

The economics and engineering of multi-sided platforms

Introduction

This note proposes using the concept of multi-sidedness to describe the way systems of systems are being used to support new forms of collaboration between end-users. The next section introduces an example of how Apple's iPod Touch and iPhone are being used in this way to create new possibilities for soldiers [1]. The last section provides an analysis of the conceptual foundation of this type of use of technology.

Apple's New Weapon

The U.S. military might acquire an electronic handheld device for the soldier against a specific battlefield requirement, probably at great expense. But the soldier is likely to have many such requirements, which Iraq has shown are likely to evolve rapidly in unexpected ways, given the need of each soldier "to be linked electronically to other troops as well as to weapons systems and intelligence sources. Making sense of the reams of data from satellites, drones and ground sensors cries out for a handheld device that is both versatile and easy to use." [1] p1. The iPod Touch (and to a lesser extent the iPhone) have emerged as the handheld of choice to fulfill this need in innovative ways.

As Lt. Col. Jim Ross, director of the Army's intelligence, electronic warfare and sensors operations in Fort Monmouth, New Jersey, observes: "as the elegantly simple iPods acquire more functionality, soldiers can shed other gadgets. An iPod may be all that they need." [1]p1. The following are some examples quoted of the kinds of collaborative use to which these iPods are being put [1] pp1-2:

- Soldiers can add phrases to language software, annotate maps and link text or voice recordings to photos ("Have you seen this man?"). Apple devices make it easy to shoot, store and play video....
- Since sharing data is particularly important in counterinsurgency operations, the Pentagon is funding technology that makes it easier for the soldier on the ground to acquire information and quickly add it to databases. Next Wave Systems in Indiana, is expected to release iPhone software that would enable a soldier to snap a picture of a street sign and, in a few moments, receive intelligence uploaded by other soldiers (the information would be linked by the words on the street sign). This could include information about local water quality or the name and photograph of a local insurgent sympathizer.
- The U.S. Marine Corps is funding an application for Apple devices that would allow soldiers to upload photographs of detained suspects, along with written reports, into a biometric database. The software could match faces, making it easier to track suspects after they're released.
- Apple iPods are proving to be surprisingly versatile. Software developers and the U.S. Department of Defense are developing military software for iPods that enables soldiers to display aerial video from drones and have teleconferences with intelligence agents halfway across the globe.

The economics of multi-sidedness

This example can be described in terms of the concept of *multi-sided markets* [2]. A multi-sided market is one in which a supplier needs two or more distinct groups of customers who value each other's participation on board the same multi-sided platform in order to generate value [3]:

In the Apple case, the iPod Touch or iPhone is the platform. The soldiers are the customers. The different kinds of collaborating role taken by the soldiers separate them into distinct groups. The value of the platform to the soldiers is its ability to enable the soldiers and the various applications to interoperate in support of what the soldiers are doing, in ways that are determined by the soldiers.

In traditional one-sided markets, suppliers serve different types of customers, but not in ways that include the interactions between the different types of customer. Thus,

An interface device that did not enable the soldier to create valuable interactions with other soldiers would be one-sided.

Economies of scale are economies derived from being able to spread development and production costs over greater volumes, while *economies of scope* are economies derived from having the flexibility to deliver products or services down a variety of different market channels using the same business model. The fact that the U.S. military could use a platform that was already in mass production to supply its soldiers allowed it to benefit from both forms of economy as a result of Apple's prior establishment of the iPod Touch and iPhone.

In multi-sided markets, a supplier's *multi-sided platform* creates economies of scale and scope for its participating customers through its ability to generate savings on the costs of its direct use, the economies of scale and scope coming from the economics and general capabilities of the device itself (in this case the benefits deriving from its prior commercial development, the savings in training as a result of its intuitive interface and familiarity). This is a familiar relationship between suppliers and their customers established through the acquisition process. In addition, however, multi-sided platforms create *economies of alignment* for its participating customers.

The customer's costs of alignment are the costs involved in bringing together just those participants needing to collaborate to meet the customer's need. The multi-sided platform creates economies in these costs of alignment in three ways:

1. Reducing the search costs of finding other types of participant

The connectivities and interoperabilities that the iPod Touch and iPhone make available to the soldier make it possible to set up a collaboration in a fraction of the time and effort that would otherwise be needed, for example in being able to share video with other soldiers.

2. Making audiences of the other types of participant on the platform such that an intermediary can make each type of participant better off through coordinating their demands.

Having enabled the soldier to set up the collaboration, the applications on the platform then add value to the content of the collaboration itself through the way it is designed to support it, for example in how data can be shared as it relates to particular locations.

3. Reducing the costs of collaborating between end-users and complementors.

The costs of collaborating across the platform are significantly less than the costs would be if soldiers had to set up the collaborations themselves.

