
Clouds on your horizon?

Association for Women in Computing - Puget Sound Chapter



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Clouds on your horizon?

Presented: Association for Women in Computing - 15 January, 2014

Daniel A. Morgan



Oracle ACE Director



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The Morgan of Morgan's Library on the web



Board Member: Western Washington OUG, ret.



Executive Board: Vancouver/Victoria OUGs


- 10g, 11g, 12c Beta Tester

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MadDog Morgan




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and ACE Directors

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cd \$MORGAN_BASE



In under the Golden Gate



to San Francisco



To watched Larry's AC72 in practice



and win the America's Cup



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Clouds on your horizon?

One Take-Away



Caveat Emptor

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Syllabus

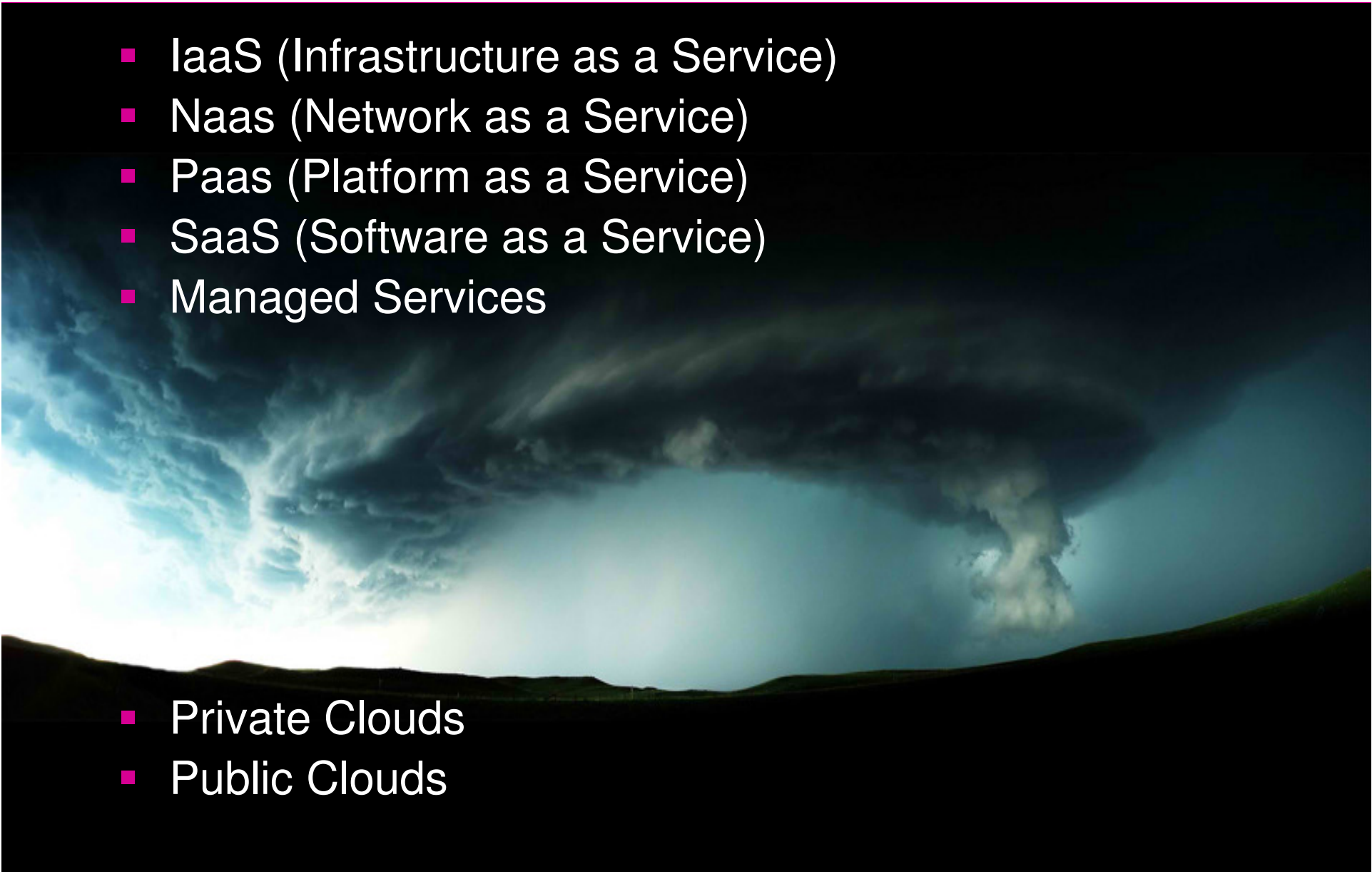
- What is "the cloud"?
- The theory
- The reality
- Reality: Some graphic examples
- How to protect yourself and your organization

Choose poorly and it is a race to the bottom

Theory

Warning: The next set of slides are rated PG

What is "the cloud?"

