



UPWARDLY MOBILE III

Mobility Unchained: From Mobile Commerce to the Internet of Things

Citi GPS: Global Perspectives & Solutions

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UPWARDLY MOBILE III

Mobility Unchained: From Mobile Commerce to the Internet of Things

On most any workday morning, we take a lot of things for granted. We assume the alarm clock will ring, the water in the shower will be hot, the car will start, the train will show up on time, the kids will call us at least once before they get on the school bus, we'll arrive at the right location for our first marketing meeting and, if we're lucky, might even have gotten to a new level on Candy Crush before we get there. In short, we're taking it for granted how much of our eventful morning we owe to Mobility — smart electric meters, smart appliances, Connected Cars, rail safety systems, smartphones, navigation, and online gaming — all made possible because of the dramatic growth in the use of mobile computing and connectivity. And this is just the tip of the iceberg. Paying for your Starbucks with your smartphone while reading a news report on a tablet after your Connected Car helped you avoid a traffic jam is a more obvious use of mobile, but with the integration of Mobility growing exponentially and across a many sectors, it will increasingly become the base of our daily living.

In our first Upwardly Mobile report in March 2012, we looked at Mobile Payments and how this technology was a way to “change the payments world” in emerging markets and “change the payments experience” in developed markets. Our second report went a bit further and looked beyond just the Mobile Payment transaction and started to look at Mobile Payments as the facilitator of Mobile Commerce (M-Commerce). In this third report of the Upwardly Mobile series, we go further again and give thought to how Mobility is not just transforming our monetary transactions, but how it is being embedded in almost every industry through the shift of commerce from traditional and electronic to mobile (E2M), the increased use of telematics in vehicle and transportation applications or the introduction of Mobility into Machine-to-Machine (M2M) interactions.

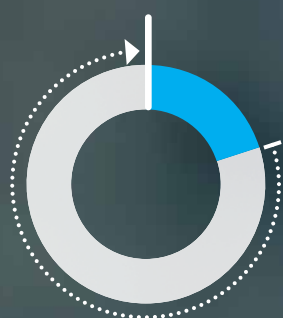
And when we started to look, we found the numbers were pretty staggering. Cisco forecasts the number of connected devices in the world will increase to 50 billion in 2020 from just 500 million in 2013. Mobile retail commerce in the U.S. rose 63% to \$34 billion in 2013 and has risen to almost 13% of all E-Commerce sales, up from just 9% in 2012 and Amazon noted that half of their customers shopped using a mobile device during the 2013 holiday season in the U.S. Revenues in commercial fleet telematics are expected to rise nearly four-fold to ~\$27 billion by 2018 and estimates for revenue in the M2M space range as high as \$1.2 trillion by 2022.

We were also surprised by the breadth of sectors that are being influenced by the proliferation of Mobility. In the same way that E-Commerce strategies were a ‘must have’ over the last few decades as the Internet came alive, the rise of M-Commerce is forcing corporations to shift their strategies to accommodate mobile. Telematics has moved beyond just GPS in a car, to rail safety and insurance pricing. In the M2M space, we found examples of Mobility in traditional manufacturing through areas such as robotics, process controls and white goods appliances, as well as in non-manufacturing sectors such as healthcare, mining, agriculture, utilities and home security. In each of the three Mobility verticals (E2M, Telematics and M2M), we explore not only the ‘use cases’ for Mobility and how each sector is implementing mobile solutions, but also identify the ‘enablers’ that will create the infrastructure for Mobility to be implemented.

Mobility

Quantifying the Opportunity

M2M REVENUE OPPORTUNITY -
THERE IS A BIG RANGE OF FORECASTS



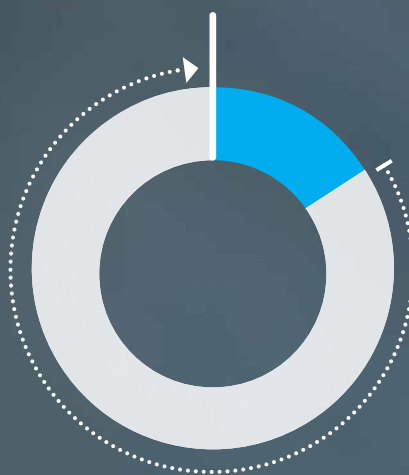
2013 \$45 billion
2022 \$242 billion

Source: Strategy Analytics



2012 \$15 billion
2017 \$31 billion

Source: Infonetics Research



2013 \$200 billion
2022 \$1.2 trillion

Source: Mechanica Research

NUMBER OF CONNECTED DEVICES

Connected Devices



Population



Connected Device/Person



| | | | |
|--------------|-------------|-------------|------|
| 2003 | 0.5 billion | 6.3 billion | 0.08 |
| 2010 | 2.5 billion | 6.8 billion | 1.84 |
| 2015E | 25 billion | 7.2 billion | 3.47 |
| 2020E | 50 billion | 7.6 billion | 6.58 |

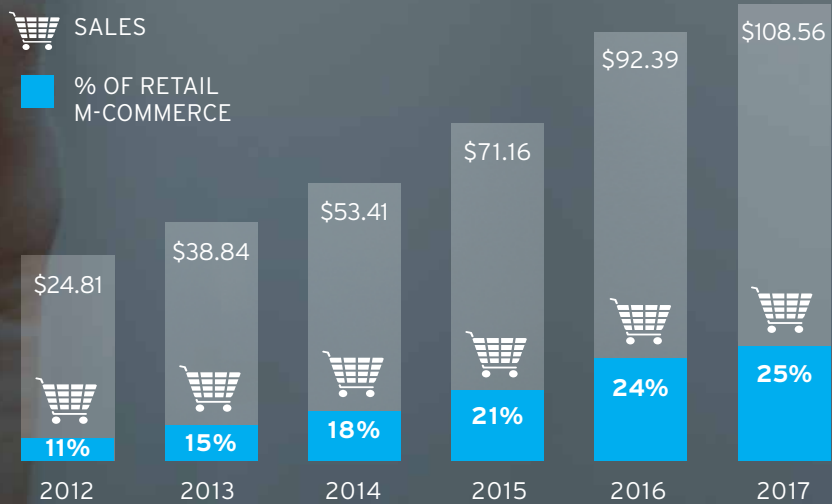
Source: Cisco

COMMERCIAL FLEET TELEMATICS MARKET



Source: ABI Research

U.S. MOBILE COMMERCE SALES VIA SMARTPHONE AND TABLET



Source: eMarketer

Mobility Unchained

The growth of mobile computing and connectivity is a defining attribute of our time...

