ENGINEERED FOR INNOVATION

ORACLE OPEN WORLD

ORACLE®

Real Life Stories on Extreme Performance with In-Memory Database Technology

Presented at Oracle Open World

The Lockheed Martin Census Practice
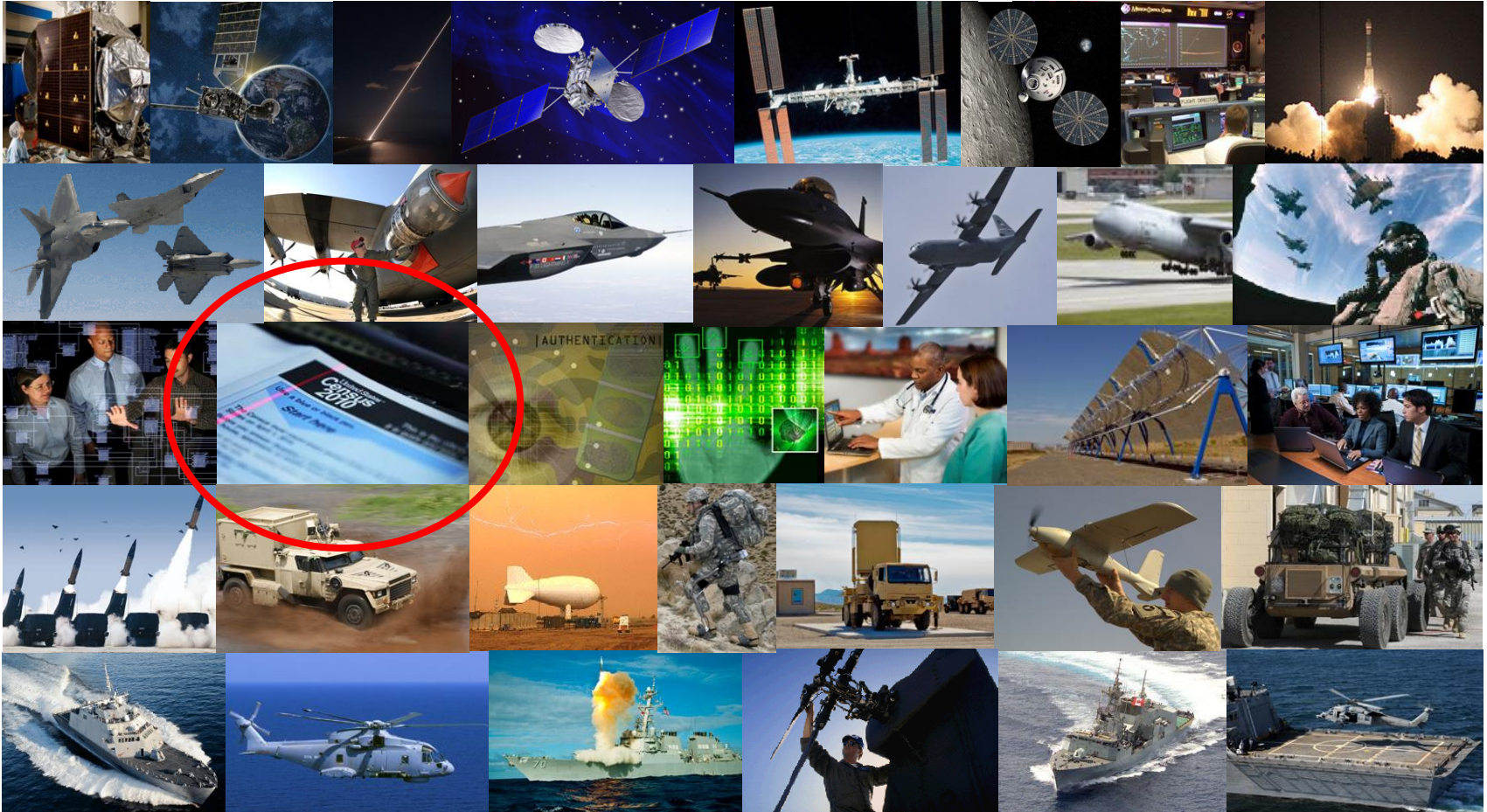
TimesTen Use in UK Census