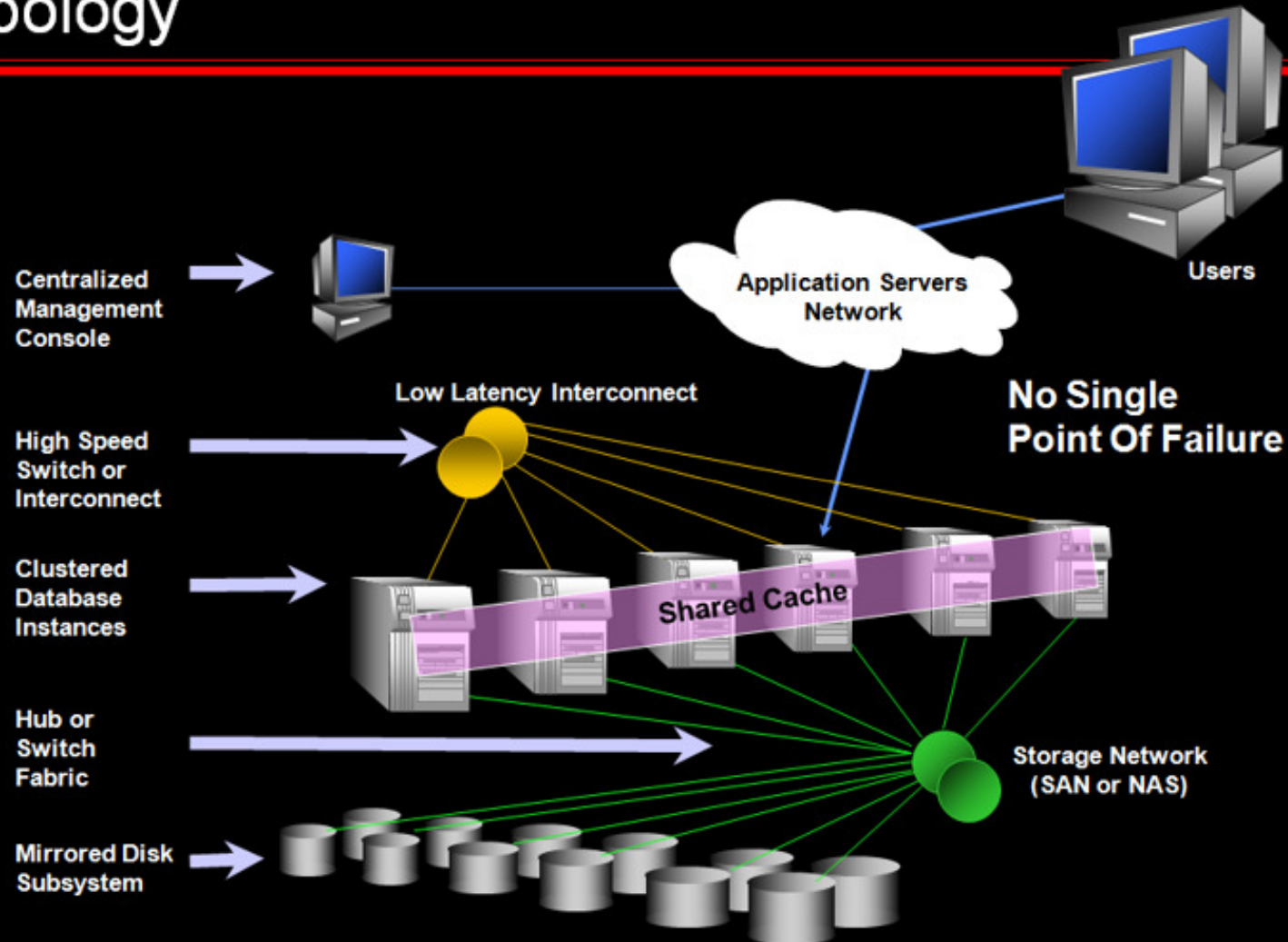
- 
- IaaS (Infrastructure as a Service)
 - Naas (Network as a Service)
 - PaaS (Platform as a Service)
 - SaaS (Software as a Service)
 - Managed Services
-
- Private Clouds
 - Public Clouds

Cloud: The Theory

- 1950s ... mainframe computers accessible via thin clients/terminals
- 1957 ... Service Bureau Corp. (SBC)
- 1961 ... John McCarthy writes: "computation may someday be organized as a public utility."
- 1966 ... Tymshare
- 1967 ... National CSS (purchased by D&B)
- 1990s .. Virtual Private Networks offered by Telcos
A cloud symbol was used to indicate the who was responsible for what part of the infrastructure
- 2116 ... Mainframe computers again?

