspace flags

Syschunks (onstat -d)

View syschunks: Lists all chunks on the server

```
chknum      smallint, -- chunk number
dbsnum      smallint, -- dbspace number
nxchknum    smallint, -- number of next chunk
              in dbspace
pagesize  smallint, -- page size in IDS 10.X
chksize     integer, -- pages in chunk
offset      integer, -- pages offset into device
nfree       integer, -- free pages in chunk
is_offline  bitval, -- chunk offline, 1=Yes, 0=No
is_recovering bitval, -- chunk recovering, 1=Yes
is_blobchunk bitval, -- chunk blobchunk, 1=Yes
is_inconsistent bitval, -- chunk inconsistent,
              1=Yes, 0=No
```

Syschunks (continued)

flags	smallint, -- flags converted by bitval
fname	char(256), -- device pathname
mfname	char(256), -- mirror device pathname
moffset	integer, -- pages offset into mirror
mis_offline	bitval, -- mirror chunk offline, 1=Yes
mis_recovering	bitval, -- mirror chunk recovering,
mflags	smallint mirror chunk flags

Sysckio (onstat -D)

View sysckio: Lists I/O statistics by chunk

```
chunknum      smallint, -- chunk number
reads         integer, -- number of read ops
pagesread     integer, -- number of pages read
writes        integer, -- number of write ops
pageswritten  integer, -- number of pages written
mreads        integer, -- number of mirror read ops
mpagesread    integer, -- number of mirror pages read
mwrites       integer, -- number of mirror write ops
mpageswritten integer -- number of mirror pages written
```

Syschfree*

Table syschfree: Lists free space on a chunk

chknum	integer, -- chunk number
extnum	integer, -- extent number in chunk
start	integer, -- physical addr of start
leng	integer -- length of extent

How much dbspace is free?

```
-- dbsfree.sql
Select d.dbsnum,
       name dbspace,
       sum(chksize) Pages_size, -- sum of all chunk pages
       sum(chksize) - sum(nfree) Pages_used,
       sum(nfree) Pages_free, -- sum of all chunks free pages
       round ((sum(nfree)) / (sum(chksize)) * 100, 2)
       Percent_free
from sysdbspaces d, syschunks c
where d.dbsnum = c.dbsnum
and d.is_blobspace = 0
group by 1, 2
order by 1;
```

SQL output

dbspace	pages_size	pages_used	pages_free	percent_free
rootdbs	20000	5653	14347	71.74
logsdbs	12500	12053	447	3.58
datadbs	25000	6722	18278	73.11
tmpdbs	12500	53	12447	99.58

How much blob space is free?

```
-- blobfree.sql
select
  name dbspace,
  sum(chksize) Size_in_Pages, -- sum of all chunks
  sum(nfree) Num_free_blob_page -- sum of freepages
from   sysdbspaces d, syschunks c
where  d.dbsnum = c.dbsnum
and    d.is_blobspace = 1
group by 1
order by 1
```

SQL output

dbspace	size_in_pages	num_free_blob_page
blobdbs	10000	2497

Where are blocks of free dbspace?

```
-- chkflist.sql
select
  name dbspace, -- dbspace name
  f.chknum, -- chunk number
  f.extnum, -- extent number of free space
  f.start, -- starting address of free space
  f.leng free_pages -- length of free space
from sysdbspaces d, syschunks c, syschfree f
where d.dbsnum = c.dbsnum
and    c.chknum = f.chknum
order by dbspace, free_pages desc
```

SQL output

dbspace	chknum	extnum	start	free_pages
datadbs	4	0	3	12497
datadbs	3	31	9107	3393
datadbs	3	15	1921	976
datadbs	3	13	1705	160
datadbs	3	30	6069	160
datadbs	3	25	5429	128
datadbs	3	19	4853	96
datadbs	3	29	5909	96
datadbs	3	24	5333	64
datadbs	3	26	5621	64

What chunks have the most I/O?

```
-- chkio.sql
select name
       dbspace,
       chknum, "Primary" chktype,
       reads, writes,
       pagesread, pageswritten
from   syschktab c, sysdbstab d
where  c.dbsnum = d.dbsnum
union all
select
       name  dbspace,
       chknum, "Mirror"      chktype,
       reads, writes,
       pagesread, pageswritten
from   sysmchktab c, sysdbstab d
where  c.dbsnum = d.dbsnum
order by 1,2,3;
```

