# Technology Challenges
# Vision and Discussion Paper

**Prepared by:**

**Mr. Anthony Jahshan**
**Managing Director, Open Spatial Australia**

**And**

**Mr. Peter Kinne**
**Manager Northern Region, Open Spatial Australia**
**South Pacific Sciences Press**

This discussion paper draws on the business management theories of Professor Clayton Christensen (Harvard Business School), market development theories of Geoffrey Moore (The Chasm Group) and twenty years of technical observations and business experiences in the Information Systems industry by Anthony Jahshan and Peter Kinne of Open Spatial Australia. The theories used in this paper are internationally referred to by Analyst Groups like IDC and Gartner, various quotes are used to substantiate observations and conclusions.

The views in this paper are that of the writers, research and reference materials belong to their respective owners.

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## Introduction

Theories on the introduction of technology whether based on automation through the use of computers or simply technologies that change our business processes have been well developed for many years. The focus of this paper is to refer to real world business experiences while applying well developed business and market development theories to formulate observations and conclusions. It is necessary to introduce the different types of change that occur in technology, how these changes impact an established industry, and how technology is adopted to create provocative thought. We use our own business experiences and observations of past technological improvements to substantiate our views and draw parallels to the past, present and future of the global Spatial Sciences industry.

## Analysing Change

There are two types of change that impact technology: Christensen[1] aptly describes them as sustaining change and disruptive change. Sustaining changes almost always improve the performance of established products along the dimensions that mainstream customers historically valued. Most advances in any particular industry are sustaining in character and seldom precipitate disruptive innovation or the failure of the firms leading those industries.

Occasionally however, innovations emerge that offer a very different value proposition than had been previously available. The characteristics of technologies that are based on a disruptive change are typically; cheaper, simpler, and more convenient to use. They usually result in worse performance, at least in the near-term. A fundamental point is that it changes the user expectation of what a system should deliver, not in terms of functionality, but in terms of architecture and value add. The functionality of the new system grows, to eventually outpace the functionality offered in the previous system.

Later we'll describe Christensen's Failure Framework and look briefly at how great firms can fail while their managers are doing all the right things. The introduction of technologies based on disruptive change alters the landscape of established vendors servicing existing industries. Innovative organisations that offer newer disruptive technologies alter the existing value proposition while delivering the functionality required by mainstream customers The value-add delivered through the changing propositions almost always creates new revenue streams.

## Adoption of Technology

The adoption lifecycle of emerging technology is best described by one of the world's leading thinkers on technology marketing, Geoffrey A Moore[2]. The original research for his Technology Adoption Lifecycle Model was done on the adoption of new strains of corn among American farmers in the 1940's. Since then the model has thoroughly transplanted itself into high tech companies globally.

Moore describes the model as a spectrum of demand for change between continuous and discontinuous innovations. He also introduces the market development chasm as a void where many technologies disappear before they enter the mainstream market place.

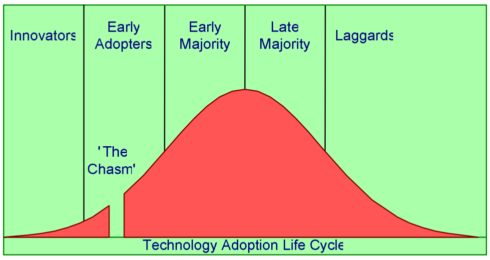


Fig 1.1

The *fast history*[3] created in the technology industry has many examples of products that on face value offered much promise. A classic example is the Apple Newton. The Newton promised to revolutionise palm-top pen-based computing solving portability and mobility problems suffered by workers in the field. More recently the dotcom bust showed us that the ASP model for delivering software as a service which offered similar promise also couldn't cross the market development chasm. However, statistically more

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[1] Professor Clayton Christensen of the Harvard Business School (author of The Innovators Dilemma)
[2] Geoffrey A Moore is President of the Chasm Group a leading marketing consultant to many high tech firms in the USA.

new products cross the market development chasm as described by Moore than products which need to cross a more treacherous Chasm described by Professor Clayton Christensen.

## The Chasm Explained

*"The chasm exist for both Entrants, and Existing Players… perhaps even more so for the existing players trying to transition to the new technology"* [4]

Christensen argues that perhaps a larger chasm exists for established vendors transitioning older architectures to new technologies that pose a disruptive threat. Moreover he observes that when the functionality of the new paradigm catches up with the functionality of the old, the leaders of the older technology cease to exist.

