Global Journal of Advanced Engineering Technologies and Sciences

INFLUENCING & IMPROVING ENTERPRISE DIGITAL MATURITY USING IOT

Hariharan Ramalingam[*1]

[*1]Product development Consultant for Enterprise IT products.

Abstract

Internet of things (IOT) is trending to become the element that connects several parameters of our every day lives to Internet. The analogy is Internet being the think engine, IOT enables to expand beyond the personal computers to every object that could be part of our daily lives, humans will be intergral part of the IOT system.

Enterprise digital maturity drives the performance of organization and market inturn.

Diversity index parameters is proposed for the measurement of a company's digital maturity based measurement data of different kinds of data sets. IOT can influence the capabilities of a company in terms of technology, tools that could influence the maturity assessment.

Some of the IOT domain application areas are

- Smart homes
- Smart work environment
- Security
- Finance/Banking
- Health care
- Social technologies

In this paper enterprise digital maturity measurement framework using IOT will be detailed. Diversity index related parameter such as Richness of data sets is proposed as a measure of the digital data richness for enterprise digital maturity benchmarking.

Keywords: Digital maturity for Enterprise & Diversity index.

Introduction

As we move forward embracing the digital transformation in our every day lives there are challenges meeting the customer expectation in real time. With this demand every enterprise needs a transformation or already adapting rapidly. For example a problem statement would be meeting the customer experinece in retail, manufacturing, finance etc. This gives the opportunity for technologies such a IoT, Big Data to play a key role for organizations to step up to the next level.

A valid question here is - how much data is enough to bench mark the digital information maturity of the enterprise? This gives the need for a measurement. Here to measure, the proposal is to use diversity index which in turn gives the richness of data. This equates to the digital maturity in an organization and IOT acts as primary tool for assessment.

- Enterprise – Organization/ business units that are driven by people, products, tools, market.
- Diversity index – A quantitative measure of different types of information. Also helps to calculate the richness of data in it.
- Internet of things (IOT) – collection of sensors & actuators which derives data out of physical objects.
- Digital maturity – A reference or bench mark for Digital transformation in any organization.
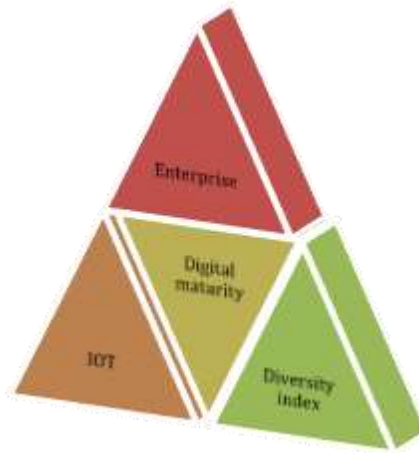
Enterprise and the need for IOT

In every organization software/IT plays a key role in operations which today is limited to servers, desktops, handhelds, networking devices such as switches, routers etc. There are endless applications which run on this infrastructure tool which inturn gives the operational data tied to organizational performance. Now the need for IOT is when the passive elements of the organization needs to be connected as well. A simple equation [5] for IOT can be


An equation for the Internet of Things.

This means that it can receive inputs from phycial objects and transform those into data using sensor & actuators which is sent onto the internet for collection and proceesing. It achieves the goal of intelligent identifying, location, tracking, monitoring and managing things.

Some of the applications are

- Retail - Connected inventory, greater knowledge of customers. Personalized and predictive services, optimized inventory management, social innovation.
- Facility management - Connected buildings, smart lighting, fire and cooling systems. Reduced carbon foot print, significant cost savings from optimized resource utilization, preventive maintenance.
- Supply chain - Real time tracking for inventory, proactive problem resolution, operational efficiency.
- Utilities - Connected meters, smart grids, automated meter reading, significant cost savings, lower cost savings.
- Manufacturing - smart sensors and digital control systems. Faster response to fluctuations in demand, maximized efficiency.
- Banking - Gather data on customer experience beyond current possibilities, risk assessment and management, security.
- Health care - Remote monitoring of patient equipment, presence status and inventory management. Faster and more accurate patient care, cost savings, improved clinician productivity, lower insurance costs.

The decision making ability for an organization is improved by having IoT enhancements to current IT infrastructure.