SQL output

dbspace	chknun	chktype	reads	writes	pagesread	pageswritten
blobdbs	6	Primary	21	3	31	10
datadbs	3	Primary	2082	31	9087	31
datadbs	4	Primary	5	0	7	0
logsdbs	2	Primary	176	996	1347	11704
rootdbs	1	Mirror	11616	26196	22499	30102
rootdbs	1	Primary	13340	26111	22271	30102
tmpdbs	5	Primary	13	2	13	3

What is the status of chunks?

```
select    name dbspace,           -- dbspace name
          d.dbsnum,              -- dbspace num
          is_mirrored,          -- dbspace is mirrored 1=Yes 0=No
          is_blobspace,        -- dbspace is blobspace 1=Yes 0=No
          is_temp,             -- dbspace is temp 1=Yes 0=No
          chunknum chunknum,    -- chunk number
          fname device,        -- dev path
          offset dev_offset,    -- dev offset
          is_offline,          -- Offline 1=Yes 0=No
          is_recovering,       -- Recovering 1=Yes 0=No
          is_blobchunk,        -- Blobspace 1=Yes 0=No
          is_inconsistent,     -- Inconsistent 1=Yes 0=No
          chksize Pages_size,  -- chunk size in pages
          nfree Pages_free,    -- chunk free pages
          mfname mirror_device, -- mirror dev path
          mis_recovering_offse -- mirror recovering 1=Yes 0=No
from      sysdbspaces d, syschunks c
where     d.dbsnum = c.dbsnum
order by  dbsnum, dbspace, chunknum
```

SQL output

dbspace	rootdbs
dbnum	1
is_mirrored	1
is_blobspace	0
is_temp	0
chunknum	1
device	/u3/dev/rootdbs1
dev_offset	0
is_offline	0
is_recovering	0
is_blobchunk	0
is_inconsistent	0
pages_size	20000
pages_free	14355
mirror_device	/u3/dev/rootdbsm1
mirror_offset	0

Scripts to re-create dbspaces and logs

mkdbspaces_script.sql

mklogs_script.sql

Available at our website for version 9.X

Database & table information tables:

- sysdatabases - Databases
- systabnames - Tables
- sysextents - Tables extents
- sysptprof - Tables I/O
- systabinfo* - Tables information

Sysdatabases

View sysdatabases: List of databases on the server.

```
name          char(128), -- database name
partnum       integer,  -- table id for systables
owner         char(32), -- user name of creator
created       integer,  -- date created
is_logging    bitval,  -- unbuffered logging, 1=Yes, 0=No
is_buff_log   bitval,  -- buffered logging, 1=Yes, 0=No
is_ansi       bitval,  -- ANSI mode database, 1=Yes, 0=No
is_nls        bitval,  -- NLS support, 1=Yes, 0=No
flags         smallint -- logging flags
```

Systabnames

Table systabnames: All tables on the server.

partnum	integer, -- table id for table
dbsname	char(128), -- database name
owner	char(32), -- table owner
tabname	char(128), -- table name
collate	char(32) -- collation associated with NLS DB

Sysextsents (oncheck -pe)

View sysextsents: Tables and each extent on the server.

<code>dblname</code>	<code>char(128), -- database name</code>
<code>tablename</code>	<code>char(128), -- table name</code>
<code>start</code>	<code>integer, -- extent physical address</code>
<code>size</code>	<code>integer -- size of this extent</code>

Sysptprof

View sysptprof: Tables IO profile.

dbname	char(128), -- database name
tablename	char(128), -- table name
partnum	integer, -- partnum for this table
lockreqs	integer, -- lock requests
lockwts	integer, -- lock waits
deadlks	integer, -- deadlocks
lktouts	integer, -- lock timeouts
isreads	integer, -- reads
iswrites	integer, -- writes
isrewrites	integer, -- rewrites
isdeletes	integer, -- deletes
bufreads	integer, -- buffer reads
bufwrites	integer, -- buffer writes
seqscans	integer, -- sequential scans
pagreads	integer, -- disk reads
pagwrites	integer -- disk writes