...and the rise of the “Internet of Things” is another potent force

There could be almost 50 billion devices connected to the Internet by 2020

And these devices generate a lot of data

The dramatic global growth in the use of mobile computing and connectivity is one of the defining attributes of our time. The most obvious manifestation of this is the proliferation of mobile phones and tablets and the simultaneous and exponential growth in their usage to connect to other humans as well as to systems and applications. The use of a mobile phone for “showrooming”, paying for a coffee or a train ticket and mobile gaming are existing examples of consumer-based Mobile Internet usage, though our belief is we have only scratched the surface in terms of use cases. But such consumer-led usage of mobile devices is not the only manifestation of the rising integration of Mobility into our everyday existence.

The rise of what has been called the “Internet of Things” or the “Industrial Internet” is another potent force. While there are many definitions for the term, the concept revolves around embedded devices that can sense and/or measure (various) criteria and communicate with other devices and/or humans, often using the same Internet Protocol that the “Internet of People” uses. Telematics is a broad use-case, with widespread usage for navigation (i.e. GPS), transportation and insurance. New generations of Machine-to-Machine (M2M) applications represent another broad group of use-cases. This has truly diverse applicability, with examples in Machinery (intrusion detection for safety), Healthcare (remote patient monitoring) and Mining (unmanned mining dump trucks), just to name a few industry verticals.

The sheer breadth of Mobility applications can be daunting. After all, we are talking about ~25 billion devices connected to the Internet by 2015 and ~50 billion by 2020 (Source: Cisco). And let us not forget that there are nearly 6.8 billion SIM-enabled connections across 3.2 billion subscribers in the world today (Source: GSMA). Consumers as well as corporations will be affected by the growth of Mobility. Many large industries are already seeing the impact – Retail, Manufacturing, Healthcare and Banking come readily to mind. We are in the early stages of a multi-year process, of course, which implies that the Technology, Telecom, Internet and other sectors have an opportunity in terms of enabling this roll-out. We would not always expect the impact to be revolutionary and it will not always involve the disintermediation of existing players although such fears are bound to arise, and in some cases a multi-year erosion of existing markets is possible.

Due to the breadth, depth and multi-year nature of the impact, we believe a framework document that answers the following questions should add value.

1. Is there a comprehensive way to classify or represent the diverse ways in which Mobility affects different industry participants?
2. Which companies and industry verticals are enabling the rise in Mobility applications?
3. How do the emerging paradigms work? Is it an incremental impact or can it be game-changing? What are some use cases?
4. Which industry verticals might be affected by the rise in Mobility in its various forms? To what extent might these industry verticals be affected?

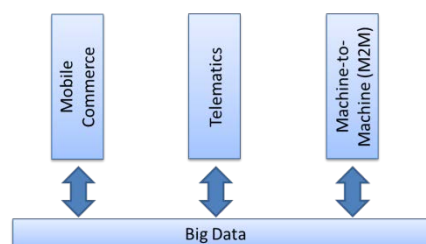
The growth of Mobility drives another coincident trend – dramatic growth in the amount of data generated by these mobile devices. Already, the volume of mobile broadband traffic has been doubling every year, reaching 1,577 Petabytes per month in 2013 (Source: Cisco). While not the primary objective of this report, clearly “Big Data” is an important related trend that we briefly address in the report.

Mobility Market Classification

The complex Mobility market perhaps is best classified by asking a few simple questions: Who uses mobile devices? To what end? What types of devices already exist? Which new devices and use cases can be envisioned?

The answers to these basic questions lead to a number of insights and eventually to our classification – illustrated below – which we use to structure this report into four basic segments.

Figure 1. Mobility – Form Factors and Scope



Source: Citi Research

1. **The Growth of Mobile Commerce** – we term this E2M, which represents the morphing of E-Commerce (as well as old-fashioned offline / physical commerce) into M-Commerce.
2. **The Evolution of Telematics** – it started with vehicle safety applications but improved mobile computing, connectivity and human-machine interfaces (HMI) should lead to a broad suite of vehicle, insurance and transportation applications.
3. **The Next Generation of Machine-to-Machine (M2M)** – we are moving from basic process automation and threshold measurement towards the “Internet of Things” or the “Industrial Internet”.
4. **Big Data** – the logical follow-through – The world’s data archive is doubled every 1.2 Years. True insights can follow from this.

Insights about Mobility

Insight #1 – Everybody and Everything, Connected? Why Not!

People and things can use mobile to connect to other people and things

People (Consumers) and/or Things (inanimate objects, e.g., machines) can use mobile devices to connect to (communicate with) other people and/or things. Figure 2 below shows some use case attributes.

Figure 2. Mobility Application Types: M-Commerce, Telematics and M2M

| Mobility Type? | Mobile Commerce | | Telematics Machine-to-Machine (M2M) | | | |
|--|---|--------------|--|-----------------------------------|-------------------|--|
| | ← a/k/a Industrial Internet a/k/a The Internet of Things → | | | | | |
| User? | Human | | | Machine / System | | |
| Connected Device Example? | Mobile Phone | Game Console | GPS | Controller Gyroscope Sensor | | |
| Application Example? | Phone Call | Gaming | Navigation | Home Automation | Process Control | |
| | Social Network | Shopping | Insurance | Smart Metering | Industrial Safety | |
| | | Search | | Remote Health | Mining | |
| Level of Interaction? Man ↔ Machine | More Human | | Significant Man-Machine Interface | | More Machine | |

Source: Citi Research

Examples of mobile devices are widespread.

