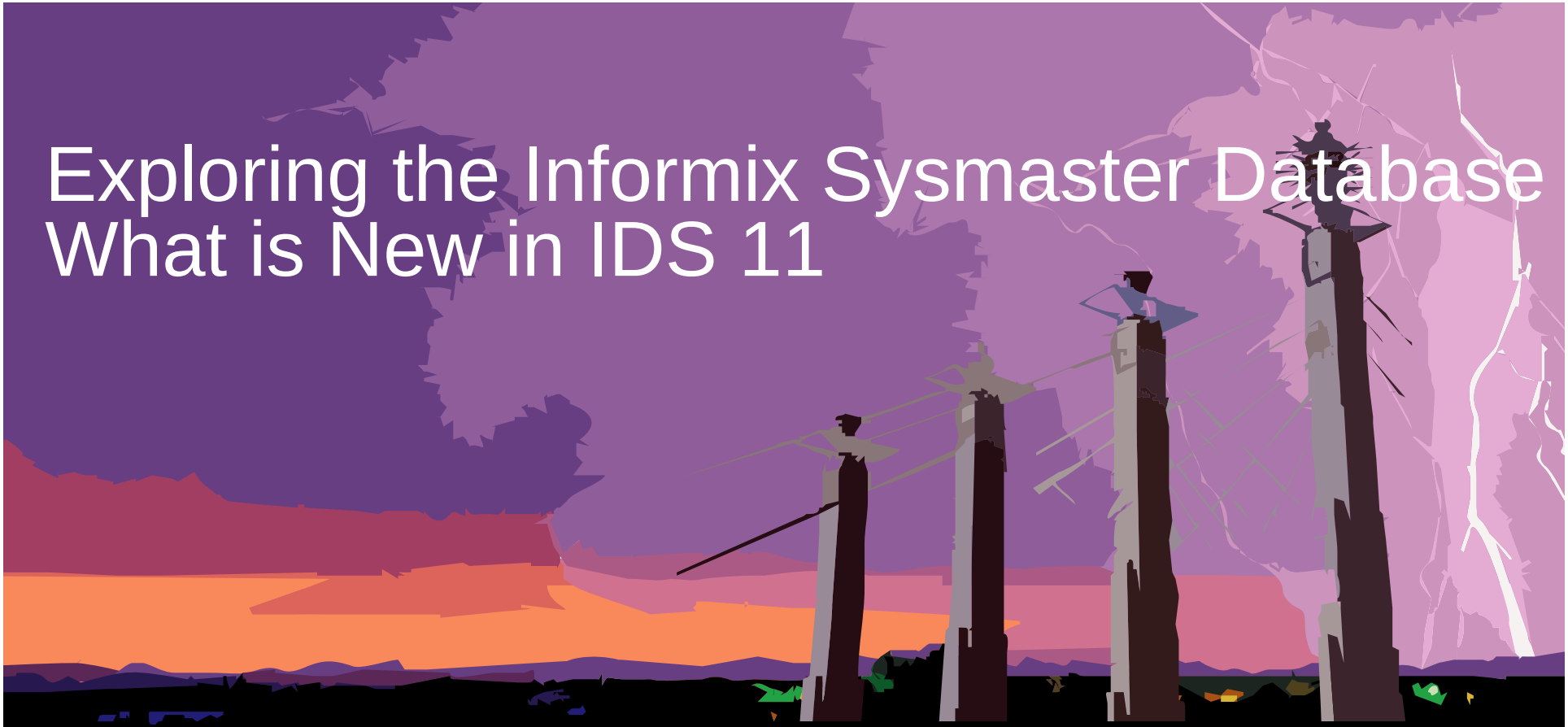
Exploring the Informix Sysmaster Database What is New in IDS 11



Lester Knutsen
Advanced DataTools Corporation

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2008 IIUG Informix Conference

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Session ###

Exploring the Informix Sysmaster Database
What is New in IDS 11

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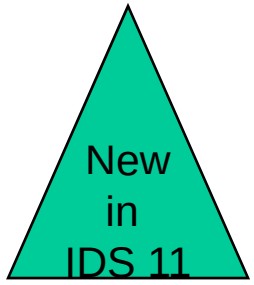
Presentation Abstract



