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# Big Data, DII and the Heisenberg principle
## *Are you ready for "Big Data" ?*

Dr Andy Ellis
ATLAS Chief Architect, HP

Integrated EA 2013

# Landscape …

Industry developments in Big Data

Research on transforming complex (M and N-form) information-intensive organisations

## Big Data and complex organisations

- **Strategic and operational roles for EA**
- **Actionable approaches for transforming complex organisations**

Grounded in

- The realities of specifying, designing, engineering, deploying, transitioning and operating one of the largest "Defence grade" COTS-based information systems environments in the world
- The economic realities of Defence Transformation

Experience from DII, Government Gateway, and other public and private sector transformation

*Not an HP pitch on Big Data, an ATLAS pitch on DII, or a pitch on quantum mechanics*

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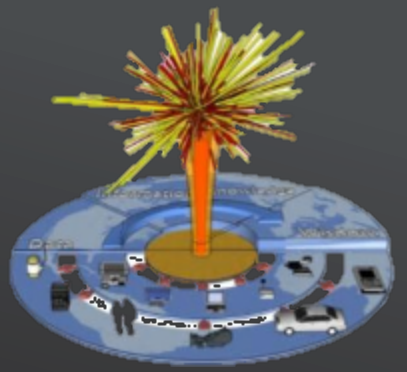
# EXPLOSION AT THE EDGE



**Why is this happening?**

- Proliferation of Embedded Technology
- Mobile Revolution
- Digitization of Content
- Speed of Business
- Emerging Relationships
- Emergence of Context

**Business Imperatives:**

- Don’t Drown in the Exaflood of Data
- Seek Data for Decisions
- Rethink Workspace
- Rethink your Customer’s Edge
- Understand the New Legalities

# RESULT: BIG DATA

**New technologies and architectures which economically extract value from very large volumes of wide variety of data, by enabling high velocity capture, discovery, and analysis.**

**Combination of Volume, Variety, Velocity, and Value requires technologies to address management, storage, access, value creation, and security. (IDC)**

**Big data** | **Analytics** | **Data intensive compute**

## Applications

**Scientific discovery**

**Improved diagnostic methodologies and treatments**

**New revenue streams, and increased process automation and efficiencies**

**Efficient management of resources via use of smart grids and other data mining**

**Efficient operations in industries such as transportation, oil and gas, finance, defence**

## Experience

**Lessons from the commercial world?**

**How is large-scale analytics being applied to ease overload for warfighters from increasing number of sensor inputs while providing "actionable" information?**

**What applications are being developed for homeland security and intelligence?**

**What role are new tools, techniques, and technologies – predictive analytics, cloud computing, metadata, etc. – playing in making big data analytics at Government level a reality?**

# Big Data is about Learning

1
**Concrete Experience**

***Measure***
***Collect/analyse data***

2
**Reflective Observation**

*What happened?*

***Challenge analysis***
***Challenge conclusions***

**Why?**

3
**Abstract conceptualisation**

***EA question:***
***Which models?***

***Test model against reality***
***Assess constraints***
***(physical, organisational, cognitive)***

4
**Active Experimentation**

*What if …?*

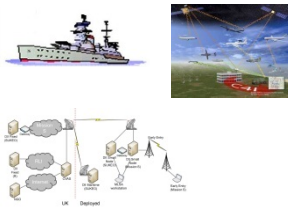
**Delivers**

**Better**

**decisions**

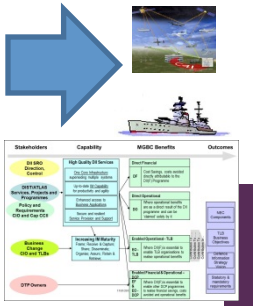
***Use models and data to understand decision quality***
(Every decision is perfect if you choose the model and data to fit the decision)
(Inappropriate models applied to complex systems can misinform or confuse)

# What is the DII question?



TLCM

MOD



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DII services
Delivered through UADs

**Chief Architect questions: What is DII?**
**These are complex organisations, so how <u>do</u> we accelerate transformation?**

Common misunderstanding:

- DII is no more complex than consumer-grade desktops with standard consumer products (eg Microsoft)
- DII is slow compared with corporate systems
- DII is just like any other government ICT system
- Security isn't that important
- MOD would work better if its corporate data were scattered across 400,000 unmanaged, potentially compromised personal devices and the Cloud
- Buying COTS services would take out most of the cost

# “Defence grade …”

Mission grade

Defence grade

(DII)

Government grade

(Govt Gateway)

Commercial grade

(eg Amazon)

Consumer grade

(eg Facebook)