- *Mobile devices that people directly use include mobile phones, game consoles, fitness monitoring devices, Point-of-Sale devices, GPS devices, etc.*
- *Mobile devices that “things” use include smart meters for parking or for utilities, Remote controllers for drones or for manufacturing, GPS devices, remote safety monitoring devices, remote health monitoring, Connected Home, etc.*

The purpose of these mobile devices is typically to share data, information or ideas – either consumer or industrial data. The sharing of such data can constitute a transaction. Sometimes, such a transaction can have explicit monetary value (Mobile Commerce or M-Commerce). Sometimes, the shared information or data is used to control an industrial or other process – in this instance, it might not have immediate measurable value but it is part of a value-creating process.

Some examples may help clarify this point.

- *A GPS device used by a driver measures or calibrates progress towards a geographical goal and communicates this information to the driver.*
- *Machine-to-Machine (M2M) technology can be used to intelligently control an industrial process – i.e., monitor and communicate heat exchanger data for improved energy efficiency or measure temperature in a boiler tube and wirelessly trigger preventive action to prevent hot spots from bursting.*
- *A consumer phone or tablet communicates credit card and order information to a merchant website in order to process an M-Commerce transaction.*

Insight #2 – Mobility Apps Range from Human-led to Autonomous

The level of direct human involvement in Mobility can vary, based on the objective of the device. There is a varying level of man-machine interaction (it is probably too early to call this a man-machine interface, in most cases). At one end of the spectrum, humans provide key inputs to the mobile transaction. At the other end of the spectrum, we have machines communicating with other machines using the same IP network used for voice-based communication.

Some examples and detail may help clarify this point.

- *Voice conversations and the exchange of thoughts, ideas, images, etc., between humans is an example of the “all human” end of the man-machine interaction spectrum.*
- *Voice-based transactions can be between a human and a computer system — for example when we communicate with an interactive voice response (IVR) system or when we use a voice-based search.*
- *An insurance company may use data collected and communicated by a GPS device to recommend an insurance premium. This is an example of an interim point where some human input combines with a lot of M2M communication.*
- *Using embedded sensors to relay aircraft engine data such as temperature and vibration to predict part failure and suggest preventive maintenance is clearly more on the “machine side” of the interaction.*

Interaction with mobile can be man-machine, or machine-machine

In Dec-2013, Incapsula reported that 61% of all web traffic was generated by (good and bad) bots. So, even the “human” end of the spectrum is not all human!

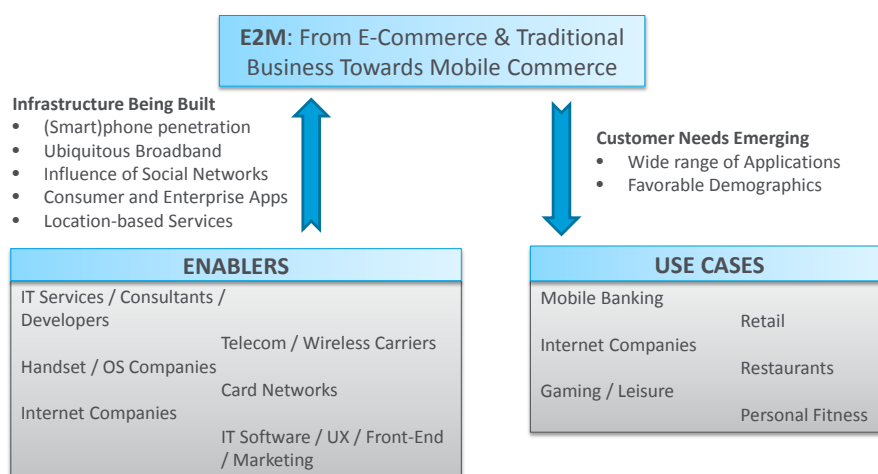
Insight #3 – Mobility Enhances the Entire Commerce Value-Chain

Transitioning from “E” to “M” is the new trend

We call the transition to Mobile Commerce “E2M”. The starting point (“E”) is often the desktop-based E-Commerce website while “M” represents M-Commerce. In many parts of the world, businesses and consumers are leapfrogging from the physical / offline world straight to mobile without the interim E-Commerce stop – that move is incorporated in our “E2M” vision as well.

Figure 3 below illustrates the various facets of “E2M”. The trend is coming alive due to the existence of key enablers that are making the requisite technology investments, whether in broadband or in more advanced handsets or in consumer and enterprise apps. Of course, this trend is exhibiting “legs” because customer needs are being met.

Figure 3. M-Commerce Enablers and Use Cases



Source: Citi Research

Retail and Banking seem to be the more advanced use cases.

- **Retail:** There are many examples and statistics of how consumers use their mobile devices to comparison shop and find out more about the products while they are in a store – popularly known as “showrooming”. For a while this was widely viewed as a negative development for retailers, but now some examples have begun to emerge of retailers who have adapted successfully to the trend. According to a May 2013 ComScore survey, the average top 50 retailer can extend their desktop audience by 45% by addressing the mobile-only customer.
- **Banking and Financial Services:** It may seem that banks are more protected from the competitive threats from technology and other companies due to regulatory reasons, but the risks are real. It seems banks realize both the risk and the opportunity — both Aite and Ovum report that in 2014 bank information technology (IT) budgets will focus on mobile banking features. Beyond this, bank IT investments include “digital wallet”, “omnichannel” and customer-data analytics, all of which have strong mobile commerce connotations.
- **Payments:** This is a lucrative function for most financial institutions and it is no surprise that payments profitability serves as a beacon for a wide range of non-financial entities including telecom companies and Internet companies.