- 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

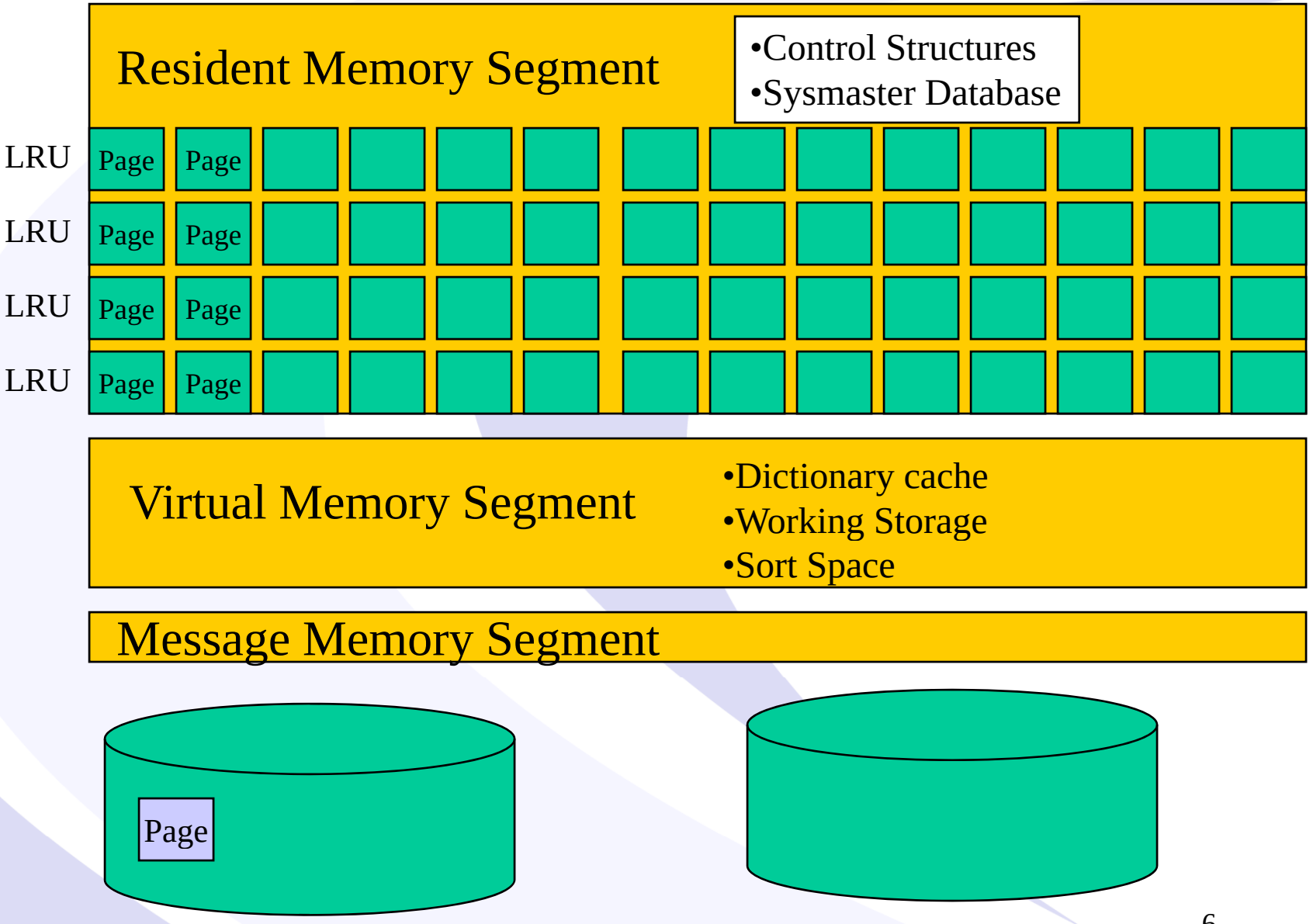
Background

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.