Cloud: One of my 2006-7 presentation slides

Topology



Cloud: The Theoretical Value

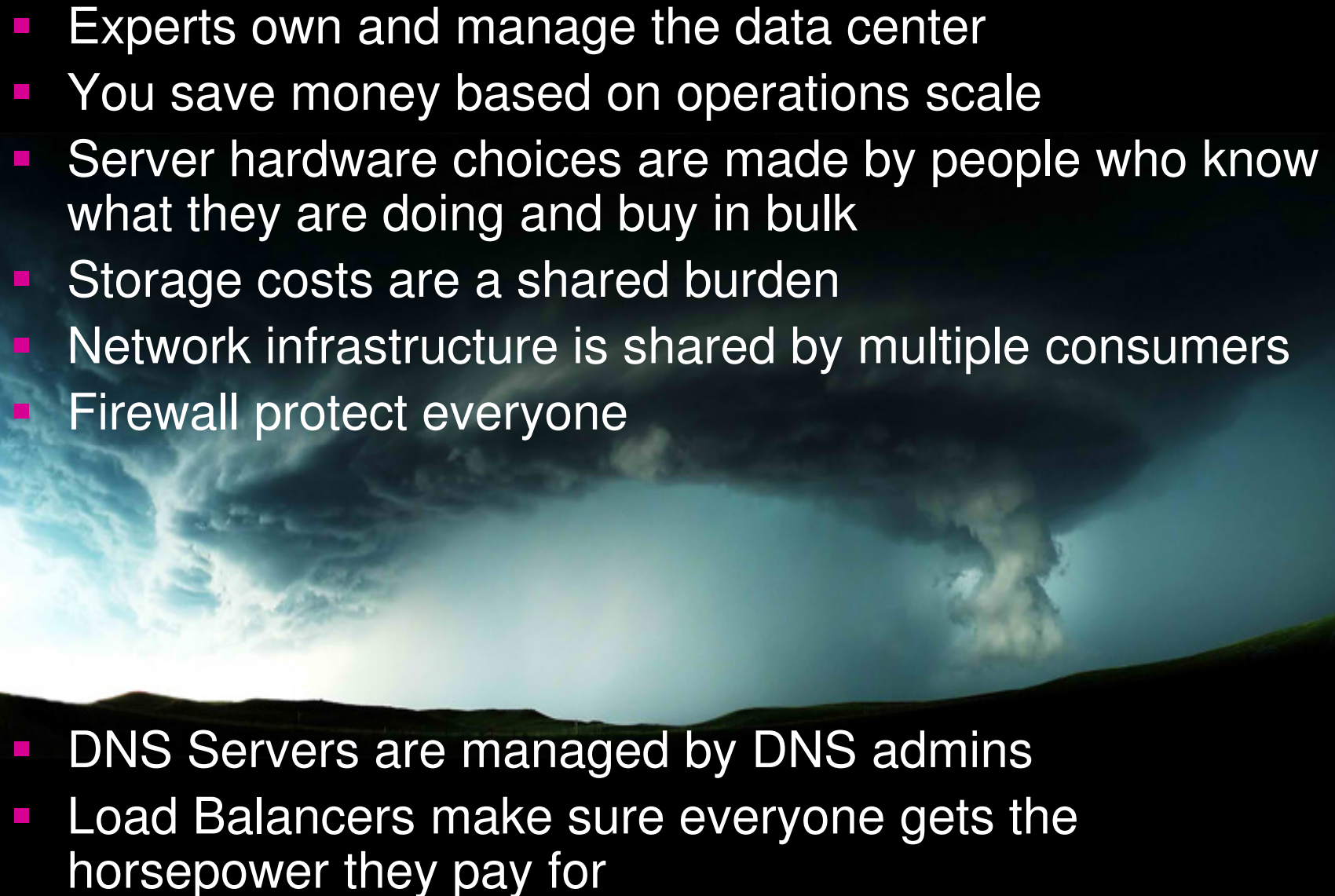
- Agility
 - Common APIs
 - Cost Sharing
 - Device and Location Independence
 - Migration
 - Monitoring
 - Multitenancy = Shared Burden
-
- On-Demand Self Service
 - Security
 - Utilization Improvement

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Cloud: The Theoretical Value

- 
- Experts own and manage the data center
 - You save money based on operations scale
 - Server hardware choices are made by people who know what they are doing and buy in bulk
 - Storage costs are a shared burden
 - Network infrastructure is shared by multiple consumers
 - Firewall protect everyone
-
- DNS Servers are managed by DNS admins
 - Load Balancers make sure everyone gets the horsepower they pay for

Reality

Warning: The next slide is rated R

Cloud: The Reality

- No standards and no definitions
- No portability: Vendor lock-in
- No control over
 - infrastructure (servers, storage, network, firewall)
 - operating system versions
 - database versions
 - application and web server versions
 - patching and patching schedules
 - uptime (whatever that may be defined to mean)
- Are there financial savings?