Vehicle safety is one driver of Telematics, but new consumer applications are driving adoption

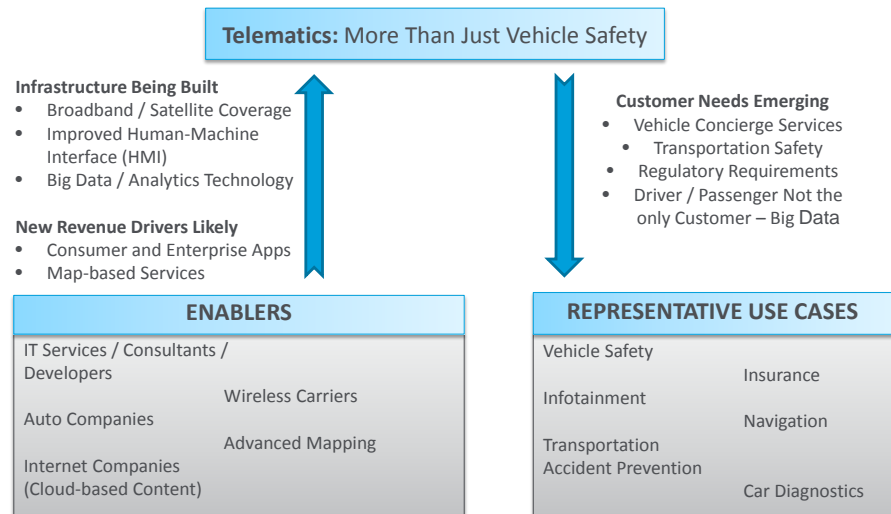
M-Commerce initiatives are of interest to entities far beyond Banks and Retail. We explore several other use cases, including (quick-service) restaurants and gaming companies.

Insight #4 – Telematics is Evolving far beyond Vehicle Safety

The most well-known “legacy” example of Telematics is in the Automotive industry, where it was first used by General Motors (GM) as a vehicle safety application. If a GM vehicle with this system – called OnStar – was involved in an accident or if the driver was in distress, external help could be sent to them at their request.

Today, for a variety of reasons – regulatory change, technological advances in user experience and communications and consumer demand for concierge services and infotainment – Telematics is growing far beyond its vehicle safety roots. In fact, these new applications have spread beyond the Automotive industry, with broader Insurance and Transportation use case deployment just a matter of time.

Figure 4. Telematics Enablers and Use Cases



Source: Citi Research

Within the Automotive industry, the use of Telematics is evolving in various ways.

- *It is becoming more ubiquitous as more Auto manufacturers (OEMs) provide the choice on more models in more countries.*
- *The range of applications is changing from safety to navigation / traffic to Infotainment to concierge services.*
- *The underlying systems are becoming more open and consumer-driven – in the past, systems were more likely to be embedded and the consumer’s only choice may have been whether or not to have it turned on.*

New applications are emerging in the Transportation industry and in Insurance.

- *ABI Research forecasts that revenues in the commercial fleet telematics market will rise to \$26.8 billion in 2018 from \$7.25 billion in 2012.*

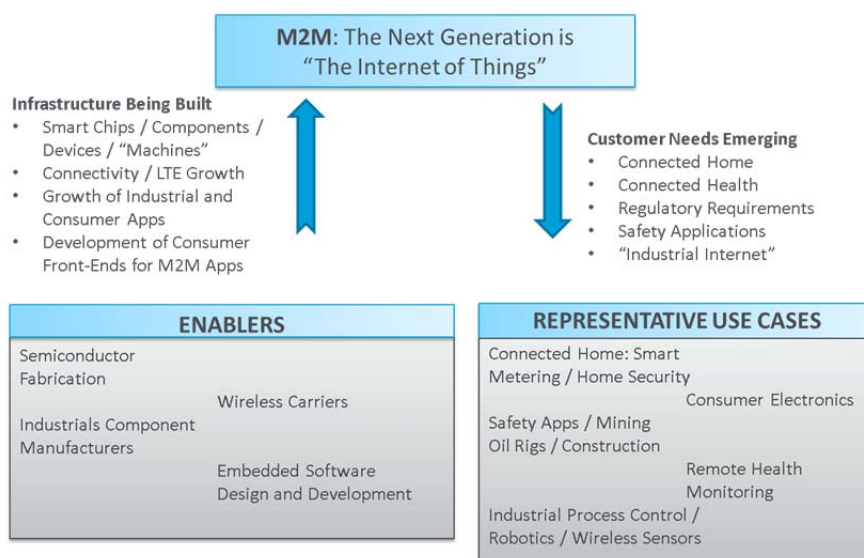
- There is considerable ongoing investment in Fleet Telematics: (i) Danaher Corp., recently acquired Teletrac (TrafficMaster) from Vector Capital; (ii) Qualcomm sold Omnitracs to Vista Equity for \$800 million in cash; (iii) Fleetmatics, a leading provider of software-as-a-service (SaaS)-based fleet management solutions for small and mid-sized businesses reached its 400,000 subscribed vehicle threshold in 2013; (iv) Francisco Partners has invested in the creation of UK-based Masternaut, a leader in Europe in the area of commercial vehicle asset tracking and mobile workforce solutions, with clients like Serco, Ryder and British Airways; and (v) Verizon's acquisition of Hughes Telematics was for Automotive as well as Fleet Telematics.
- Leading strategy consultant Boston Consulting Group (BCG) said in December 2013 that more than 70 insurers worldwide offer telematics-based insurance programs. While overall penetration is less than 1% so far, interest is high.
- Consultant Towers Watson has launched a strategic alliance with Hughes Telematics in North America and Vodafone outside North America for its usage-based insurance data services practice. AIG Europe is signed up for a pilot.