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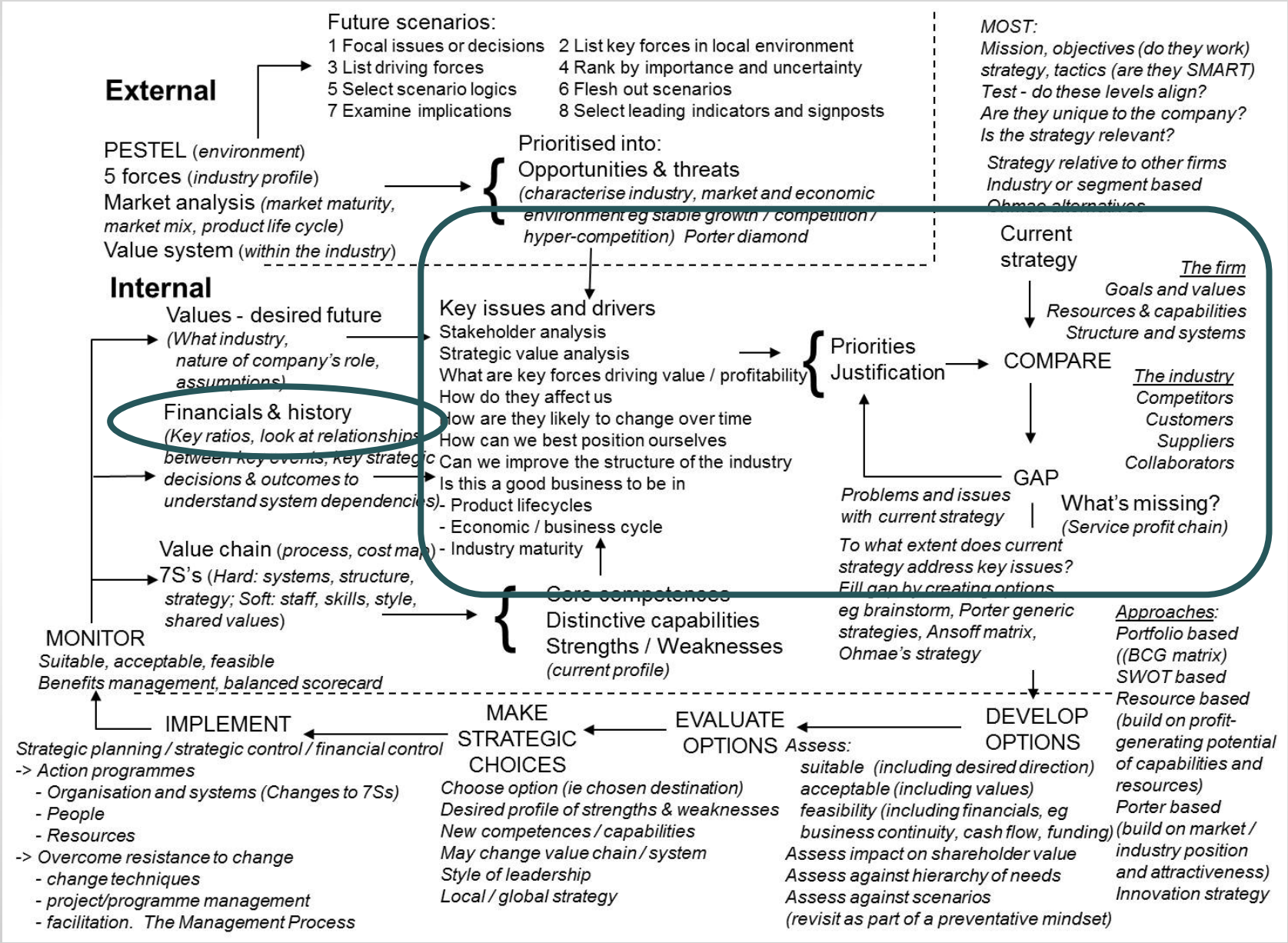
# How do we accelerate transformation? What focus?