There are many examples that support this view. One very prominent observation is the disruptive change in the database industry leading up to 1985 when Cullinet was the market leader in the database market on mainframes with their IDMS product. Oracle, an entrant into the database market segment, based its architecture on the *disruptive* client-server technology. In 1985 Cullinet had the market share and the resources to transition its IDMS product to the newer Client Server architecture and win. In 1985 Oracle was not a publicly listed company and Ashton and Tate owned the database market on the personal computer with dbase.

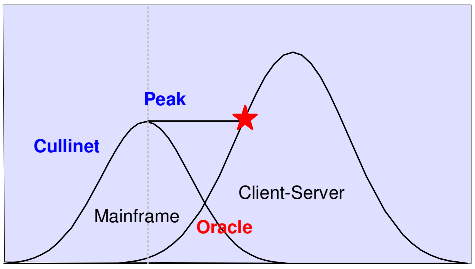



Fig 1.2

***"When the functionality of the new paradigm catches up with that of the preceding, the leaders of the preceding paradigm cease to exist."***

(Clayton Christensen
(Harvard Business School)

For Cullinet to compete on the newer disruptive technology they would need to do so surreptitiously, admission that IDMS was based on outdated technology would mean disaster to their existing revenue models. Customers would stop buying IDMS (on mainframes) in anticipation for the newer product on Client Server. This created a *Resource Allocation* dilemma where good managers resourced revenue generating projects and put lesser importance on those that didn't. The *Resource Allocation* dilemma was supported by good executive management goaled on profits. Christensen refers to this situation as the *"resource allocation profit maximisation decision",* making the allocation of resources on ground braking development projects difficult and one that is seldom taken in preference to improving profits. In short they know what has brought success in the past and roll out the same strategies.[5] This process has been the fundamental of the past success for any market dominant player; however, this is the same set of circumstances where innovators gain ground.

We have observed a similar peak in the current "Client Server" architecture/environment which came about in 2002. This was largely due to the timing of the burst in the dotcom bubble and its ensuing aftermath. The dotcom era heralded new architectures that delivered improved value propositions, and as technology leaders scrambled to position their platforms (J2EE, .NET etc) as an industry de-facto standard, many solutions providers (including the Spatial Information Management vendors) pondered how these new architectures would affect them. An insightful observation made by Dave Duffield former CEO and founder of Peoplesoft on internet architecture as *"if this technology sees the light of day, it will have a profound effect on every business application on the market today"*. During the peak of the dotcom phase Duffield took his leading product architect Ken Morris and asked him a question, *"if you had your time over how would you build our product today?"* An organisation facing a disruptive change has to ask this question, and their reaction to it will determine future success or failure. For example Larry Ellison, at the same time in history, took the innovators of Quicken (PC based accounting software) and got them to develop the same software[6] only difference being it would be delivered over the internet. This business

[3] Fast History as described by Clayton Christensen when referring to the disk drive industry as it transitioned form one technology to the next
[4] Professor Clayton Christensen (Harvard Business School) author of many titles including The Innovators Dilemma (HBS Press)
[5] M. Treacy and F Wiersema; The Discipline Of Market Leaders. Perseus Book 1995 p11-13
[6] Now known as Netsuite.com and is not owned by Oracle.

has evolved to become the Netsuite.com application. In December 1999 Bill Gates announced that all software will be delivered as a service over the internet. Many of these initiatives exist today with varied success. What is valid is the prophetic nature of these observation and actions.

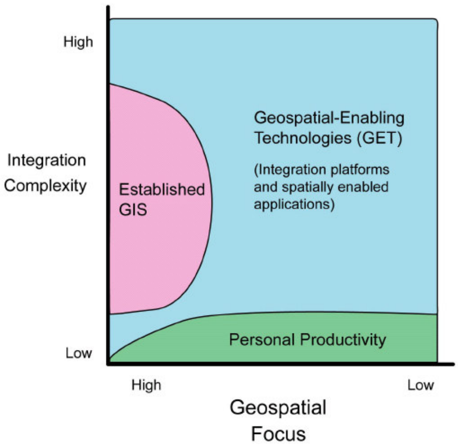
Since 2002, Information Technology Architectures have seen a consolidation phase. The focus has been on Internet delivered solutions and the paramount value of the content of an organisations data is fast becoming a common thread as the pathway forward for many companies. The burst in the dotcom bubble had a negative impact on speculative investment and a positive impact on Information Technology as it established the infrastructure to enable internet based application delivery. During this time there has also been evidence of consolidation in the Spatial Industry, a broadening of the definition of GIS to Spatial, reducing the significance of the G in GIS, absorbing the G into the IS framework, and acknowledgment that the quality of spatial data and its content is paramount.