Insight #5 – What's Next for M2M? It's Time for the Internet of Things

Computing power and the level of wireless connectivity of devices is increasing

Specific to M2M transactions, it is important to note that early versions of M2M technology have existed for many years. What is new recently is that the computing power and level of wireless connectivity of these devices is increasing at a very rapid rate. Also these devices are increasingly connected to the Internet, which opens up a range of application possibilities that can benefit from a better man-machine interface.

Figure 5. M2M Enablers and Use Cases

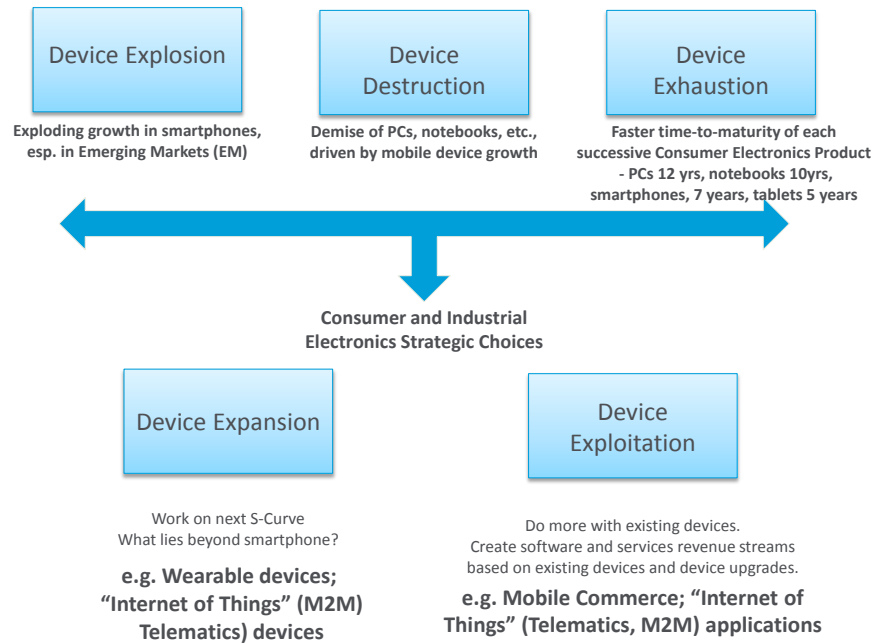


Source: Citi Research

Insight #6 – Déjà vu for a Device Cycle

Citi has written about the "State of Devices" for over a year, and followed through the various phases of device life. Mobility is at the core of these themes. The figure below shows that Mobility is likely to continue to be at the heart of future growth for both consumer and industrial applications.

Figure 6. Mobility Should Continue to be at the Heart of Important Industry Developments



Source: Citi Research

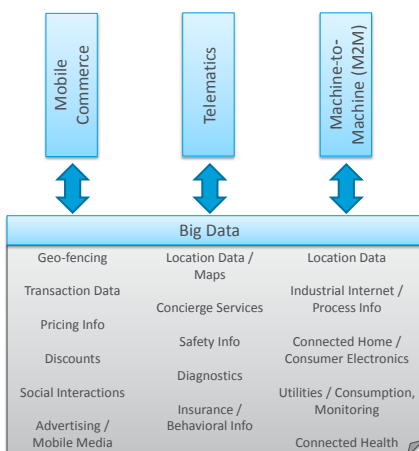
We note a similar cycle happened with personal computers (PCs) about 10-15 years ago, when rapid increments in processing power drove PC demand, but then we had to wait for software and services to catch up to the potential. Eventually, we got there due to the rise of E-Commerce and cloud computing. Mobile Computing is in the process of going through some of the stages reflected in Figure 6 – already handset manufacturers are investing in both the Device Expansion and Device Exploitation stages mentioned above.

Insight #7 – Big Data Insights are the Logical Follow-through

Billions of people (consumers) use billions of devices to communicate and transact. Specifically, we generate over 2.5 quintillion bytes every day (or the equivalent of 57.5 billion 32GB tablets) from consumer transactions, communication devices, online behavior and streaming services. Additionally, connected machines (whether in a telematics-based or an industrial-based environment) generate and transmit data. Cumulatively, across people and machines, this represents a treasure trove of information, even when we consider that this data is in many different silos.

The concept and reality of Mobility is that it dramatically increases the reach and scope of information that can be tracked and insights that can be gained.

Figure 7. Mobility Enhances Big Data Scope



Source: Citi Research

We are in the midst of a paradigm shift in how businesses and governments operate with Mobile Commerce increasing

M-Commerce is NOT the same as mobile payments. Our prior mobile payments reports ([Upwardly Mobile](#) and [Upwardly Mobile II](#)) note that the specific payment transaction, while it could be done with a mobile device, was only a small part of the overall commerce value-chain.

E2M – Path to Mobile Commerce

Mobility can enable a significant paradigm shift in terms of how a wide range of businesses and governments operate. We envision that the process these entities went through about 12-18 years ago as the Internet became a bigger part of our lives, will likely be repeated – this time with mobile. Said another way, developed markets (DM) spent the last 12-18 years going “E” (as in E-Commerce) from a primarily physical world and over the next 5-7 years we will likely transition rapidly to “M” (as in M-Commerce). At the same time we recognize that there are many markets, for example China, that are leapfrogging directly to a “primarily mobile” world from a physical world. Regardless of where we are coming from, we know Mobility is a crucial part of how we will transact in the future.

The list of vertical industries and commerce functions affected by this transition to M-Commerce is a long one – Retail has increasingly gone mobile; a Mobile banking presence is already a reality for many banks and the functionality available within it is increasing; quick-service restaurants are adopting the trend; consumer finance functions, including mobile money transfer, are a crucial part of the change. Gaming, recreation, toys, lodging, health and fitness are some other areas where Mobility applications can be an important driver of change.