# … and which models?

**Reference models**

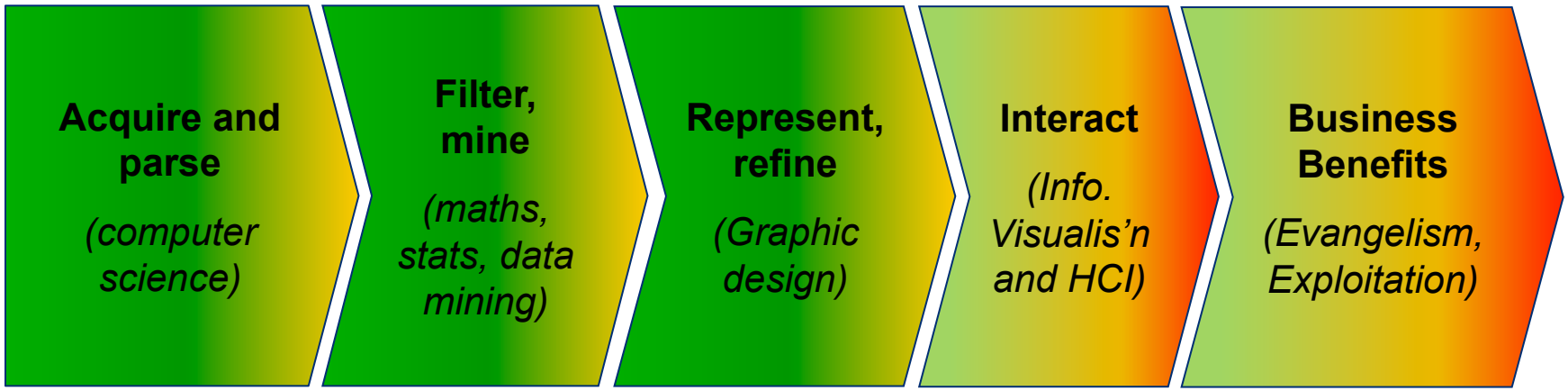
DIRM, **MODAF, TOGAF**, NAF, DODAF, CMMi, FEAF, LCIA Zachmann framework

**Reference theories**

Systems engineering, software economics, system economics, learning theory, theories of technology investment, Open Innovation, psychology of programming, theories of quantitative and qualitative research, theory of contract, transaction cost economics, agency theory, supply chain theory, production engineering, production economics, market economics, institutional economics, intellectual capital, theory of constraints, control theory, organisational psychology, theories of professional practice

# Big Data sequence

**Business context**
**Technology industry context**




after Fry, B.J. (2004) MIT

**TECHNICAL**
**~20,000 design documents acquired, parsed, filtered and mined**
**Other datasources mined**
**Metamodel enhanced and extended**
**Multiple datasources triangulated**

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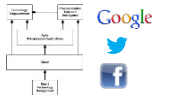
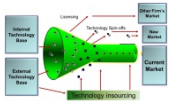
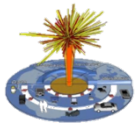
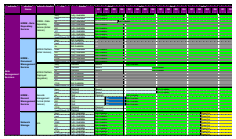
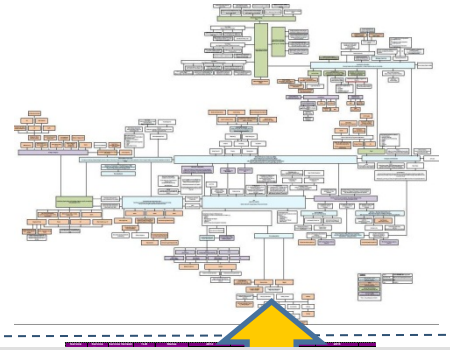
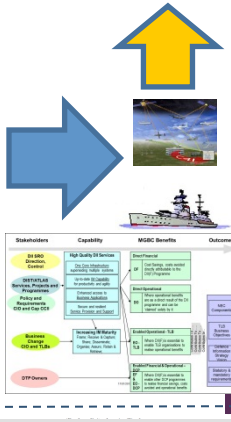
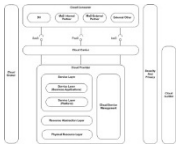
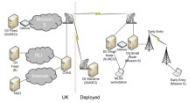
# What is DII?







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DII services
Delivered through UADs

# What is DII?

Innovative technologies

Industry trends

Operational effectiveness

TLCM

Information superiority

Capability taxonomy

Future Operating Environment

Military effect

Product futures

Innovation projects

Service portfolio

MG BC

New requirements

Joint working

Consortium working

Programme governance

User Capability roadmap

Service roadmap

Physical estate

Business model

Programme management

Enabling Capability roadmap

DII estate

Training environments

Project management

Product roadmap

Corporate systems

Consortium systems

Data ecosystem

System integrity

Operating model

Production management

Business metamodel

System metamodel

Service Operations business model

Representative environments (DMO)