I suspect not if you were doing things well in the first place

More Reality

Warning: The next set of slides are rated XXX

Dose of Reality #1

Configuration Management The Cloud meets the Puppet

DC2 Outage: But Hours Earlier

ORAS1N1

2013-08-08 13:04:45.315: [AGFW][1159891264] {0:4:7} Agfw Proxy Server received the message: RESOURCE_STATUS[Proxy] ID 20481:508508
2013-08-08 13:04:45.315: [AGFW][1159891264] {0:4:7} Received state change for ora.asm oras1n1 1 [old state = ONLINE, new state = UNKNOWN]

ORAS1N2

2013-08-08 13:12:07.199: [CRSMAIN][96481872] Sync-up with OCR
2013-08-08 13:12:07.199: [CRSMAIN][96481872] Connecting to the CSS Daemon
2013-08-08 13:12:07.202: [CRSRTI][96481872] CSS is not ready. Received status 3
2013-08-08 13:12:07.202: [CRSMAIN][96481872] Created alert : (:CRSD00109:) : Could not init the CSS context, error: 3
2013-08-08 13:12:07.202: [CRSD][96481872][PANIC] CRSD exiting: Could not init the CSS context, error: 3

ORAP1N1

2013-08-08 16:57:31.162: [AGFW][1164335424] {0:12:9} Agfw Proxy Server received the message: RESOURCE_STATUS[Proxy] ID 20481:147794
2013-08-08 16:57:31.162: [AGFW][1164335424] {0:12:9} Received state change for ora.LISTENER_SCAN2.lsnr 1 1 [old state = ONLINE, new state = OFFLINE]

ORAP1N2

2013-08-08 17:09:09.393: [UiServer][1175996736] {2:7473:48658} Done for ctx=0x2aaaac2532b0
2013-08-08 17:09:39.156: [GIPCHDEM][1115060544] gipchaDaemonProcessHAInvalidade: completed ha name invalidate for node 0x2aaaac25bb60 { host 'orap1n1', haName '9f34-b767-de19-a294', srcLuid 04a03a5c-f4851208, dstLuid e3aa430e-82601c00 numInf 2, contigSeq 62781, lastAck 56961, lastValidAck 62780, sendSeq [56961 : 56961], createTime 72155204, flags 0x28 }

O/S Changes: DNS Changes

Aug 4 04:09:16 orap1n1 Updating DNS configuration for: orap1n1.ams2.sf.privAug 4 04:09:16 orap1n1 Initial DNS Server: 10.2.198.34Aug 4 04:09:16 orap1n1 Connecting to DNS server 10.2.198.34Aug 4 04:09:16 orap1n1 Connected to DNS server 10.2.198.34Aug 4 04:09:16 orap1n1 Updating both HOST and PTR record for: orap1n1.ams2.sf.privAug 4 04:09:16 orap1n1 Deleting old reverse lookup records for orap1n1.ams2.sf.priv on 10.2.198.34Aug 4 04:09:17 orap1n1 Adding GSS support to DNS server 10.2.198.34Aug 4 04:09:17 orap1n1 Added GSS support to DNS server 10.2.198.34Aug 4 04:09:17 orap1n1 Failed to delete reverse lookup record 11.78.2.10.in-addr.arpa. Reason Refused (5).Aug 4 04:09:17 orap1n1 Deleting reverse lookup records for our current new IP Address(s) on ad010.ams2.sf.privAug 4 04:09:18 orap1n1 No reverse lookup records found for 11.0.168.192.in-addr.arpa on ad010.ams2.sf.privAug 4 04:09:18 orap1n1 No reverse lookup records found for 21.34.254.169.in-addr.arpa on ad010.ams2.sf.privAug 4 04:09:19 orap1n1 No reverse lookup records found for 12.0.168.192.in-addr.arpa on ad010.ams2.sf.privAug 4 04:09:20 orap1n1 No reverse lookup records found for 181.139.254.169.in-addr.arpa on ad010.ams2.sf.privAug 4 04:09:20 orap1n1 Failed to delete reverse lookup record 11.78.2.10.in-addr.arpa. Reason Refused (5).Aug 4 04:09:21 orap1n1 Failed to delete reverse lookup record 10.78.2.10.in-addr.arpa. Reason Refused (5).Aug 4 04:09:22 orap1n1 Failed to delete reverse lookup record 102.78.2.10.in-addr.arpa. Reason Refused (5).Aug 4 04:09:22 orap1n1 Failed to delete reverse lookup record 100.78.2.10.in-addr.arpa. Reason Refused (5).Aug 4 04:09:23 orap1n1 Failed to delete reverse lookup record 14.2.2.10.in-addr.arpa. Reason Refused (5).Aug 4 04:09:23 orap1n1 Deleting host records for orap1n1.ams2.sf.priv on ad010.ams2.sf.privAug 4 04:09:23 orap1n1 Failed to delete host record for orap1n1.ams2.sf.priv. Reason Refused (5).