What is Mobile Commerce?

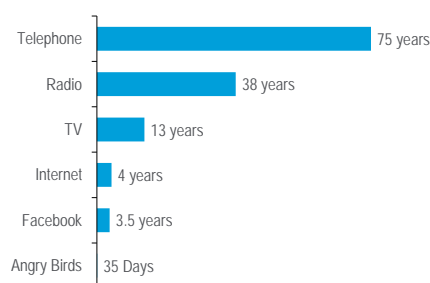
Mobile Commerce (M-Commerce) is the means by which digital or electronic commerce is enabled over a mobile device. We view M-Commerce broadly — so it is not just the purchase transaction — rather it also includes the comprehensive range of activities before and after the (prospective) buying or selling of goods or services.

Why Should We Care about M-Commerce?

The following anecdotal evidence should highlight the importance of this emerging M-Commerce trend. Clearly, this is a trend with plenty of traction – Figure 8 highlights the speed of change – and it is affecting many large industry verticals.

M-Commerce represents change, and with change there is often some level of disruption. But incumbents who embrace the change can stay relevant and even increase their market opportunity – witness the point on “show rooming” below, as it demonstrates that traditional retailers can use M-Commerce investments to their advantage.

Figure 8. Time to Reach 50 Million Users



Source: Citi Digital Strategy Team

- Nielsen reported that 91% of U.S. consumers have their phone within arm's reach 24/7. ComScore said in August 2013 that one-third of U.S. monthly visitors to the average digital retailer website come exclusively on mobile platforms.
- IBM Digital Analytics Benchmark indicated that during the fourth quarter of 2013 online sales were up ~10% year over year versus 2012 and mobile accounted for 35% of all online shopping traffic — a 40% increase versus the fourth quarter of 2012. Leading “mobile” product categories seem to be health and beauty (online up ~15% year-on-year while mobile sales grew by ~82%) and apparel (online up ~10% year-on-year but mobile sales grew ~55%). On the other hand, home goods experienced a faster growth online than mobile (~46% vs. ~38% year-on-year).

- According to a January 2013 report from Pew, 46% of “showrooming” shoppers still ended up making a purchase in-store in 2012, an 11-point increase from 2011.
- According to Internet Retailer magazine, in 2013 mobile retail commerce in the U.S. was approximately \$34 billion, up ~63% from ~\$21 billion in 2012. Mobile retail was likely 12%-13% of all U.S. E-Commerce sales, up from just more than 9% in 2012, according to the Mobile 500. The same magazine also publishes a global “Mobile 500” list of retailers that have adopted mobile commerce strategies — the 107 European merchants on the list expected combined mobile sales growth of 103% in 2013 to \$4.44 billion, and the 19 Asian merchants ranked in the Mobile 500 expected ~85% growth to about \$527.5 million.
- More than half of Amazon customers shopped using a mobile device during the 2013 holiday season, (between U.S. Thanksgiving and Christmas). Amazon shipped to 185 countries during this period.

How is Mobile Commerce Enabled?

The simplicity of transferring money via a phone or paying for coffee using a mobile phone belies the underlying complexity of everything that needs to happen to enable the M-Commerce transaction.

Figure 9 to the left illustrates the number of players that can be involved.

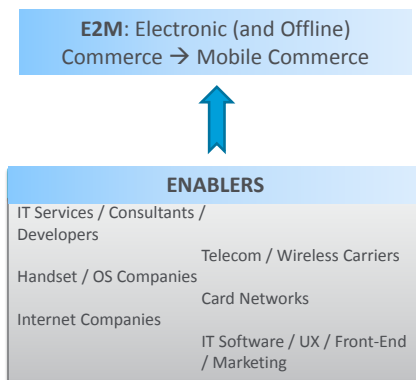
IT Services – Ideate and Build the Mobile Interface

It is a safe assumption that a majority of companies in a multitude of industry verticals need to figure out how the rise of the Mobility trend will affect them – are there risks to be mitigated or opportunities to be seized? How should the go-to-market or operating strategy of a corporation change to adapt to mobile? Is this merely a technology adaptation or a deeper business adaptation? It is no wonder that nearly every business and technology consultant has tried to seize the high ground with advice, white papers and early case studies on the trend. Mobile (and the associated) growth of social networks represent a solid growth area for most consulting organizations.

Once advice is given, it needs to be implemented as well. It starts with pilot implementations and different industries are at different points in terms of implementation maturity.

There is a lot of work to be done, both external- and internal-facing from an IT Service client's standpoint: (i) Marketing and sales systems need to be adapted for mobile devices, not just from the standpoint of a different form factor but also to account for the behavioral and capability differences that mobile devices have. E-Commerce systems need to be re-thought from a “mobile first” lens; (ii) For situations where clients interact currently using offline means or a desktop – for example, if forms need to be filled or client information needs to be collected – the process needs to be redone with a mobile interface in mind; (iii) Enterprise resource planning (ERP) systems need to adapt to the growth of mobile; (iv) Supply chain systems must adapt to exploit Mobility; (v) Payment systems may need to be re-configured for Mobility; (vi) Employee-facing systems may also need to change to provide employees the choice of mobile interaction – this could prove increasingly important for the younger demographic. In other words, significant portions of existing IT systems must adapt.

Figure 9. M-Commerce Enablers



Source: Citi Research

IT Service clients are doing a lot of work on M-Commerce

Almost every IT company in the market has a strategy and desire to exploit this growth opportunity. We provide some representative examples below.