Detailing below is the functional blocks of a typical IoT middle ware which can be applied to the above domains [4].
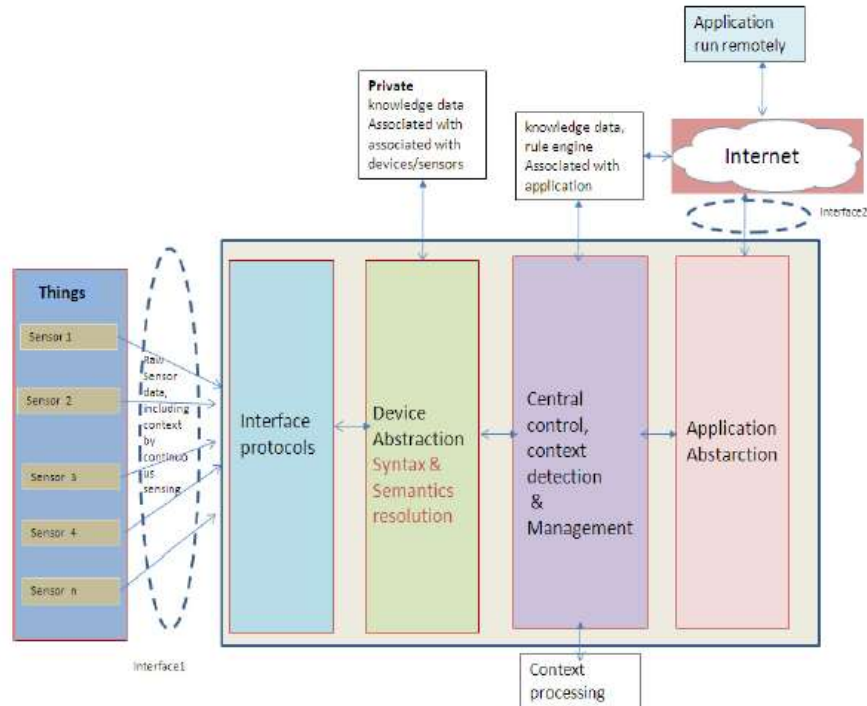
*Tables below bring the comparison of middles ware features, interface protocols*

IoT Middleware	Features of Middleware				
	Device Management	Interoperation	Platform Portability	Context Awareness	Security and Privacy
HYDRA	✓	✓	✓	✓	✓
ISMB	✓	✗	✓	✗	✗
ASPIRE	✓	✗	✓	✗	✗
UBIWARE	✓	✗	✓	✓	✗
UBISOAP	✓	✓	✓	✗	✗
UBIROAD	✓	✓	✓	✓	✓
GSN	✓	✗	✓	✗	✓
SMEPP	✓	✗	✓	✓	✓
SOCRADES	✓	✓	✓	✗	✓
SIRENA	✓	✓	✓	✗	✓
WHEREX	✓	✓	✓	✗	✗

IoT Middleware	Interface protocols				
	Zigbee	RFID	WiFi	Bluetooth	Sensor (others)
HYDRA	✓	✓	✓	✓	✓
ISMB	✗	✓	✗	✗	✓
ASPIRE	✗	✓	✗	✗	✗
UBIWARE	✗	✓	✓	✗	✓
UBISOAP	✗	✓	✓	✗	✓
UBIROAD	✗	✓	✓	✓	✓
GSN	✗	✓	✓	✗	✓ IEEE-1451
SMEPP	✗	✗	✓	✓	✓
SOCRADES	✗	✓	✗	✗	✓
SIRENA	✗	✓	✗	✓	✓
WHEREX	✓	✓	✓	✓	✓

Managing data volumes is an integral part of the IoT middle ware.

Digital maturity for Enterprise

In theory with reference to McKinsey the Digital maturity of an Enterprise is measured by Culture, Strategy, Capabilities, Organization & Talent [1]. Each of these parameters have got rich data for Digital maturing assessment. For example, the culture needs assessment to see if mindsets and behaviors are ready for digital transformations. Strategy assessment needs to be done to see if visions, goals are in place for the same. Capabilities assessment needs to be done for evaluating system tools and technology for achieving digital transformation goals. Finally Structure, process and talent data gives the organization and Talent assessment. All these contributes to Digital quotient assessment below.The maturity scope determined by a Digital qutotient (DQ) assessment directly correlated with digital and financial performance.
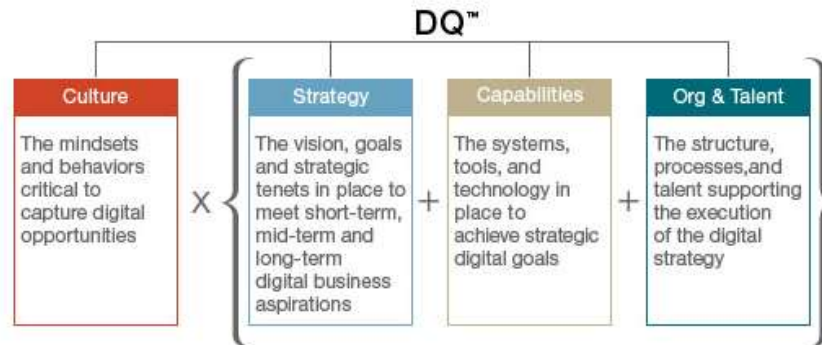
IoT contributes directly to the capabilities part of digital maturity for Enterprise. Indirectly can act as support for data from culture, strategy, organization structure, process and talent. The richness of data is measured by Diversity index.