Systabinfo*

View systabinfo: Table information

ti_partnum	integer, -- table's partnum
ti_flags	smallint, -- partition flags
ti_rowsize	smallint, -- rowsize (max for variable)
ti_ncols	smallint, -- number of varchar or blob columns
ti_nkeys	smallint, -- number of indexes
ti_nextns	smallint, -- number of extents
ti_created	integer, -- date created
ti_serialv	integer, -- current serial value
ti_fextsiz	integer, -- first extent size (in pages)
ti_nextsiz	integer, -- next extent size (in pages)
ti_nptotal	integer, -- number of pages allocated
ti_npused	integer, -- number of pages used
ti_npdata	integer, -- number of data pages
ti_octptnm	integer, -- OCT partnum (optical blobs only)
ti_nrows	integer -- number of data rows

What databases are on the server?

```
-- dblist.sql
select
-- use dbinfo function to convert partnum to
  dbspace
  dbinfo("DBSPACE",partnum) dbspace,
  name database,
  owner,
  is_logging,
  is_buff_log
from sysdatabases
order by dbspace, name;
```

SQL output

dbspace	database	owner	is_logging	is_buff_log
datadbs	extentdb2	usr2	0	0
datadbs	zip1	usr1	0	0
datadbs	zip_lk	lester	0	0
rootdbs	extentdb	lester	0	0
rootdbs	extentdb1	usr1	0	0
rootdbs	onpload	lester	1	0
rootdbs	stores1	usr1	0	0
rootdbs	stores2	usr2	0	0
rootdbs	stores7	informix	0	0
rootdbs	sysmaster	informix	1	0

What is the size of my databases?

```
select  dbsname,  
        sum( pe_size ) total_pages  
from    systabnames, sysptnext  
where   partnum = pe_partnum  
group  by 1  
order  by 2 desc
```

What tables have extents?

```
-- tabextents.sql
select
  dbname,
  tablename,
  count(*)          num_of_extents,
  sum( pe_size )   total_size
from  systabnames, sysptnext
where partnum = pe_partnum
group by 1, 2
order by 3 desc, 4 desc;
```

SQL output

dbname	tablename	num_of_extents	total_size
zip7	zip	50	1168
zip_lk	zip	27	1544
rootdbs	TBLSpace	8	400
sysmaster	syscolumns	6	56
datadbs	TBLSpace	4	200
sysmaster	sysviews	3	24
sysmaster	sysprocbody	3	24
sysmaster	systables	3	24
extentdb1	extent_sizes	2	24
sysutils	sysprocbody	2	16
sysmaster	sysconstraints	2	16
stores2	sysprocbody	2	16

How calculate new extent sizes?

```
-- tabextprop.sql
select  dbsname,
        tabname,
        count(*) num_of_extents,
        sum (pe_size ) current_pages_used,
        round (sum (pe_size )
              * 2 { Your systems page size in KB }
              * 1.2 { Add 20% Growth factor })
        Proposed_ext_size, { First Extent Size in KB }
        round (sum (pe_size )
              * 2 { Your systems page size in KB }
              * .2 { Estimated 20% Yearly Growth })
        Proposed_next_size { Next Extent Size in KB }
from    systabnames, sysptnext
where   partnum = pe_partnum
group  by 1, 2
order  by 3 desc, 4 desc;
```

SQL output

dbname	zip7
tablename	zip
num_of_extents	50
current_pages_used	1168
proposed_ext_size	2803
proposed_next_size	467

dbname	zip_lk
tablename	zip
num_of_extents	27
current_pages_used	1544
proposed_ext_size	3706
proposed_next_size	618

What tables have the most I/O?

```
-- tabprofile.sql
select
  dbname,
  tablename,
  DBINFO ( 'dbspace', partnum ),
  lockreqs, lockwts, deadlks, lktouts,
  isreads, iswrites, isrewrites, isdeletes,
  bufreads, bufwrites, seqscans, pagreads,
  pagwrites
from sysptprof
order by isreads desc;
-- change this sort to whatever you need to
monitor.
```

SQL output

dbname	tablename	isreads	iswrites	lockreqs
zip	zip	41898	41898	830
sysmaster	systables	11402	0	67187
sysmaster	sysusers	10276	315	51373
sysmaster	sysviews	2653	0	15919
sysmaster	sysprocauth	2212	0	13272
zip_lk	zip	1399	0	1
sysmaster	sysprocedures	1108	0	6649
sysmaster	syscolumns	872	0	5182
sysmaster	sysdatabases	538	3	1469
sysmaster	flags_text	450	0	2546
zip	systables	101	34	239
sysmaster	systabauth	86	0	536