- *Global utility GDF Suez used Accenture and Microsoft expertise to implement a mobile information system for field technicians that resulted in a substantial reduction in administrative processing time for service-call reports, and a major increase in field-force productivity.*
- *Bharti Airtel, an integrated telecommunications company with operations in 19 countries across Asia and Africa, is working with Infosys as its technology partner for ‘airtel money’, a mobile wallet service.*
- *Bank IT provider Fidelity National Information Services indicated in mid-2013 that it was already supporting 20 million customers with its mobile banking solutions.*
- *IBM and Monitise announced an agreement with Visa Europe in September 2013 to provide Visa Europe’s member banks with new mobile banking, payment and commerce services. IBM’s primary contribution is its MobileFirst suite of solutions – both for software and for support services.*

While E2M (the transition to M-Commerce) can prove to be a large and lucrative opportunity, we believe Services companies need to invest in developing solutions for this market. Also, we believe that in many organizations, the buyer for these “omnichannel” services is different from the Chief Information or Technology Officer – so these Services companies must invest in new relationships with heads of business units as well as Chief Marketing Officers, who often are more vested in such transformational initiatives.

IT Software – Tools to Build and Run the Website

Tools need to be built to run M-Commerce front-ends

IT Software companies have invested in developing tools for “mobile first” front-ends as well as marketing software that can exploit the unique attributes of a mobile device.

“Mobile First” Front-Ends

For E2M to become a reality, commerce front-ends and underlying platforms need to be “Mobile First”, driven by software that can streamline browsing, transacting, and sharing via social networks. This is similar to the transition that happened beginning in the late 1990s from applications that were client-server (or proprietary) to applications that were web- or open standards-based. “Mobile First” has the positive externality of also helping to simplify web-based interfaces and it is likely that, over time, companies with a more elegant front-end will gain share in both M-Commerce and E-Commerce.

There have been significant advances in this area over the last two years, as the number of legitimate mobile platforms have narrowed (iOS and Android are now clear leaders) and various technologies have emerged that give a variety of suitable alternatives around user-experience (UX).

Commerce front-ends can be platform-agnostic or platform-specific in a write-once, deploy-many way. They can also be (i) native to the mobile platform, which can be optimized, thereby deeply leveraging the capabilities of that platform – but this requires separate development for each platform; or (ii) mobile web, which is standards based and inherently cross-platform, but also less feature rich than native. It is likely that a variety of hybrid technologies will ultimately prevail in the mainstream as platforms mature, enabling rich experiences but also efficiently “write-once, run-many”.

Public software companies have been investing in “Mobile First” platforms, including salesforce.com (with its recently extended salesforce1 as well as Heroku), SAP’s acquisition of Sybase (mobile assets include Sybase Unwired, 365), Adobe’s various efforts (PhoneGap, Flash and UI design tools), and PegaSystems’ recent acquisition of Antenna. Private players include Verivo (an Antenna competitor focused on extending existing enterprise applications to mobile platforms) as well as Appcelerator and Sencha (focused on new mobile apps).

1:1 Marketing Software

Marketing changes in a mobile world as well

Marketing organizations are growing in sophistication in their marketing efforts. Previous marketing campaigns were run with software that tracked ad spending and campaign spending. New marketing software is focused on:

- **Adapting to “Omni-Channel”** – New marketing software is more focused on optimizing marketing spend across all online mediums (including web, email, mobile app, search, display, social, etc.) instead of just tracking ad and campaign spending.
- **Greater focus on automation and enabling campaigns** – Campaigns today are run with extreme sophistication with (i) A/B testing (randomized experiments with A and B variants); (ii) automated campaign flows (e.g. email the customer if their coupon is about to expire and they have something in their shopping cart); and (iii) lead scoring (have a sales rep call them if they download a whitepaper).
- **Taking greater advantage of the specific attributes of Mobile** – Mobile extends the reach of marketing automation by (i) driving a deeper connection with users, as the phone is a more “personal device” than a PC and is location-aware; and (ii) creating a bigger trove of data to mine, since a phone is a more dynamic “sensor” than a PC).
 - *For example, American Express’ mobile app sends alerts whenever a customer transacts near a location where the customer has previously clipped a coupon via Twitter, and American Express can mine the information available on FourSquare or Instagram to understand where a customer is likely to be or what they are likely to purchase.*

The trend of marketing dollars moving online is not new, and while Mobile can be viewed as a continuation of this trend, it remains to be seen how incremental “mobile marketing” is on top of “online marketing”. There is considerable industry data which shows that consumers with mobile devices shop and spend more online than those that don’t have “smart” mobile devices (phones and tablets)¹. We expect that a customer targeted through the richness of mobile marketing will be of more value than a web-only user. As the capabilities of mobile devices continue to advance, this trend is likely to escalate.

Key public players in the 1:1 marketing software space include salesforce.com (Marketing Cloud including ExactTarget), Oracle (Art Technology Group assets acquired by Oracle and Eloqua), and Adobe (Marketing Cloud including Omniture).

¹ Explored further in [2013 State of Devices - Device Exhaustion Setting In; Upgrades Should Drive Smartphone Q4](#)