Aug 10 12:03:23 orap1n1 Updating DNS configuration for: orap1n1.ams2.sf.privAug 10 12:03:23 orap1n1 Initial DNS Server: 10.2.198.33Aug 10 12:03:23 orap1n1 Connecting to DNS server 10.2.198.33Aug 10 12:03:23 orap1n1 Connected to DNS server 10.2.198.33Aug 10 12:03:24 orap1n1 Updating both HOST and PTR record for: orap1n1.ams2.sf.privAug 10 12:03:24 orap1n1 Deleting old reverse lookup records for orap1n1.ams2.sf.priv on 10.2.198.33Aug 10 12:03:24 orap1n1 Adding GSS support to DNS server 10.2.198.33Aug 10 12:03:24 orap1n1 Added GSS support to DNS server 10.2.198.33Aug 10 12:03:25 orap1n1 Failed to delete reverse lookup record 11.78.2.10.in-addr.arpa. Reason Refused (5).Aug 10 12:03:25 orap1n1 Deleting reverse lookup records for our current new IP Address(s) on ad009.ams2.sf.privAug 10 12:03:25 orap1n1 No reverse lookup records found for 11.0.168.192.in-addr.arpa on ad009.ams2.sf.privAug 10 12:03:26 orap1n1 No reverse lookup records found for 21.34.254.169.in-addr.arpa on ad009.ams2.sf.privAug 10 12:03:27 orap1n1 No reverse lookup records found for 12.0.168.192.in-addr.arpa on ad009.ams2.sf.privAug 10 12:03:27 orap1n1 No reverse lookup records found for 181.139.254.169.in-addr.arpa on ad009.ams2.sf.privAug 10 12:03:28 orap1n1 Failed to delete reverse lookup record 11.78.2.10.in-addr.arpa. Reason Refused (5).Aug 10 12:03:28 orap1n1 Failed to delete reverse lookup record 10.78.2.10.in-addr.arpa. Reason Refused (5).Aug 10 12:03:29 orap1n1 Failed to delete reverse lookup record 101.78.2.10.in-addr.arpa. Reason Refused (5).Aug 10 12:03:30 orap1n1 Failed to delete reverse lookup record 14.2.2.10.in-addr.arpa. Reason Refused (5).Aug 10 12:03:30 orap1n1 Deleting host records for orap1n1.ams2.sf.priv on ad009.ams2.sf.privAug 10 12:03:30 orap1n1 Failed to delete host record for orap1n1.ams2.sf.priv. Reason Refused (5).Aug 10 12:03:30 orap1n1 Updating host records for orap1n1.ams2.sf.priv on ad009.ams2.sf.privAug 10 12:03:31 orap1n1 Failed to update host records orap1n1.ams2.sf.priv: Reason Refused (5).

7,824 lines of changes in /var/log/messages on one server
This happened 152 times on one server , in DC2, in 6 days

O/S Changes: Ruby?

Aug 8 13:04:22 orap1n1 ERROR: **While executing gem** ... (Gem::RemoteFetcher::FetchError)**Aug 8 13:04:22 orap1n1** Errno::ETIMEDOUT:
Connection timed out - connect(2) (http://rubygems.org/latest_specs.4.8.gz)**Aug 8 13:04:22 orap1n1** INFO: `gem install -y` is now default and will be
removed
Aug 8 13:04:22 orap1n1 INFO: use --ignore-dependencies to install only the gems you list

Aug 8 15:42:41 orap1n1 ERROR: **While executing gem** ... (Gem::RemoteFetcher::FetchError)**Aug 8 15:42:41 orap1n1** Errno::ETIMEDOUT:
Connection timed out - connect(2) (http://rubygems.org/latest_specs.4.8.gz)**Aug 8 15:42:41 orap1n1** INFO: `gem install -y` is now default and will be
removed
Aug 8 15:42:41 orap1n1 INFO: use --ignore-dependencies to install only the gems you list

This happened twice just before the outage

O/S Changes: Ruby?