What tables have sequence scans?

```
select  dbsname,
        tabname,
        sum(seqscans) total_scans
from    sysptprof
where   seqscans > 0
group  by 1, 2
order  by 3 desc
```

User session information tables:

- `sysessions` - Session data
- `sysesprof` - User statistics
- `syslocks` - Locks
- `syseswts` - Wait times

Sysessions

(onstat -g ses)

View sysessions: User session and connection information

sid	integer, -- Session id number
username	char(32), -- User name
uid	smallint, -- User unix id
pid	integer, -- User process id
hostname	char(16), -- Hostname
tty	char(16), -- TTY port
connected	integer, -- Time user connected
feprogram	char(16), -- Program name
pooladdr	integer, -- Pointer to private session pool

Sysessions (continued)

```
is_wlatch    integer, -- Flag 1=Yes wait on latch
is_wlock     integer, -- Flag 1=Yes wait on lock
is_wbuff     integer, -- Flag 1=Yes wait on buffer
is_wckpt     integer, -- Flag 1=Yes wait on checkpoint
is_wlogbuf   integer, -- Flag 1=Yes wait on log buffer
is_wtrans    integer, -- Flag 1=Yes wait on a transaction
is_monitor   integer, -- Flag 1=Yes a monitoring process
is_incrit    integer, -- Flag 1=Yes in critical section
state        integer -- Flags
```

Sysesprof

(onstat -g ses)

View sysesprof: User session performance statistics

sid	integer, -- Session Id
lockreqs	decimal(16,0), -- Locks requested
locksheld	decimal(16,0), -- Locks held
lockwts	decimal(16,0), -- Locks waits
deadlks	decimal(16,0) -- Deadlocks detected
lktouts	decimal(16,0), -- Deadlock timeouts
logrecs	decimal(16,0), -- Logical Log written
isreads	decimal(16,0), -- Reads
iswrites	decimal(16,0), -- Writes
isrewrites	decimal(16,0), -- Rewrites
isdeletes	decimal(16,0), -- Deletes
iscommits	decimal(16,0), -- Commits
isrollbacks	decimal(16,0), -- Rollbacks
longtxs	decimal(16,0), -- Long transactions

Sys sesprof (continued)

bufreads	decimal(16,0),	-- Buffer reads
bufwrites	decimal(16,0),	-- Buffer writes
seqscans	decimal(16,0),	-- Sequential scans
pagreads	decimal(16,0),	-- Page reads
pagwrites	decimal(16,0),	-- Page writes
total_sorts	decimal(16,0),	-- Total sorts
dsksorts	decimal(16,0),	-- Sorts to disk
max_sortdiskspace	decimal(16,0),	-- Max space used by a sort
logspused	decimal(16,0),	-- Current log bytes used
maxlogsp	decimal(16,0)	-- Max bytes of logical logs used

Syslocks (onstat -k)

View syslocks: Active locks on server

dbname	char(128), -- Database name
tablename	char(128), -- Table name
rowidlk	integer, -- Rowid for index key lock
keynum	smallint, -- Key number of index key lock
owner	integer, -- Session ID of lock owner
waiter	integer, -- Session ID of first waiter
type	char(4), -- Type of Lock

Syslocks – Type of Locks

B - byte lock

IS - intent shared lock

S - shared lock

XS - repeatable read shared key

U - update lock

IX - intent exclusive lock

SIX - shared intent exclusive

X - exclusive lock

XR - repeatable read exclusive

Syseswts

View syseswts: Wait status and times on objects

```
sid      integer, -- Session ID
reason  char(50), -- Description of reason for wait
numwaits integer, -- Number of waits for this reason
cumtime float,   -- Cumulative wait time for this reason
maxtime integer -- Max wait time for this reason
```

Example SQL: dbwho.sql

```
select sysdatabases.name database, -- Database Name
       syssessions.username,      -- User Name
       syssessions.hostname,     -- Workstation
       syslocks.owner sid        -- Informix Session ID
from   syslocks, sysdatabases , outer syssessions
where  syslocks.tabname = "sysdatabases"
       -- Locks on sysdatabases
and    syslocks.rowidlk = sysdatabases.rowid
       -- Join to database
and    syslocks.owner = syssessions.sid
       -- Use session ID
order by 1;
```