Service Operations operating model

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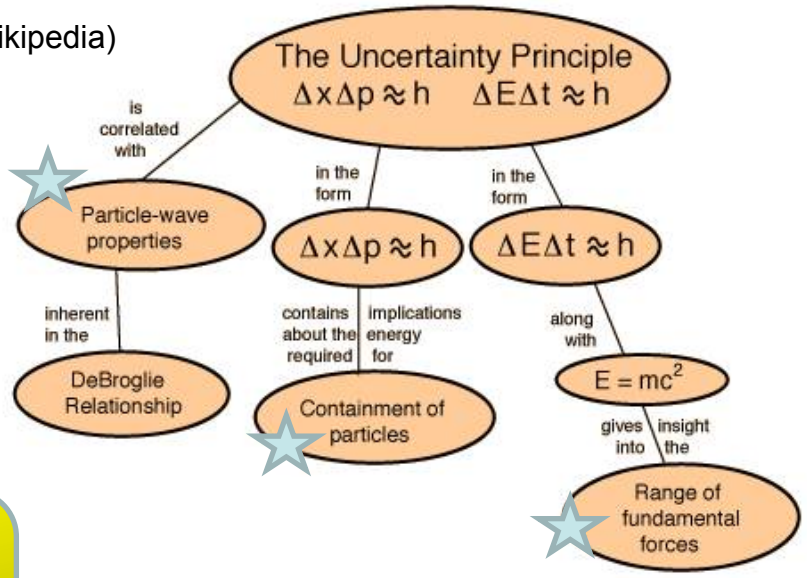
# Heisenberg - uncertainty principle, not observer effect

- In quantum mechanics, the uncertainty principle is any of a variety of mathematical inequalities asserting a fundamental limit to the precision with which certain pairs of physical properties of a particle, such as position x and momentum p, can be known simultaneously. The more precisely the position of some particle is determined, the less precisely its momentum can be known, and vice versa.
  - Paraphrase of Heisenberg's uncertainty paper of 1927. (Wikipedia)

***The uncertainty principle states a fundamental property of quantum systems. It is not a statement about the observational success of current technology.***




**Complex software intensive systems. Some aspects are deterministic, others manifest as a probability function.**

# Better decisions?

**Limiting factors for Big Data**

**Cognitive limitations**
Limited attention, limited processing capacity and limited problem-solving ability

**Information limitations**
Limited ability to interpret information, uncertainty

**'Rational ignorance'**
Limiting the information and analysis tools applied by using familiar models (which may be inappropriate) to avoid cognitive effort

**Bounded Rationality**

# How do we accelerate transformation?

Mission grade

Defence grade

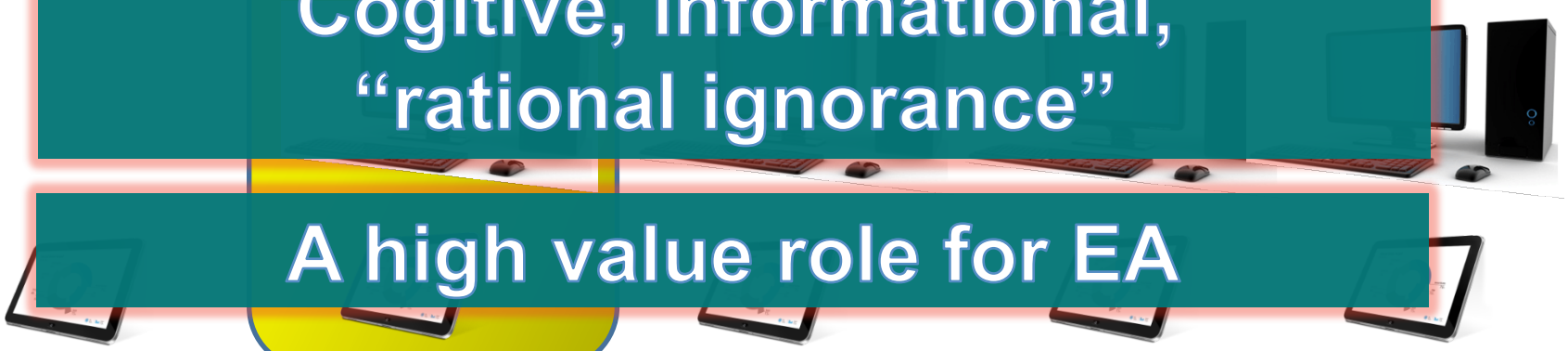
Government grade

Commercial grade

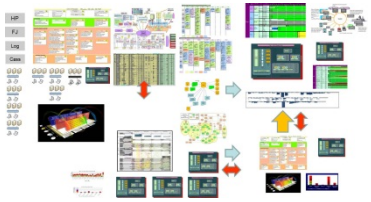
Consumer grade

**Address those limiting factors**
**Cogitive, informational, "rational ignorance"**

**A high value role for EA**



(DII)



(Govt Gateway)

(eg Amazon)

(eg Facebook)

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**Are you ready to use Big Data to improve the performance of your enterprise?**

Are you ready for Big Data?

Thank you