Aug 8 13:04:22 orap1n1 ERROR: While executing gem ... (Gem::RemoteFetcher::FetchError)Aug 8 13:04:22 orap1n1 Errno::ETIMEDOUT:
Connection timed out - connect(2) (http://rubygems.org/latest_specs.4.8.gz)Aug 8 13:04:22 orap1n1 INFO: `gem install -y` is now default and will be
removed
Aug 8 13:04:22 orap1n1 INFO: use --ignore-dependencies to install only the gems you list

Aug 8 15:42:41 orap1n1 ERROR: While executing gem ... (Gem::RemoteFetcher::FetchError)Aug 8 15:42:41 orap1n1 Errno::ETIMEDOUT:
Connection timed out - connect(2) (http://rubygems.org/latest_specs.4.8.gz)Aug 8 15:42:41 orap1n1 INFO: `gem install -y` is now default and will be
removed
Aug 8 15:42:41 orap1n1 INFO: use --ignore-dependencies to install only the gems you list

This happened twice just before the outage: Note the first time above 13:04:22
and the first indication of an issue 23 seconds later

ORAS1N1

2013-08-08 13:04:45.315: [AGFW][1159891264] {0:4:7} Agfw Proxy Server received the message: RESOURCE_STATUS[Proxy]
ID 20481:508508

2013-08-08 13:04:45.315: [AGFW][1159891264] {0:4:7} Received state change for ora.asm oras1n1 1 [old state = ONLINE, new
state = UNKNOWN]

O/S Changes: NTP Time Synchronization

```
Aug 8 12:56:04 orapln1 ntpd[1339]: ntpd exiting on signal 15
Aug 8 12:57:27 orapln1 ntpdate[12406]: step time server 10.2.255.254 offset 82.262906 sec
Aug 8 12:57:27 orapln1 ntpd[12408]: ntpd 4.2.2p1@1.1570-o Fri Jul 22 18:07:53 UTC 2011 (1)
Aug 8 12:57:27 orapln1 ntpd[12409]: precision = 1.000 usec
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface wildcard, 0.0.0.0#123 Disabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface wildcard, ::#123 Disabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface bond2, fe80::217:a4ff:fe77:fc18#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface lo, ::1#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface bond0, fe80::217:a4ff:fe77:fc10#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface eth2, fe80::217:a4ff:fe77:fc14#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface eth3, fe80::217:a4ff:fe77:fc16#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface lo, 127.0.0.1#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface eth2, 192.168.0.11#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface eth2:1, 169.254.34.21#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface eth3, 192.168.0.12#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface eth3:1, 169.254.139.181#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface bond0, 10.2.78.11#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface bond0:1, 10.2.78.10#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface bond0:3, 10.2.78.102#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface bond0:4, 10.2.78.100#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: Listening on interface bond2, 10.2.2.14#123 Enabled
Aug 8 12:57:27 orapln1 ntpd[12409]: kernel time sync status 0040
Aug 8 12:57:27 orapln1 ntpd[12409]: frequency initialized 0.000 PPM from /var/lib/ntp/drift
```

Dose of Reality #2

If you can't see it ... it can't hurt you

Unobserved Job Failure

```
1 select owner, job_name, job_type, trunc(start_date) SDATE, trunc(next_run_date) nxtrun, failure_count
2 from dba_scheduler_jobs
3* where failure_count <> 0;
```

OWNER	JOB_NAME	STATE	SDATE	NXTRUN	FAILURE_COUNT
SYS	SM\$CLEAN_AUTO_SPLIT_MERGE	SCHEDULED	14-MAR-2011 00:00:00	14-AUG-2013 00:00:00	17
SYS	RSE\$CLEAN_RECOVERABLE_SCRIPT	SCHEDULED	14-MAR-2011 00:00:00	14-AUG-2013 00:00:00	20
SYS	DRA_REEVALUATE_OPEN_FAILURES	SCHEDULED			10
ORACLE_OCM	MGMT_CONFIG_JOB	SCHEDULED			4
EXFSYS	RLM\$SCHDNEGACTION	SCHEDULED	13-AUG-2013 00:00:00	13-AUG-2013 00:00:00	3
EXFSYS	RLM\$EVTCLEANUP	SCHEDULED	27-APR-2011 00:00:00	13-AUG-2013 00:00:00	2
RDBA5	LONG_RUN_SESS_JOB	SCHEDULED	12-AUG-2013 00:00:00	13-AUG-2013 00:00:00	1
XISAY_PROD	POPULATE_CATALOG	DISABLED	01-JUN-2009 00:00:00	08-AUG-2013 00:00:00	2559