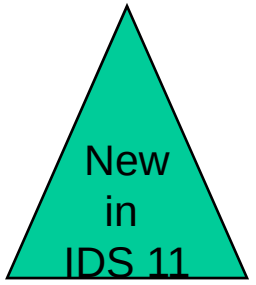
What is the sysmaster database?

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

IDS Control Structures in Memory are the Sysmaster Database

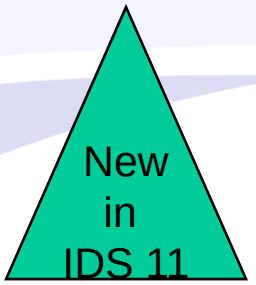


What in the Sysmaster database is new in IDS 11?



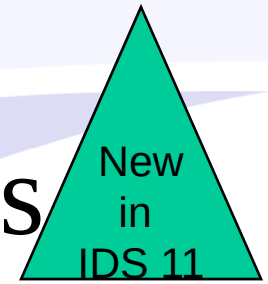
- Some of the new Sysmaster tables
  - Syscheckpoint
  - Sysenv
  - Sysenvses
  - Sysmgminfo
  - Sysnetclienttype, Sysnetglobal, Sysnetworkio
  - Sysonlinelog
  - Syssqltrace, Syssqltrace_info, Syssqltrace_iter
  - Systhreads
- New Sysadmin database
- Updated Scripts and notes will be available at my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



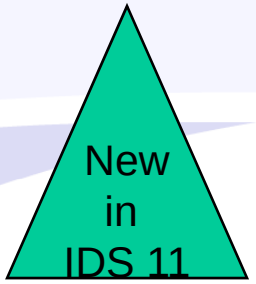
Sysenv

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

Sysenvses

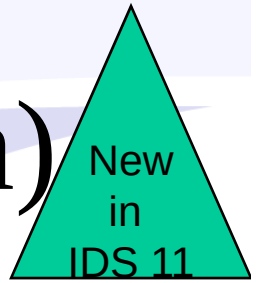
envses_sid	Session ID of user
envses_id	Unique numeric identifier
envses_name	Environment variable name
envses_value	Environment variable value

Sysonlinelog (onstat –m)



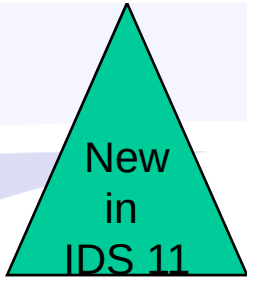

```
offset          Offset into the online
                log file

next_offset     Offset to the end of
                the record in the online
                log file
line            Online log message text
```

Sysmgminfo (onstat –g mgm)



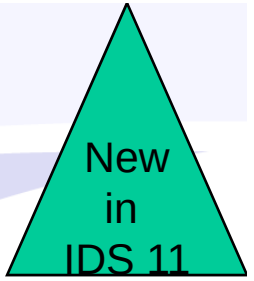
max_query	Current maximum number of active PDQ queries allowed on the server
total_mem	Current total memory for PDQ queries
avail_mem	Free PDQ memory
total_seq	Current number of PDQ sequential scans
avail_seq	Unused sequential scans
active	Number of active PDQ queries
ready	Number of PDQ queries waiting and ready to run
min_free_mem	Minimum fee 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



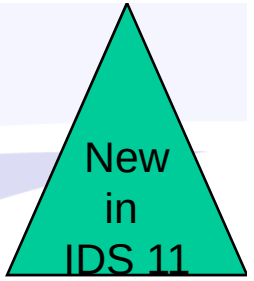
Field	Results	Comments
max_query	32	The max number of PDQ queries that can currently run on my laptop is 32
total_mem	512	There is 512 KB of memory available for PDQ queries
avail_mem	0	No memory is available, because it is all used by the one running query
total_seq	1048576	The max number of sequence 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