The focus given to spatial information from database vendors such as Oracle and IBM goes beyond their ability to store the information in a corporate database. Location based services and spatially enabled business applications have created the need to merge spatial queries with business queries resulting in an innovative dimension to reporting on data. IDC reports [7] that a trend exists where users are moving away from proprietary spatial systems in favour of the Open approach. Moreover they note that Oracle currently commands above 90% of the spatial database market share. Our observation is that Oracle leads this sector because of the ease in harmonising spatial data models with other corporate data models based on their implementation of ISO TC211 standard that extends SQL to include spatial capabilities.

***"Our (GIS) customers are now starting to recognize that between 80 % and 90% of what they want to do, they can do with Oracle."***

(Jack Pellicci, Group Vice President of the Business Development Group, Oracle)

Basically, we now have access to data interoperability at the entity level and this foundation opens the data up to a wider range of users. Although this is not stopping the use of any GIS applications, it changes the view from integrating a GIS into business systems to spatially enabling every business system. IDC White Paper[8] suggests this change in mindset extends the value and potential of spatial information. Further, it determines that "*spatially enabled business applications*" are where the productivity and competitive advantages lie for businesses.




Illustrating the potential for spatial information in spatially enabled applications v the current GIS paradigm.

Fig 1.3([9])

What is being suggested is that we are observing the maturation of the old GIS paradigm and the emergence of database driven spatial applications or spatially enabled applications. Further, if this change were having an affect then we should be able to see some sort of signs or market indicators.

Treacy and Wiersema[10] identify the signs of a failing value proposition as "bolt on tactics" or "temporary quick fixes" and they go on to explain this in terms of the "*Road Map to Oblivion*". Simply, the companies which are displaying this type of behaviour have reached a threshold with respect to their current value proposition and in order to maintain revenue growth, include strategies which extend their perceived performance without addressing the real issue of reduced value.

## Road Map to Oblivion

[7] Worldwide Spatial Information Management Forecast 2002-2006 (IDC #26841, May 2002)
[8] IDC White Paper, Jan 2005 Spatial Capabilities for Enterprise Solutions
[9] IDC White Paper, Jan 2005 Spatial Capabilities for Enterprise Solutions
[10] M. Treacy and F Wiersema; The Discipline Of Market Leaders. Perseus Books 1995 p11-13

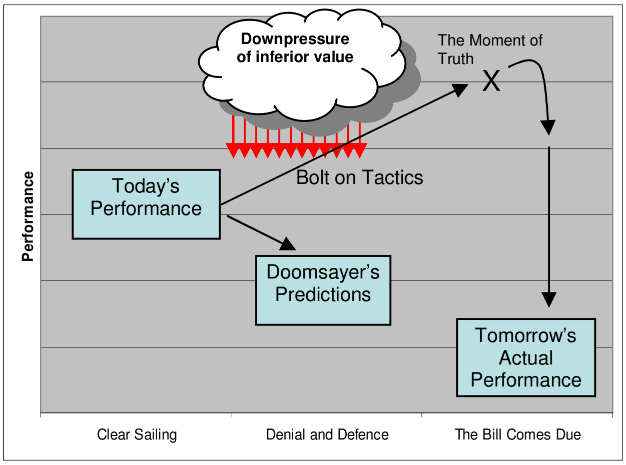



Fig 1.4 (11)

The current market leaders owe growth and repeatable revenue largely to shipping a product. The change to server side analytics and placing spatial information in open standards databases reduces the value proposition of desk top client software.

We observe locally the two market leaders in Australia[11] have in the last three years exhibited market development behaviour that signals downward pressure on their existing revenue streams and product lines that is akin to that described in Treacy and Wiersema. These practises have been heavy discounting (particularly when competing for new business) with one vendor perhaps leading with this as its preferred methodology. This particular vendor has created a licensing program where the suite of products is discounted to an extreme and offered on a "right of use" / "unlimited use" licence to Local Governments, State Governments and Selective Commercial Corporations.

The other vendor has chosen to maintain revenue growth through eliminating their partners/reseller channel and going direct.

Both strategies are significant and interpreted as indicators that the value is shifting away from desk top applications due to some new challenge or shift in value of traditional GIS client software.