Thus economies of alignment come from the availability of applications, from the way the device makes their functionality interoperable and sharable, and from the way this makes the collaboration itself between soldiers less costly and more effective (i.e. reducing its *externalities* from the perspective of the supplier). Key issues facing the supplier of these multi-sided platforms are:

1. The pricing structure – how much to charge the participants, depending on the nature of the *direct value* they gain from their interactions with the platform, and *indirect value* they gain from their interactions with others enabled by the platform.
2. The scope of the supplier's platform – the scope of the multi-sidedness that it offers depends on the amount of *horizontal* integration across different types of use, and *vertical* integration across multiple layers of functionality.
3. The economics of supply – the economics of the functions that are core to the multi-sided nature of the market that the platform is supporting.
4. The economics of collaboration – the economics of the collaborations the platform is supporting.

Describing the multi-sidedness of a platform

The role of a supplier's platform in a multi-sided market can be summarized in terms of the following:

- The platform's participants can be divided between *end-users* and *complementors*. A complementor makes particular functionality (e.g. a video camera application, or an encryption tool) available on the platform to be taken up for use by end-users within a particular collaboration, and will have its own supply-chain for positioning its functionality on the platform. The complementors and different types of participant on a supplier's platform together form a *business ecosystem* co-creating value with the platform supplier occupying a key position [4]. Examples of the complementors would be hardware and software providers, mobile network operators, peripheral equipment suppliers, application and content providers. *'Marquee' customers* bring many end-users to a supplier's platform (in the iPod example the U.S. Military), while *'killer apps'* provided by complementors on a platform attract end-users to it (for example iTunes on the iPod).

The iPod example provides many instances of these complementors, including Next Wave Systems, and the applications being funded by the U.S. Marine Corps.

- The *indirect customer situation*, from the perspective of the supplier, is the context in which the end-user puts together a collaboration. This indirect situation needs to be distinguished from the direct customer situations of the end-users (again from the perspective of the supplier) within the collaboration itself.

For example the indirect customer situation might be defined by the need to determine an appropriate response in a stop-and-search incident. The end-users within the collaboration would then be the soldiers needing to exchange information using (for example) a video

application, each of which would be in a direct customer situation from the perspective of the supplier of the platform.

- The particular set of relationships between end-users and complementors that are brought together in a collaboration define a *geometry-of-use*.¹ Thus although there may be very large numbers of possible collaborations between all the end-users and complementors using a multi-sided platform, there will be a limited number of these geometries-of-use that can be supported by the platform, each instance of which becomes a particular '*threading*' of that geometry-of-use in a particular operational situation in a way that meets the particular timing characteristics of the situation within a *synchronization event*.

A particular geometry-of-use might be the ability "to snap a picture of a street sign and, in a few moments, receive intelligence uploaded by other soldiers (the information would be linked by the words on the street sign). This could include information about local water quality or the name and photograph of a local insurgent sympathizer." [1] p1. The synchronization event might be how long the 'few moments' need to be in the given situation.

The role of the multi-sided platform can thus be summarized in terms of the following diagram:

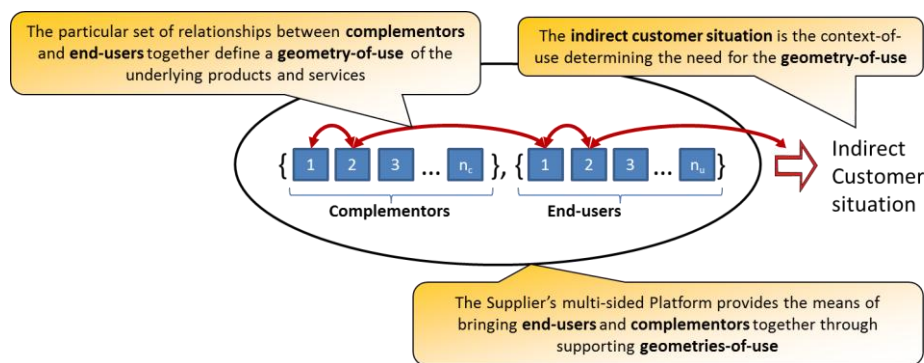


Figure 1: The role of a multi-sided platform

In these terms, the economics of the multi-sided platform will depend on the variety and nature of the indirect customer situations it can be used in support of, defining a multi-sided market. The corresponding nature and variety of geometries-of-use that it can support and their economics will derive from three forms of economy:

1. The economies of scale and scope created by the way the platform aggregates demand across all its participants.
2. The economies of alignment it creates for its participants through enabling them to find participants appropriate to particular geometries-of-use, and through enabling those geometries to work better and more cost-effectively than they would otherwise do.

The role of the multi-sided platform in the lives of its end-users will be limited by the number of geometries-of-use that it can support, with its *agility* being defined by the variety of geometries that it can support at a given *demand tempo*. Whether or not the platform prospers will in turn depend on the

¹ The concept of 'geometry-of-use' is derived from the way aircraft agility depends on 'variable geometry' - see <http://www.asymmetricdesign.com/2006/01/type-iii-agility-in-organisations/>.

economics of how the functions it provides and the collaborations it supports are currently met in the lives of its end-users.