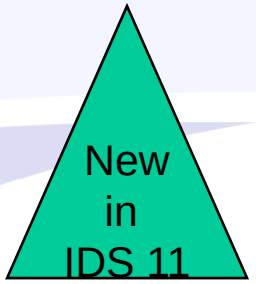
- Sysnetclienttype - an overview of the network activity for each client type
- Sysnetglobal - provides an overview of the system network
- Sysnetworkio - provides an overview of the system network I/O

Sysnetclienttype



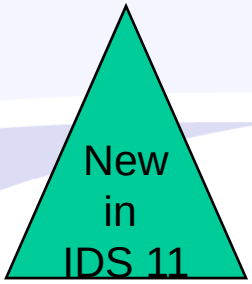
nc_cons_allowed	Are connections allowed
nc_accepted	Number of connections
nc_rejected	Number of cons rejected
nc_reads	Number of network reads
nc_writes	Number of network writes
nc_name	Name

Sysnetglobal



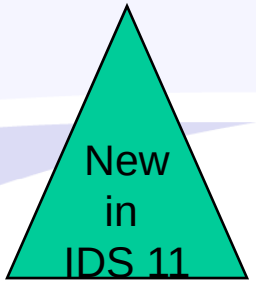
ng_reads	Number of network reads
ng_writes	Number of network writes
ng_his_read_count	Network reads by discon users
ng_his_write_count	Network writes by discon users
ng_his_reads_bytes	Amount of data txfr by discon users
ng_his_writes_bytes	Amount of data txfr by discon users
ng_connects	Number of connections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

Sysnetworkio



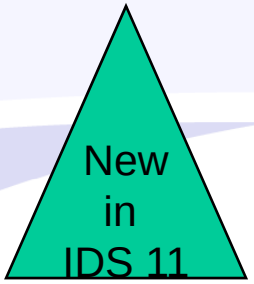
net_id	Network ID
sid	Session id
net_netscb	Address of netscb
net_client_type	Client type
net_client_name	Client protocal name
net_read_cnt	Number of read operations
net_read_bytes	Number of bytes txfr to server
net_write_cnt	Number of write operations
net_write_bytes	Number of bytes txfr to client
net_open_time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

Syssqltrace, Syssqltrace_info, Syssqltrace_iter



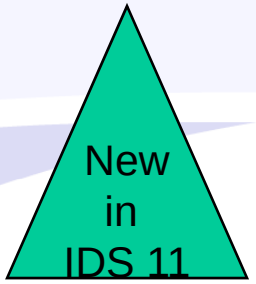
- Syssqltrace - detailed information about a single SQL statement
- Syssqltrace_info - information about the SQL profile trace system
- Syssqltrace_iter - lists the SQL statement iterators.

Syssqltrace -1 of 2



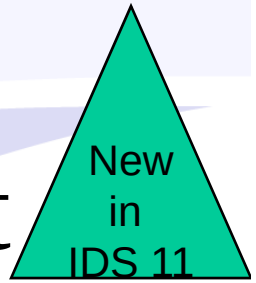
sql_id	Unique SQL execution ID
sql_address	Address of the statement in the code block
sql_sid	Database session ID of the user running the SQL statement
sql_uid	User ID of the statement running the SQL
sql_stmttype	Statement type
sql_stmtname	Statement type displayed as a word
sql_finishtime	Time this 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_lockwttime	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_totaltime	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



sql_numiowaits	Number of times an I/O operation had to wait
sql_avgiowaits	Average amount of time that the SQL statement had to wait
sql_totaliowaits	Amount of time that the SQL statement had to wait for I/O.
sql_rowspersec	Average number of rows (per second) produced
sql_estcost	Cost associated with the SQL statement
sql_estrows	Estimated number of rows returned for the SQL statement
sql_actualrows	Number of rows returned for the SQL statement
sql_sqlerror	SQL error number
sql_isamerror	RSAM/ISAM error number
sql_isollevel	Isolation level of the SQL statement.
sql_sqlmemory	Number of bytes needed to execute the SQL statement
sql_numiterators	Number of iterators used by the statement
sql_database	Database name
sql_numtables	Number of tables used in executing the SQL statement
sql_tablelist	List of table names directly referenced in the SQL statement.
sql_statement	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
- Use 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 initalized 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 backuped
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
rapgs_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
   rollbk
2839     94       122      457      0        0        0        0
   0
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
   seqscans
67       0        966      0        0        0        0        4
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
lruwrites	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 – Sysshmvals*