Dose of Reality #3

If you can't see it it can hurt you
... and everybody else too

Repeating Issue: Unannounced Loads

ASHPCE1D


MMDD	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0804	0	0	0	0	0	0	0	0	0	0	0	0	5	32	18	65	91	13	12	20	84	9	14	9
0805	137	112	26	27	141	17	21	9	85	13	21	17	96	23	23	24	91	13	11	21	86	11	14	9
0806	151	111	21	24	96	41	50	14	84	22	20	22	91	18	17	18	92	24	10	11	83	9	14	20
0807	139	100	32	30	99	43	49	19	105	17	31	14	76	23	27	25	111	20	15	18	86	13	13	10
0808	145	99	29	30	109	52	48	11	102	25	47	24	101	23	20	23	117	31	30	16	91	12	11	9
0809	123	83	65	37	93	17	25	10	102	23	44	25	111	37	24	29	98	19	29	16	92	16	15	9
0810	169	120	52	32	125	58	38	9	109	17	26	14	104	13	17	15	93	13	16	11	61	10	10	9
0811	107	82	51	34	85	17	22	10	73	10	12	11	92	32	13	69	65	11	11	10	60	9	12	9
0812	149	121	26	15	70	16	24	11	95	34	15	18	34	67	21	21	87	11	13	9	77	9	14	9
0813	115	76	55	56	27	9	9	9	11	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0

What patterns do you see in this data?

Repeating Issue: Unannounced Loads

ASHPCE1D

MMDD	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0804	0	0	0	0	0	0	0	0	0	0	0	0	5	32	18	65	91	13	12	20	84	9	14	9
0805	137	112	26	27	141	17	21	9	85	13	21	17	96	23	23	24	91	13	11	21	86	11	14	9
0806	151	111	21	24	96	41	50	14	84	22	20	22	91	18	17	18	92	24	10	11	83	9	14	20
0807	139	100	32	30	99	43	49	19	105	17	31	14	76	23	27	25	111	20	15	18	86	13	13	10
0808	145	99	29	30	109	52	48	11	102	25	47	24	101	23	20	23	117	31	30	16	91	12	11	9
0809	123	83	65	37	93	17	25	10	102	23	44	25	111	37	24	29	98	19	29	16	92	16	15	9
0810	169	120	52	32	125	58	38	9	109	17	26	14	104	13	17	15	93	13	16	11	61	10	10	9
0811	107	82	51	34	85	17	22	10	73	10	12	11	92	32	13	69	65	11	11	10	60	9	12	9
0812	149	121	26	15	70	16	24	11	95	34	15	18	34	67	21	21	87	11	13	9	77	9	14	9
0813	115	76	55	56	27	9	9	9	11	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0



Addressed by resizing redo logs: Increased from 400MB to 4GB

60 corresponds to one change per minute ... the ideal range is 4 to 12 per hour

Self-Protection

Warning: The next set of slides are rated G

Questions You Need To Ask

- How is uptime defined?
- When the vendor says we guarantee 99.9% availability what does that mean?

Availability %	Downtime per year	Downtime per month*	Downtime per week
90% ("one nine")	36.5 days	72 hours	16.8 hours
95%	18.25 days	36 hours	8.4 hours
97%	10.96 days	21.6 hours	5.04 hours
98%	7.30 days	14.4 hours	3.36 hours
99% ("two nines")	3.65 days	7.20 hours	1.68 hours
99.5%	1.83 days	3.60 hours	50.4 minutes
99.8%	17.52 hours	86.23 minutes	20.16 minutes
99.9% ("three nines")	8.76 hours	43.8 minutes	10.1 minutes
99.95%	4.38 hours	21.56 minutes	5.04 minutes
99.99% ("four nines")	52.56 minutes	4.32 minutes	1.01 minutes
99.999% ("five nines")	5.26 minutes	25.9 seconds	6.05 seconds
99.9999% ("six nines")	31.5 seconds	2.59 seconds	0.605 seconds
99.99999% ("seven nines")	3.15 seconds	0.259 seconds	0.0605 seconds

source: wikipedia

- Probably not!

Questions You Need To Ask

- Security

- What protections is in place to control access and prevent theft?
- How are the controls implemented?
- What independent organization has audited the controls?
- Are audit trails created? By what activities?
- Who reviews the audit trails?
 - How often?
 - Show us an audit trail
 - How many employees or contractors have been warned/terminated in the last 2 years for policy violations?
- If data is accessed do you know by who, when, and what they saw?
- If data was taken how do you know what was taken?
- How long after a breach will we be notified in writing with the details?
- When was the last time someone tried to break into your systems?