ORACLE
OpenWorld 2011

John White

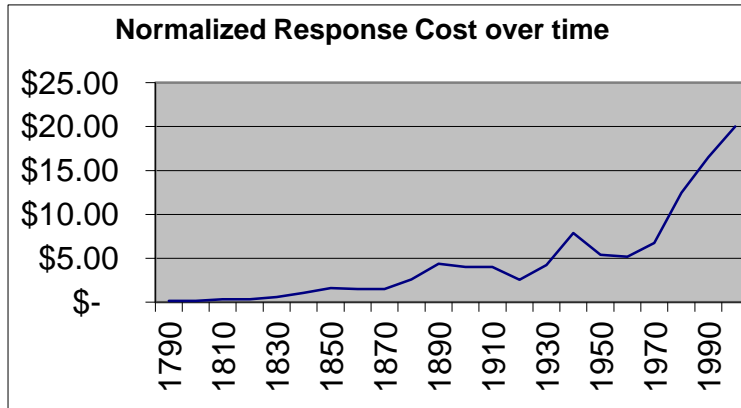*Chief Architect – UK Census*

IS&GS-Civil, Greenbelt, MD

John.White@lmco.com

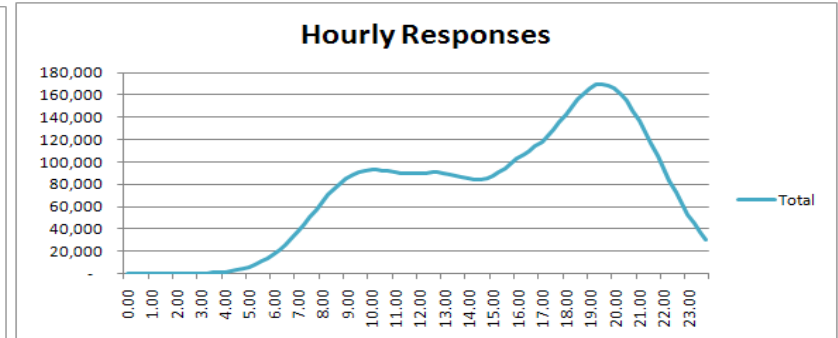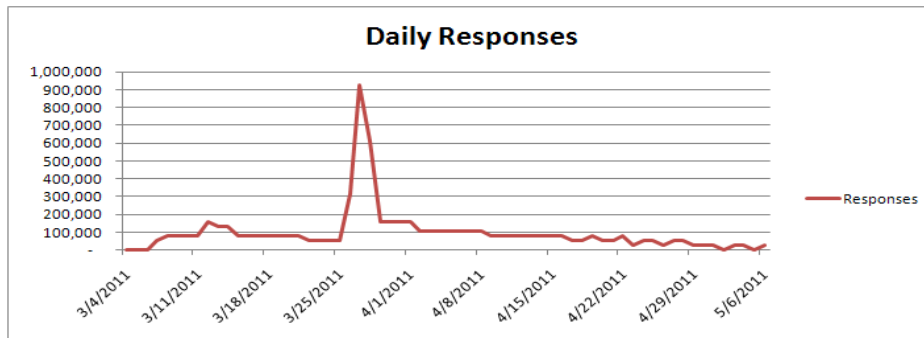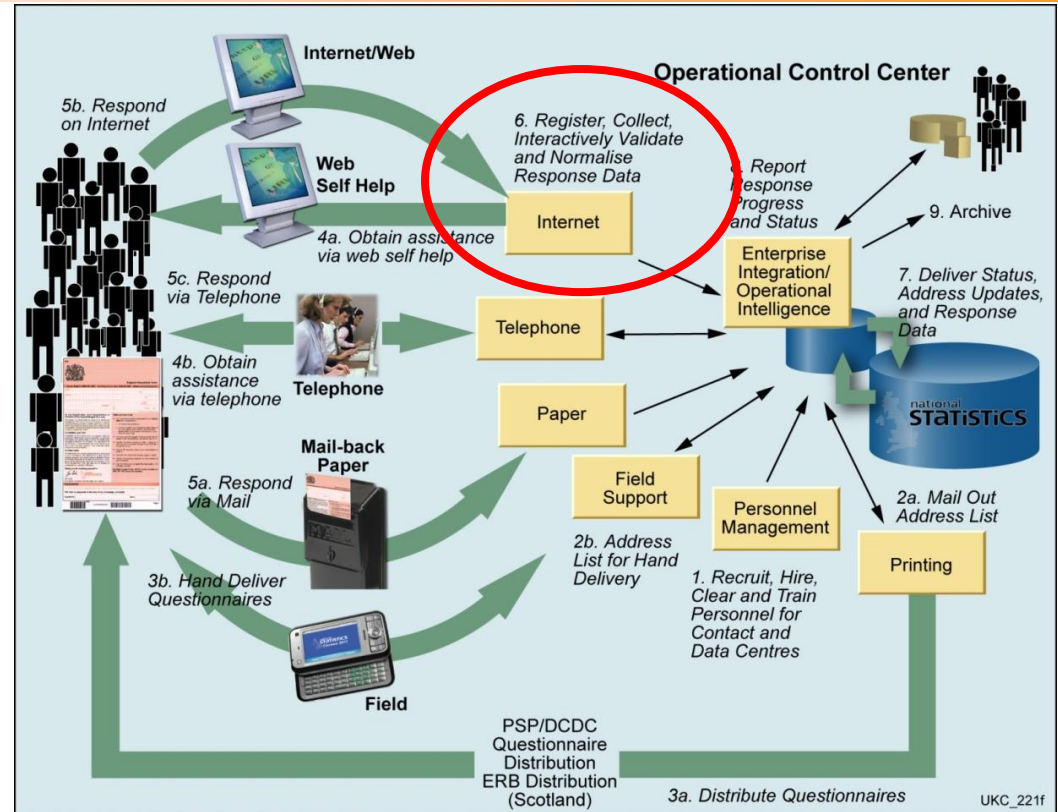# *Lockheed Martin – We Are the How*