## Industry Challenges

Clearly the spatial industry is not immune to change and is currently coming to terms with many challenges which affect the value, user base and application of its technology. These are broadly identified by:

- Low Cost Internet and Intranet Mapping tools (Google, NASA World Wind)
    - user base beyond the limits of any of the mainstream vendors, and,
    - didn't use mainstream vendors (low barrier to entry).
    - Fundamentally changes the user expectation of what web mapping should deliver. The existing vendor web GIS platforms look staid and outdated overnight. This means vendors have to re-engineer their platforms or face user desertion.
- Data
    - Data delivery through tools like Google Earth and NASA World Wind shows that, for the business and consumer markets to embrace the industry, content is of paramount importance. This poses the challenge and opportunity to the Australian industry of how this will be delivered.
- Stale technology stacks
    - offering convoluted product add-ons,
    - upgrades difficult to discern from previous versions, and,
    - Proprietary Cul-de-sacs - proprietary formats to protect the technology stack (vendor

*"Executives whose companies are making lots of money ought not to wonder whether the power to earn attractive profits will shift, but when."*

(Clayton Christensen (Harvard Business School)

*to want to keep control of the technology stack that wants to go in a different direction. And just keep bringing it back in. You can't cross the chasm (by doing that); you need to get out there and start looking at different ways of doing things. "*

(Dr Xavier Lopez, Oracle Corporation)

[11] GIS/Spatial Survey Summary Report 2004/2005 Corporate GIS Consultants Australia Pty Ltd

lock-in).

- 3D (all current GIS vendors have a code base limited to 2D or 2.5D)
  - cadastre, topographical data management and subterranean datasets are demanding 3D management environments, and,
  - Spatial Databases are all capable of storing true 3D data.
- IT departments are consuming GIS
  - applying corporate standards to Spatial Data,
  - opening data to other business applications (enterprise systems),
  - making data more important than the application,
  - taking a Process Solution (GIS) to an Enterprise Solution,
  - enabling true ISO vendor independent Spatial Databases (Oracle, Progress, IBM DB2), and,
  - demanding open Standards - No vendor “lock in”, reducing specialist requirements.

The challenge of the chasm, is not only relevant to the vendors, but facing the industry as a whole. Every practitioner needs to ask how this will impact my future and is my skill base sufficient to meet the challenges of the future.

All of these challenges undermine the value of current GIS applications as they expand the potential user community without the need to utilise the incumbent’s technology. We suggest the greatest threat is the database vendors as they add business value in ways traditional GIS vendors cannot and possible would not. The entry of Microsoft in the open database driven arena, will signal the end of the existing GIS application vendor dominance.

***“…Oracle's move may be disruptive to some established SIM (Spatial Information Management) vendors…”***

(Directions Magazine)

Further, the database vendors are adding value to existing business applications and therefore their client base. So from the database vendor’s point of view this new functionality is incremental or sustaining. They have simply added spatial data types as part of the standard options and enabled access to queries and other database functionality such as security, replication, and cluster architectures. The GIS incumbents find it impossible to justify the development of these technological functions as it either does not add value or is too far removed from their core business. Moreover they do not usually have the resources or capabilities to make these changes, It is likely that the barrier to entry from these traditional players is now impossibly high. Simply it serves no benefit to replicate the business functions in a GIS application and therefore leaves the only sensible option, spatially enabling the business applications.

The change in the Industry is both a threat and an opportunity, as one of the greatest barriers to entry in the market is being removed. A small player can build a new application based on the new technology, without having to resort to huge investment in base technology such as storage, projection etc. The opportunity to leverage the investment of the global IS players present a real opportunity for the spatial industry, especially in Australia to embrace the changes and deliver solutions based on the new paradigm.

The GIS vision has been for ubiquitous mapping everywhere. The IS industry has woken up to the GIS/Mapping arena, and the sheer weight of the IS industry players, will either consume the existing players, or drive them back into the data capture/maintenance niche where GIS began.

## Conclusion

The GIS community is undergoing an evolutionary change from Geographic Information Systems to Spatial Enabled Applications and this is most noticeable in technological requirements as the focus moves from process type applications to enterprise systems.

Evolution is not always smooth and it is possible we are witnessing a significant change in the way spatial systems are valued and implemented.

Simply, the Spatial Industry is going “enterprise” and in doing so will transition to; open structures, open standards and a data centric paradigm.