Engineering platforms

A business ecosystem involves very large numbers of end-users and complementors collaborating in very large numbers of different ways. A fundamental policy issue that this raises is concerning the relationship between particular end-users and complementors, including systems of systems that might be designed for use within these complex and changing ecosystems; and the nature and variety of the sets of collaborations within these ecosystems, themselves being fundamentally socio-technical in nature. These collaborations will have costs of alignment associated with them, and the opportunity in engineering multi-sided platforms is to reduce these costs of alignment and increase the depth and variety of collaborations possible.

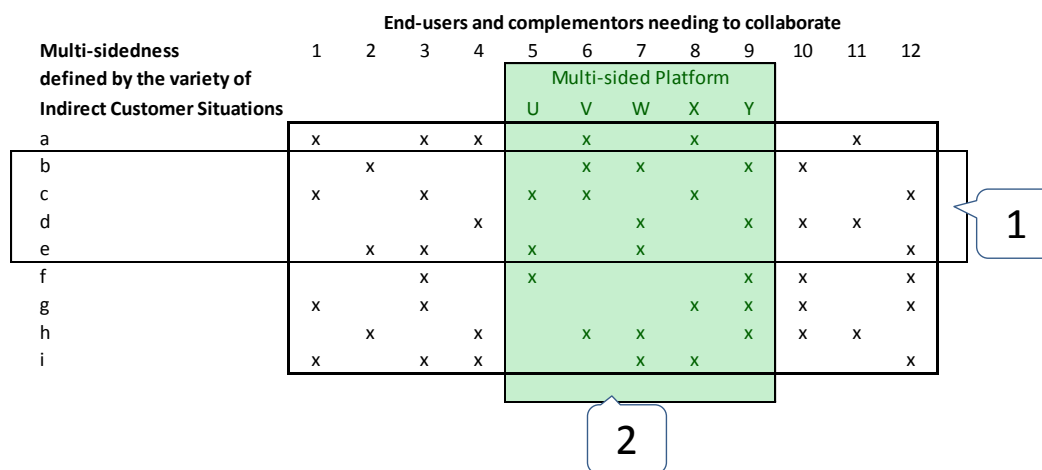


Figure 2: The variety of relationships between end-users and complementors within an ecosystem

Such ecosystems, represented by Figure 2, involve a variety of relationships between end-users and complementors ('1' in the figure). A multi-sided platform can support the development of this ecosystem by creating indirect value amongst its end-users and complementors ('2' in the figure). There would be scope for many such multi-sided platforms, and understanding the economics and engineering of each platform's multi-sidedness would provide an approach to understanding how platforms, suppliers and users could co-evolve within this larger context.

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Glossary

multi-sided

market

– a market in which a supplier needs two or more distinct types of customer who value each other's participation on board the same platform in order to generate value..... 2

business ecosystem - is a set of operationally and managerially independent end-users and complementors who are co-creating value within the context of a multi-sided market..... 4

demand tempo – the tempo at which demands for a new type of geometry-of-use arises. 5

economies

of alignment - economies derived from being able to orchestrate sets of participants in varieties of collaborations 2

of scale - economies derived from greater volumes. 2

of scope- economies derived from being able to deliver services down a variety of market channels. 2

indirect customer situation – the indirect situation from the perspective of the supplier, in response to which an end-user puts together a collaboration. 4

marquee customer – a customer who brings many end-users to a supplier's platform (in the iPod example the U.S. Military). 4

platform

– a platform that supports multi-sided relationships between a supplier and its customers 2

agility – the variety of geometries-of-use that it can support at a given demand tempo. 5

complementor

– a participant in a collaboration making particular functionality (e.g. a video camera application, or an encryption tool) available on the platform to be taken up for use by end-users within that collaboration, with its own supply-chain for positioning its functionality on the platform . 3

killer app – an application on a platform provided by a complementor that attracts end-users to it (for example iTunes on the iPod)..... 4

direct value – the value a participant derives from its direct interactions with the platform..... 3

end-user – a user of the composite performance of a collaboration supported by a platform. 3

externalities – the costs carried by the direct customer of a supplier as a result of using the supplier's service..... 3

geometry-of-use

– the particular set of relationships between complementors and end-users brought together in a collaboration. 4

synchronization event – the composite experience of the threading of a geometry-of-use 4

thread – a particular instance of the use of a geometry-of-use, creating a particular sequencing of events through its operational use..... 4

horizontal scope – the different kinds of connectivity and interaction possible between nodes, complementors, end-users etc. 3

indirect value – the value a participant derives from its interactions with others enabled by the platform. 3

vertical scope – the layering of hardware, middleware and software provided by the platform..... 3

References

1. Sutherland, B., *Apple's New Weapon: To help soldiers make sense of data from drones, satellites and ground sensors, the U.S. military now issues the iPod Touch*, in *Newsweek* 2009.
2. Silverthorne, S., *New Research Explores Multi-Sided Markets: an interview with Andrei Hagiu*, in *Harvard Business School Working Knowledge* 2006. p. <http://hbswk.hbs.edu/item/5237.html>.
3. Evans, D.S., A. Hagiu, and R. Schmalensee, *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries*. 2006, Cambridge: MIT.
4. Iansiti, M. and R. Levien, *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability*. 2004, Boston: Harvard Business School Press.