sh_mode int, turbo mode number
sh_boottime int, boot time of day
sh_pfclrtime int, time profilers were last clr
sh_curtime int, current mt_time
sh_bootstamp int, boot time stamp
sh_stamp int, current time stamp
sh_mainlooptcb int, address of main daemon thread
sh_sysflags int, system operating flags
sh_maxchunks int, size of chunk table
sh_maxdbspaces int, size of dbspace table
sh_maxuserthreads int, max # of user structures
sh_maxtrans int, max # of trans structures
sh_maxlocks int, # of locks total
sh_maxlogs int, size of log table
sh_nbuffs int, # of buffers total
sh_pagesize int, buffer size in bytes
sh_nlrus int, # of lru queues
sh_maxdirty float,LRU can have this % dirty pages
sh_mindirty float,LRU has % dirty pages after clean
sh_ncleaners int, # of cleaning/flushing procs
sh_longtx int, the long transaction flag

sh_optstgbsnum int, Subsystem Staging Blobspace
sh_cpflag int, TRUE => doing checkpoint
sh_rapages int, Number of pages to read ahead
sh_rathreshold int, When to start next read ahead
sh_lastlogfreed int, last log (id) written to tape
sh_rmdlktout int, max timeout when distributed
sh_narchivers int, number of active archives
sh_maxpdqpriority int, max pdqpriority
sh_fuzcpflag int, fuzzy checkpoint flag
sh_needcpsyn int, hard checkpoint
sh_nfuzzy int, # buffers marked fuzzy
sh_nfuzzyprev int, # buffers marked fuzzy in last ckpt
sh_oldestlsnuq int, lsn of oldest update not
sh_oldestlsnpos int, flushed to disk
sh_builddpt int, builing DPT necessary
sh_ndptentries int, #entries in DPT
sh_dptsize int, size of DPT
sh_curmaxcons int, max #connections in this run
sh_ovlmaxcons int max #connections since server init

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
```

Syschkio (onstat -D)

View syschkio: 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 blobspace 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	chknum	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
           chknum chunknum,                 -- chuck 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,              - chuck 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
dbsnum	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
```

Sysextents (oncheck -pe)

View sysextents: Tables and each extent on the server.

```
dbsname     char(128), -- database name
tabname     char(128), -- table name
start       integer, -- extent physical address
size        integer -- size of this extent
```

Sysptprof

View sysptprof: Tables IO profile.

```
dbsname          char(128), -- database name
tabname          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
   dbsname,
   tabname,
   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

dbsname	tabname	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

dbsname	zip7
tabname	zip
num_of_extents	50
current_pages_used	1168
proposed_ext_size	2803
proposed_next_size	467
dbsname	zip_lk
tabname	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
   dbsname,
   tabname,
   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

dbsname	tabname	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:

- syssessions - Session data
- syssesprof - User statistics
- syslocks - Locks
- syseswts - Wait times

Syssessions (onstat -g ses)

View syssessions: 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
```

Syssessions (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 crtical section
state       integer -- Flags
```

Syssesprof (onstat -g ses)

View sysyesprof: 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
```

Syssesprof (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

```
dbsname       char(128), -- Database name
tabname       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 sysseswts: 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,
        l2date(connected) 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,
            syssesprof.sid,
            lockreqs,
            bufreads,
            bufwrites
from        syssesprof, syssessions
where   syssesprof.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            systrans 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 Syssqexplain:

```
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_secthreads, sqx_sqlstatement
```

Display Current SQL

```
-- syssql.sql

select  username,
        sqx_sessionid,
        sqx_conbno,
        sqx_sqlstatement
from syssqexplain, 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 syssqexplain
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.advancedatatools.com

- Washington Area Informix Users group

  www.iiug.org/waiug

- International Informix Users Group

  www.iiug.org

Thank You

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