**Between the Idea and the Achievement, There Is One Important Word:
HOW … And It Is the HOW that Makes All the Difference**

Use Case: UK 2011 Census

Normalized Response Cost over time


Cost by Response Channel
- Field - ~$90
- Telephone - ~$10
- Paper - ~$4
- Internet - ~$1

Operational Control Center

5b. Respond on Internet — Internet/Web

Web Self Help

4a. Obtain assistance via web self help

6. Register, Collect, Interactively Validate and Normalise Response Data — Internet

8. Report Response Progress and Status

9. Archive

7. Deliver Status, Address Updates, and Response Data

5c. Respond via Telephone — Telephone

4b. Obtain assistance via telephone

Telephone — Enterprise Integration/ Operational Intelligence

5a. Respond via Mail — Mail-back Paper

Paper

national STATISTICS

Field Support

Personnel Management

2b. Address List for Hand Delivery

2a. Mail Out Address List

3b. Hand Deliver Questionnaires

1. Recruit, Hire, Clear and Train Personnel for Contact and Data Centres

Printing

Field

PSP/DCDC Questionnaire Distribution ERB Distribution (Scotland)

3a. Distribute Questionnaires

UKC_221f

Daily Responses

Hourly Responses

Challenge: Central DB Load

- **Requirement: Must store data after each page**

- **Initial IDB Load Estimate: 465 TPS**
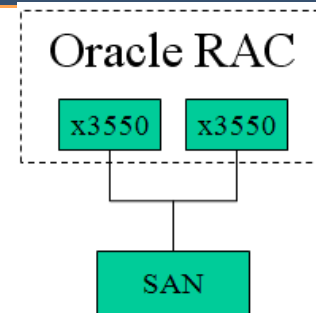
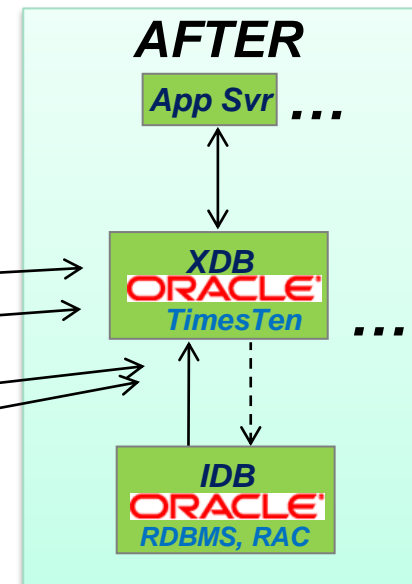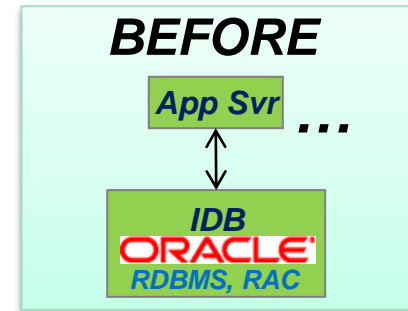| Change	Increased load on IDB
Load Balancer design solution	2X
WSH integration/login redirection solution	2X
24->32 page questionnaires	1.6X
Questionnaire App Database Interaction	8X
Increased Internet Uptake	5X
Total	**2 * 2 * 1.6 * 8 * 5 = 256X**

- **Final IDB Load Estimate:** *119,026 TPS*
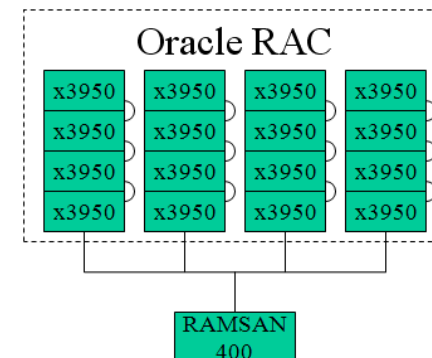
Use of Times 10

- **Rearchitected solution to reduce load on IDB**
- **Used TimesTen as local data cache in cluster**
  - *Served local transactions*
  - *Read from IDB during login*
  - *Aged to IDB after local transaction*
- **Enabled move from risky Active/Active to Active/Passive IDB**
- **Concerns**
  - *Deployment Location*
  - *Sizing*
  - *Aging latency*
  - *Network load*

BEFORE

App Svr …

IDB
ORACLE
RDBMS, RAC

AFTER

App Svr …

XDB
ORACLE
TimesTen …

IDB
ORACLE
RDBMS, RAC

Before

Internet

IDC WSH WSH IDC

SIG (P) SIG (P)

LB LB LB LB

FW FW FW FW

WS WS WS WS WS WS WS WS WS WS WS WS WS WS WS WS

FW FW

LB LB

AS AS AS AS AS AS AS AS AS AS AS AS

UDBC UDBC
ORACLE ORACLE
RDBMS RDBMS

IDB IDB
IDB IDB
ORACLE ORACLE
RDBMS, RAC RDBMS, RAC

FW FW

WAN (35Mbps)

Advanced Replication

After

Internet

SIG (S) SIG (P) SIG (P) SIG (S)

LB LB LB LB LB LB

FW FW FW FW FW FW

WS WS WS WS | WS WS WS WS | WS WS WS WS | WS WS WS WS | WS WS WS WS | WS WS WS WS

FW FW

AS AS AS AS | AS AS AS AS | UDBC UDBC | UDBC UDBC | AS AS AS AS | AS AS AS AS

ORACLE
RDBMS, RAC RDBMS, RAC

ORACLE
TimesTen

X10 X10 | X10 X10 | X10 X10 | X10 X10

ORACLE
TimesTen

TimesTen

Oracle RAC
x3850 x3850
RAMSAN 440

IDB
IDB
ORACLE

FW FW

IDB
IDB
ORACLE
RDBMS, RAC

WAN (65Mbps)