Dbwho shell script

```
#!/bin/sh
# Program: dbwho      Description: List database, user and
  workstation of all db users
echo "Generating list of users by database ..."
dbaccess sysmaster - <<EOF
select  sysdatabases.name database,
        syssessions.username,
        syssessions.hostname,
        syslocks.owner sid
from    syslocks, sysdatabases , outer syssessions
where   syslocks.rowidlk = sysdatabases.rowid
and     syslocks.tabname = "sysdatabases"
and     syslocks.owner = syssessions.sid;
order  by 1;
EOF
```

List all Active Sessions

```
-- sessions.sql
select  sid,
        username,
        pid,
        hostname,
        to_date(to_char(to_number(to_char(sysdate, 'J')) - connected, '999999999999999999'), 'YYYYMMDD') startdate
        -- convert unix time to date
from    syssessions
```

Sample Output

sid	username	pid	hostname	startdate
47	lester	11564	merlin	07/14/1997

List Users Waiting on Resources

```
-- seswait.sql
select username,
       is_wlatch,  -- blocked waiting on a latch
       is_wlock,  -- blocked waiting on a locked record or table
       is_wbuff,  -- blocked waiting on a buffer
       is_wckpt,  -- blocked waiting on a checkpoint
       is_incrit  -- session is in a critical section of
                  -- transaction (e.g writting to disk)
from   syssessions
order by username;
```

Sample Output

username	is_wlatch	is_wlock	is_wbuff	is_wckpt	is_incrit
lester	0	1	0	0	0
lester	0	0	0	0	0
lester	0	0	0	0	0

Monitor Resource Usage by User

```
-- sesprof.sql
select      username,
            sysprof.sid,
            lockreqs,
            bufreads,
            bufwrites
from        sysprof, syssessions
where      sysprof.sid = syssessions.sid
order by   bufreads desc
```

Some Undocumented Extras...

Some Key systrans fields

```
tx_id          integer -- pointer to transaction table
tx_logbeg     integer -- transaction starting logical log
tx_loguniq    integer -- transaction current logical log
                    number
```

Display Transactions and Logs

```
-- txlogpos.sql
select      t.username,
            t.sid,
            tx_logbeg,
            tx_loguniq,
            tx_logpos
from        sysstrans x, sysrstcb t
where      tx_owner = t.address
```

SQL Output

username	sid	tx_logbeg	tx_loguniq	tx_logpos
informix	1	0	16	892952
lester	53	0	0	0
informix	12	0	0	0

Display SQL Explain Output

View Syssexplain:

```
sqx_sessionid, sqx_sdbno, sqx_iscurrent,  
sqx_executions, sqx_cumtime, sqx_bufreads,  
sqx_pagereads, sqx_bufwrites, sqx_pagewrites,  
sqx_totsorts, sqx_dsksorts, sqx_sortspmax,  
sqx_conbno, sqx_ismain, sqx_selflag,  
sqx_estcost, sqx_estrows, sqx_seqscan,  
sqx_srtscan, sqx_autoindex, sqx_index,  
sqx_remsql, sqx_mrgjoin, sqx_dynhashjoin,  
sqx_keyonly, sqx_tempfile, sqx_tempview,  
sqx_secthread, sqx_sqlstatement
```

Display Current SQL

```
-- sysssql.sql

select  username,
        sqx_sessionid,
        sqx_conbno,
        sqx_sqlstatement
from    syssexplain, sysscblst
where   sqx_sessionid = sid
```

Current SQL Output

```
username      lester
sqx_sessionid 55
sqx_conbno    2
sqx_sqlstatement select username,sqx_sessionid, sqx_conbno, sqx_sqlstatement
                from syssqexplain, sysscblst
                where sqx_sessionid = sid
```

```
username      lester
sqx_sessionid 51
sqx_conbno    0
sqx_sqlstatement update items set total_price = 300 where item_num = 1
```

How to find expensive queries?

```
select  sqx_estcost,  
        sqx_sqlstatement  
from sysqsexplain  
order by sqx_estcost desc
```

This will list all current running queries
ordered by the SQL Explain estimated costs

More Information

- Scripts and presentation at:
www.advanceddatatools.com
- Washington Area Informix Users group
www.iiug.org/waiug
- International Informix Users Group
www.iiug.org



Thank You

Lester Knutsen

Advanced DataTools Corporation

Lester@advancedatools.com

Advanced DataTools