Architecting Sustainable Solutions

Bil-T
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Gunnar Menzel, 20th Nov 2020
Sustainability is a Key Subject for Consumers

Climate change and sustainability issues are top of our social and economic agenda

- Nearly 80% of consumers want to be able to make a difference in saving the planet for future generations.
- 72% are personally concerned about their environmental footprint.
- 66% choose to purchase products or services based on their “environmental friendliness.”

Our Capgemini Research Institute surveyed 7,500 consumers and 750 large organizations.
The digital revolution is driving major change across our world as we know it. Technology has become the most important driver across industries. Digital is part of our everyday life, as a company and as an individual. New technologies are bringing about change that is swifter and more radical than ever before.
As global incomes rise, internet penetration and the use of connected, smart devices grows significantly.

However, Technology has many Unintended Consequences:

- IT accounts for around 3% of global CO2 emission, same level as global aviation fuel in 2018.
- As a country, the IT industry would be the 3rd largest electricity consumer in the world.
- $52bn worth of precious metals are wasted each year through e-waste.
- The number of connected devices will grow by 12% annually between 2017 and 2030.
First video with over 5bn views consuming more electricity than 40,000 US households over a full year.
Driven by Data, Data Centres and Communications Network are the biggest contributors*

Relative Contributions of ICT Categories - 2010

Smart Phones, 4%
Displays, 9%
Notebooks, 8%
Desktop, 18%
Communication Network, 28%
Data Centres, 33%

Relative Contributions of ICT Categories - 2020

Smart Phones, 11%
Notebooks, 6%
Displays, 7%
Desktop, 7%
Communication Network, 24%
Data Centres, 45%

Yet, IT can contribute to solving a wide range of issues

Various ways where IT can make a real impact

IT can enable savings of $5 trillion worth of resources and generate an additional $2 trillion in revenues by 2030.

By 2030, IT has the potential to cut 9.7 times as many carbon emissions as they emit which would save 20% of global CO₂ emissions by 2030.

Digital solutions can contribute to achieve all 17 UN Sustainable Development Goals and >50% of the 169 sub-targets.
An Architect’s role is to **drive change** that creates business opportunity through applied innovation.

They will shape and translate business and IT strategy needs into realizable, **sustainable** technology solutions, while taking end-to-end solution delivery ownership from idea to benefits delivery.

In detail, an Architect

- provides insight, thought leadership and innovation to ensure that the solution meets the client’s business goals,
- ensures that the solution\(^1\) is **designed** for production and can be delivered efficiently maximising re-use, and
- ensures that the solution has integrity (is safe, secure and compliant).

\(^1\) Related to a Solution Architect
Sustainability Strategy

Establish a clear IT Sustainability Strategy

External Influences:
- Environment
- Technology
- Economy

Institutional Influences:
- Government
- Communities
- NGO

Value Chain Influences:
- Customers
- Employees
- Suppliers

Scope of this deck

See 43rd Hawaii International Conference on System Sciences - 2010
https://www.computer.org/csdl/pdfs/api/csdl/proceedings/download-article/120mHq4Qw4J/spdf
How to Architect Sustainable Solutions

Making sure that sustainability related aspects are a core part of the solution design process

1. By defining what **sustainability means**

2. By ensuring that the entire architecture **design process considers sustainability** related artefacts

3. By ensuring that there is a **balance** between value for money, agility, compliance and sustainability

4. By applying a **design thinking** approach
What is Sustainability?

*IT sustainability covers more than Green IT*

• Sustainability in an information technology context can be characterized by the *application of IT practices* and *technologies* for the benefit of customers and others stakeholders that ensure long-term well-being in economic, social, and environmental sustainability pillars.

• Broadly *sustainability* means that the sourcing, operation and disposal of IT equipment does not directly or indirectly *negatively affect* economic, social, and environmental aspects.

• *Sustainability* in an IT context can be related to aspects such as electricity consumption, water usage as well as economical and social implications.

1: https://ieeexplore.ieee.org/document/5428622
Use an Architecture Content Framework

Integrated Architecture Framework V6 / SE

Four Abstraction Levels

Why does IT need to be transformed?
Context information and key principles that support the value proposition

“What” services / capabilities are required?
“What” is required from each service?

“How” can customer needs be realized with technology components?
“How” do technology components interrelate
“How” do components ‘implement’ services

“With What” standards, products, guidelines will technology components be implemented?

Three Perspectives: Sustainability, Security and Governance across all Abstraction Layers and Aspect Areas

Why?
Contextual Abstraction Level

What?
Conceptual Abstraction Level

How?
Logical Abstraction Level

With what?
Physical Abstraction Level

Four main Aspect Areas: Business, Information, Information Systems and Technology Infrastructure
The Sustainability Perspective adds considerations and knowledge to any or all aspects areas in terms of context in Environmental, Social and Economic sustainability and considerations and measures of the sustainable context of the architecture and outcome.

It considers resource sourcing, utilisation and disposal, environmental impact, social impact and outcomes, and economic outcomes.
Solution related Artifacts

A selection of key sustainable related artifacts

- The overriding IT Principles
- Any sustainable relevant inputs
- Any compliance and standards related material
- Any Corporate / Companywide sustainability strategy/ies

• The sustainable related requirements “a physical server must not consume more than 270Watt per h in peak” or a “the total CO2 footprint for a typical high volume 2U Server over its entire lifetime including the production, delivery (embedded carbon), operational and disposal footprint must not exceed 6tons CO2.”

• The logical solutions (options) that meets the functional and non-functional requirements whilst meeting all contextual aspects incl sustainability targets

• The resulting physical solution(s)
Sustainability Design Thinking

Balancing various drivers to designing a sustainable solution

- Compliance
- Value for Money
- Sustainability
- Security
- Functionality
- Customer
- Architect
- Stability
- Agility
- Usability
- Quality
- Availability
- Security
- Functionality
- Quality
- Usability
- Customer
- Architect
- Stability
- Agility
- Usability
- Quality
- Availability
- Security
- Functionality
- Quality
- Usability
- Customer
- Architect
- Stability
- Agility
- Usability
Solution related design process

Moving from conceptual, logical into physical

What

Conceptual Design

Functional Requirements

Non-Functional Requirements

How

Logical Option 1
Logical Option 2
Logical Option 3

Pros and Cons per Option

With

What

Physical Option 1
Physical Option 2
Physical Option 3

Physical Specifications

Physical Design
The Challenge / The Design Question

Scan
Ensures that everyone has the same level of understanding

Present
Understand
Discuss
Collect

Baseline design request

Focus
Develops solution options

Consider
Structure
Concepts

Create Concepts

Act
Creates Design Candidates

Test
Check
Validate
Approve

Design Candidate

Tools / Approach / Method

Brainstorm
Trade shows
Presentations
Concepts
Prototypes
Blueprints

Brainstorm
Whiteboard
External Inputs

Collaborate
Line by Line check
Architecting IT Sustainability Solutions

Establish IT Sustainability Strategy & Ensure that Sustainability are core to the solution

- **ICT** can have a **substantial sustainability** impact
- **Sustainability** goes wider than **Green IT**
- To **successfully architect** an IT solution
  - Establish IT **sustainability strategy**
  - Use a formal **framework**
  - Ensure that sustainability is **core** to the solution
Unlock the possibilities …
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