Diversity index

It represents a quantititave measure for different types there are in datasets [2]. For example in an organization capabilities such as systems, tools and technology can catagorized into data sets and the types refers to the configurations used. Now here each carry a weighted value (corresponding to some real phenomenon) which inturn can be used to calculate the generalized mean.

The equation is

$$ ^qD = \frac{1}{M_{q-1}} = \frac{1}{\sqrt[q-1]{\sum_{i=1}^{R} p_i p_i^{q-1}}} = \left(\sum_{i=1}^{R} p_i^q \right)^{1/(1-q)} $$

- The denominator M_{q-1} equals the average proportional abundance of the types in the datasets as calculated with the weighted generalized mean with exponent q-1.
- q – refers to the order of diversity, defines the sensitivity of diversity value to few versus abundant. When q=1, the above equation is undefined. In this case q will be 1 or greater than 1 considering minimal sytems/tool requirement for an organization. As the value of q increases then it increases the weight given to most abundant data sets.
- p_i – refers to the proportional abundance of the ith type
- R - is the richness (total no. of types in the dataset),

Implementation model/ frame work

Now that we have the references for Enterprise digital maturity, Divesity index and IOT, the next step is how to leverage these for our objective i.e. data on Enterprise digital maturity.

So here we propose a frame work/ implementation model which uses loop up table (LUT) design which calls for data from the IOT on fixed parameters relevant for that organization to determine the maturity. The LUT goes as an input to the weighted values which inturn is used by the diversity index formula / Richness of data. This result gives a value

for enterprise digital maturity of an organization. Now this value inturn can be compared with bench mark values based on multiple data sets evaluation or sampling.
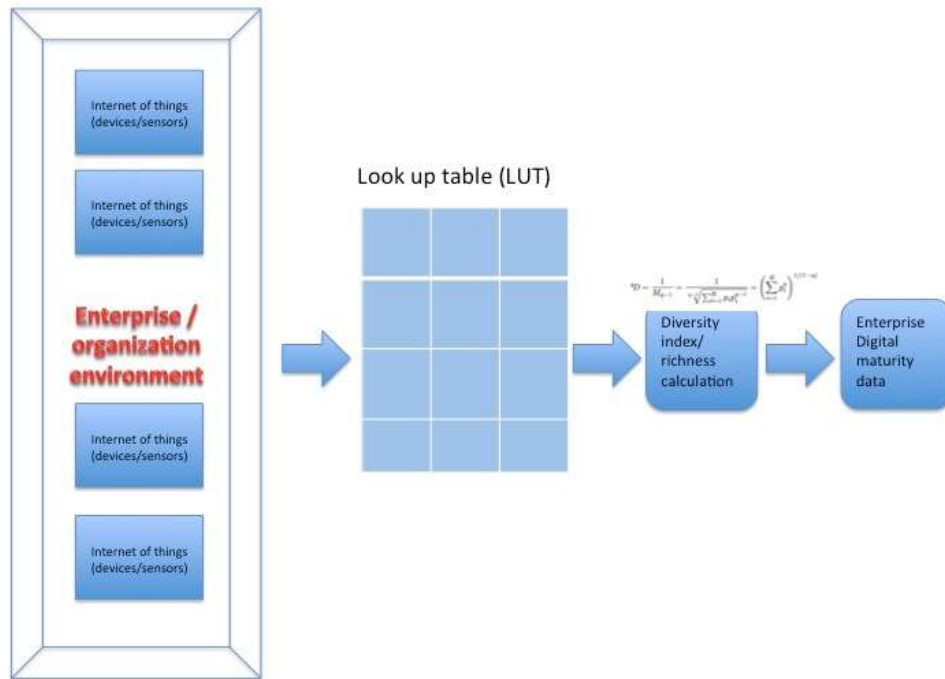
Conclusion

Digitizing and assessing the organization performance is thus made available using IOT apart from other IT infrastructure tools and systems. Raising the bar with analytics can become a constant phenomenon and IOT can improve and influence the process overall. Recommendation is to leverage the analytics assets in organization for performance improvement.

References

1. Christina Shiefield, "Digital QuotientTM" – A comprehensive assessment how an organization'd digital maturity and capabilities drive financial performance", weblink http://www.mckinsey.com/client_service/mckinsey_digital/digital_quotient.
2. Diversity index from Wikipedia, weblink - https://en.wikipedia.org/wiki/Diversity_index.
3. Kaivan Karimi, Pierre Roux, Andreas Eieland, Espen Krangnes, Henrik Flodell, Bill Boldt, "Integrating the internet of things – Necessary building blocks for broad market adoption", White paper – Atmel corporation.
4. Soma Bandyopadhyay, Munmum Sengupta, Souvik Maiti and Subhajit Dutta (Aug 2011), " Role of middleware for internet of things: A study", International Journal of Computer Science and Engineering Survey (IJCSES) Vol2, No.3.
5. Adrian McEwen & Hakim Cassimally, "Designing the Internet of things", Willey publications.