Questions You Need To Ask

- Backup and Recover
 - To what hardware do you perform backups?
 - At what point in the process is a backup encrypted?
 - Who has the keys for decryption?
 - What happens if that person catches the flu?
 - How does the backup get off-site to a secure location?
 - How often are backup tapes/storage recycled?
 - Do the answers make sense to an independent senior consultant?

Questions You Need To Ask

- Disaster Recovery

- What mechanisms do you have available in the event that there is a loss of the data center in which our applications are running?
- Are there systems onto which we can failover real-time?
- Is the failover to identical hardware with identical infrastructure?
- When was the last time they live-tested the DR solution?

Questions You Need To Ask

- Change Management
 - How is the configuration of your servers documented?
 - What is the process for initiating configuration changes?
 - What change threshold must be reached before customers are notified?
 - Modify a configuration parameter?
 - Patch software?
 - Upgrade software version?
 - Change firewall and network hardware?
 - Replace storage array?
 - Replace physical server(s)?
 - What is the frequency of patching for O/S, database, application servers, web servers?
 - Ask to view one day of change management logs and do so with an independent senior consultant

Questions You Need To Ask

- Personnel

- How many dedicated network admins do you employ?
- Do you have a dedicated DNS administrator do you employ?
- How many dedicated storage admins do you employ?
- How many database admins do you employ?
- How many web server admins do you employ?
- How many of these admins are direct employees and how many are contractors?
- How many of these admins are physically located in North America or Western Europe?
 - If off-shore what is the distribution, per shift, 7x24x365 of L1, L2, and L3+ resources?
- How do you keep these admins' skills up to date?
 - What is the annual training budget per person?

Questions You Need To Ask

- Infrastructure

- How many NTP servers are in the data center?
- How many DNS servers are in the data center?
- How are these assets configured and maintained?
- Do these answers make sense to an independent senior consultant?

Conclusion

Warning: The next slides are rated G

How To Go It Alone

- Buy the right hardware
 - This means do not buy based on price alone. Ten \$25,000 servers do not equal one \$250,000 server. They are far more expensive
- Hire the right internal leadership team
 - Separate technology management from people management
They are very different skills
 - You do not choose a configuration parameter by consensus
- Hire the right internal technologists
 - 2 DBAs at \$75,000/yr cost many times more than one DBA at \$150,000/yr

How To Go It Alone

- Go outside to managed services for those requirements where you can not justify going it alone
 - DNS Administration
 - Firewall Configuration
 - Migration and Upgrade
 - Network Administration
 - Storage Administration
- Get an outside, very expensive, consultant and use them like you would use an attorney: When required for their very senior skill set

Remember we started talking about mainframes?



System z10 EC is great technology that is designed to help you lower your running costs

Great Technology

- Low point of entry and expanded granularity: **100**
- More flexibility with more engines: **64 engines**
- More powerful specialty engines for new and different workloads: **50% or more**
- Upgradeable from previous generation IBM System z9™ and IBM zSeries® 990 (z990) servers
- Accredited with **EAL5 security classification**
- Highest Capacity / Kilowatt rating



Great Value

- Pay for the capacity you need, today and for future growth
- Designed for 'right sized' configurations
- Improved price / performance for Linux®, Java™ and eligible data serving workloads
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- Generation to generation price / performance improvements for software and maintenance from z9 and z990
- Consolidate x86 software licenses at up to a 30 to 1 ratio
- Sub-capacity software pricing to better align IBM software costs with use: **Lowest cost per unit of work**
- Expanded Virtualization capabilities that enable Total IT Cost savings **Gold Standard**

Introducing the World's first Enterprise Quad Core with the performance to replace more than 120 x86 cores.

Remember we started talking about mainframes?



z/VM Virtualization Value point #2: Environmental Cost



z10 EC – 26 IFLs

30 Square Feet

Hourly Energy Usage: 16.3 KWatts

Annual Energy Usage: 0.2 M KWatts*

Cost: \$24.6 K/year

*z/VM or x86
Virtualization?
IT Cost Implications
of Scenario #1*

z/VM Net Savings
per year
900,000 KWatts

\$108.4K

81% Less electricity



8 Racks of x86 Blades (304 CPUs)

43 Square Feet

Hourly Energy Usage: 87.8 KWatts*

Annual Energy Usage: 1.1M KWatts*

Cost: \$133.0 K/year

* Source of power consumption data for the
Sun SunFire X2100 (1U) Opteron 2.8 GHz 1 MB
server: *Competitive Profiles*

Become Greener with z/VM Virtualization on z10 EC: 5X better than x86 Virtualization

Thank you

and remember ... your Cloud Provider is trying to cut costs too