DataGuard

Results

- **Verified with cloud based full scale load testing:**
  - *3.0 million daily responses*
  - *200,000 peak concurrent users*
  - *1 second average page response time*
  - *IDB: 6,118 TPS*
  - *Availability maintained through simulated site, cluster and component failure*

- **Actual production usage:**
  - *3.7 million total responses*
  - *36,000 peak concurrent users*
  - *<1 second average page response time*
  - *IDB: 1,101 TPS*
  - *Production availability: 99.94%*

Lessons Learned

- **Performance better than expected – 10X better**
- **Needed more RAM than expected – 24GB/CPU**
- **Log writing greater than expected**
  - *Data written to XDB disk then aged to central IDB*
  - *Disks need to be sized to handle transaction load*
- **TimesTen deployment doesn't have to be coresident with app**
- **Latency somewhat configurable**
  - *Max Latency = aging frequency + max time to age*
- **Network load not overly burdensome**
  - *On par with Advanced Replication traffic load - ~10Mbps*
- **Cloud based testing was most cost effective to do full load test**

Thank You!
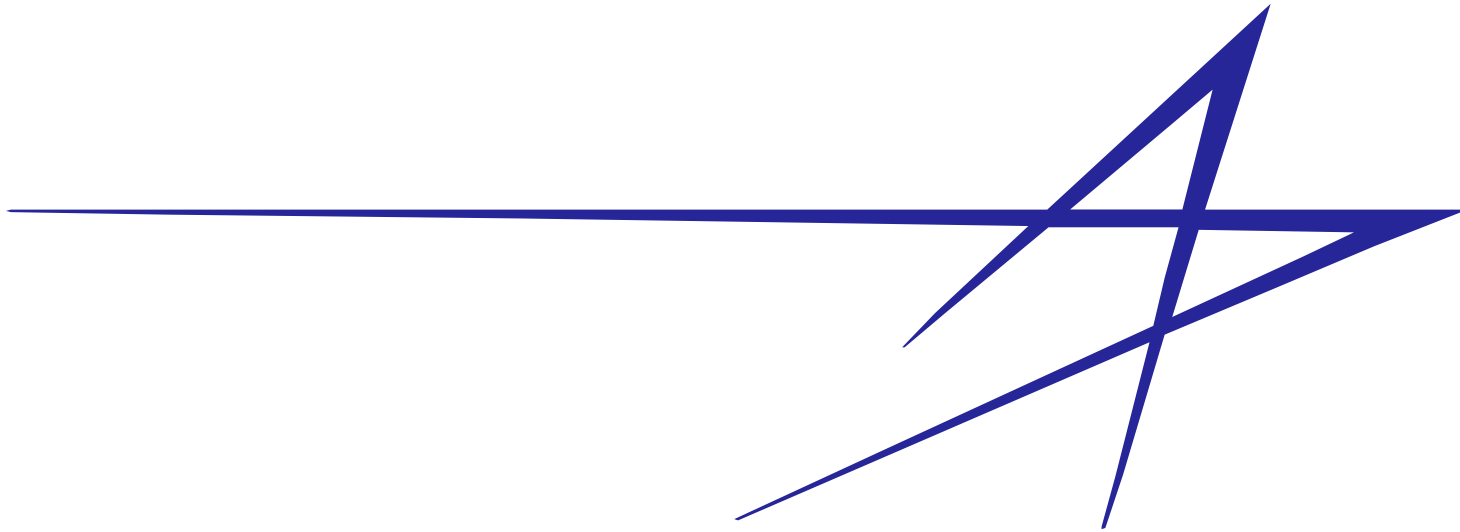
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