Telecom operators are using M-Commerce as a new source of revenue

Telecom – Connectivity and Newer Revenue Streams

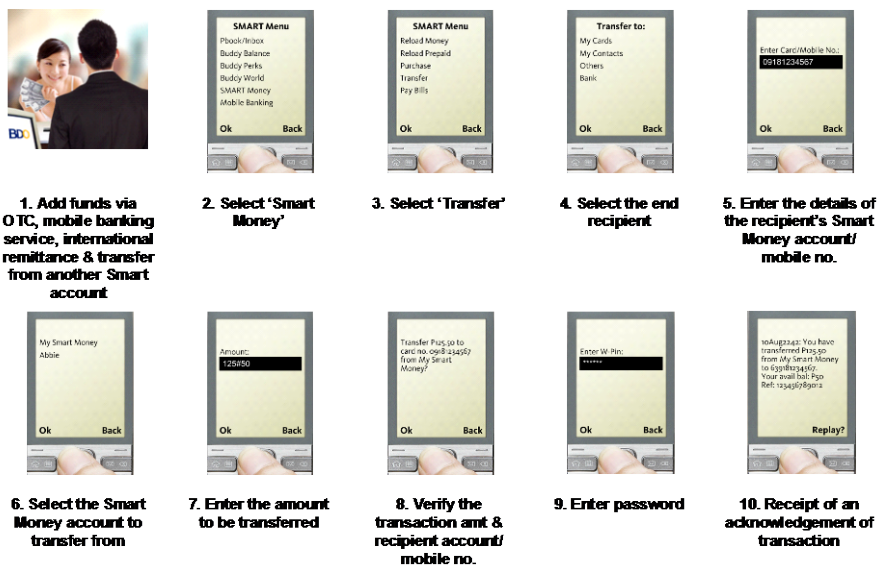
The heart of anything “mobile” is the telecom’s relationship with their subscriber. The possibility of extending a telecom companies revenue stream beyond traditional voice/data service revenues into areas such as mobile money / financial inclusion or as a mobile commerce service facilitator is very promising.

The strategies for telecom operators are very distinct between emerging markets and developed markets. In an emerging market such as the Philippines or Kenya, a telecom can act as key enablers of financial inclusion. Due to the extensive penetration of their distribution network penetration, they can reach all the way down to the neighborhood level in any geography.

- The m-Pesa mobile wallet and remittance example in Kenya is well known. Vodafone is attempting to transplant its mobile wallet success (via Safari Telecom in Kenya) in other countries today. Similarly, Globe and SMART have mobile payment services in the Philippines, Telenor has them in Pakistan, MTN has them in various parts of Africa and Millicom has them in Central and Latin America. Essentially all of these services allow consumers to utilize mobile virtual wallets for services such as airtime top-ups, remittances and P2P services with the main touch points starting and/or ending with the telecom’s distribution platform.

In emerging markets where banking penetration is particularly low, the proliferation of these mobile wallet services has proven to be an opportunity for the telecom companies. Mobile users can store and transfer/transact value from their mobile wallets in a secure manner. Telecoms have monetized this with minor transaction fees and/or churn reduction. Consumers on the other hand benefit from the convenience offered by secured mobile wallets/remittance services.

Figure 10. SMART Money Transfer Process Flow – Remittance



Source: Citi Research, PLDT/Smart Communications

Within developed markets however, telecom companies can find the entrenched nature of the competition and regulatory barriers far more difficult to overcome. In such a situation, rather than function as the network and start with basic remittance services, a wireless provider could focus more on mobile banking and wallets as solutions. The high level of smartphone penetration in developed markets could allow a telecom provider to host Near-Field Communication (NFC)-based or app/web-based solutions for mobile commerce. Monetization in such instances is more difficult as the value is likely to be captured by entrenched third-party providers.

Handset (and OS) Manufacturers – Content and Hardware

Handset and operating system (OS) manufacturers are key enablers in creating an environment that encourages M-Commerce

It is safe to say that most smartphone owners closely associate their device – whether Apple iPhone or an Android phone or a tablet – as the primary enabler of the mobile transactions that are done on the device. The content that is purchased through Apple's App Store or Google or an independent provider constitutes one basis for the growth of M-Commerce.

Android already has a ~52% share in smartphones. However, December 2013 data from IBM suggests that Android online spend is lower than iOS. This is partly explained by the demographics of device ownership – Apple owners tend to earn more than Android device owners – and partly by a legacy developer tendency to develop apps for Apple iOS first, although this could gradually fade away. Also, part of the issue was that the study may not have captured commerce-related activities such as searches, “showrooming” and game downloads. Regardless, we believe that Apple as well as handset manufacturers like Samsung and LG are key enablers of creating an environment that encourages M-Commerce.

- *Apple sold \$10 billion of apps in 2013 alone, and has sold at least \$21 billion of apps since the store was opened in 2008.*
- *Recent Apple advances such as its 2013 introduction of a 64-bit chip (enables much faster data processing) and the Touch ID biometric scanner, which can enhance security, can be considered incremental components that address specific consumer needs in terms of M-Commerce transactions.*
- *While there is speculation each year that Apple will support NFC technology, Apple has stayed away from formally endorsing this technology. Instead, it introduced its wallet app, Passbook, in 2012 and has steadily enhanced this app, which offers functionality such as the merchant ability to code Passbook offers and deliver them via email, Web or within their brand apps. These Passbook items, which include stored offers, can be used to alert the user when the phone is at a particular location. Merchants such as Starbucks, United Airlines and Target have signed up and Passbook is already a leading M-Commerce app.*
- *Apple has ~600 million accounts on file, most of which are linked to credit cards – while it has not done so yet, it is conceivable that this information could be used in the future in an M-Commerce capacity.*
- *Samsung, the leading provider of Android-based handsets, introduced several features with its S4 smartphone that can help promote M-Commerce. It has technology from Mobeam (which is discussing mobile couponing with companies such as P&G) that enables a retailer to accept mobile payments, coupons and loyalty cards without the need to invest in new scanners – this uses a light source on the phone to “beam” the bar code data to the sensor on a point-of-sale (POS) laser scanner. The phone also provides NFC capability and includes Samsung’s mobile wallet app, which lets users to store coupons, loyalty cards and tickets.*

- A couple of years ago, Google made a splash with its Google Wallet strategy and announcement. However, over the past couple of years it has moved steadily from an in-store ambition (as envisioned by the initial NFC-based avatar of Google Wallet) to the more recent online form. Google Wallet introduced its Instant Buy API, an application programming interface which enables merchants to accept Google Wallet Instant Buy on browser-based apps and native Android apps) in 2013 to speed up and enhance the mobile checkout.
- Semiconductor intellectual property (IP) company ARM provides specifications (ARM architecture) as well as building blocks (cores and peripherals) that aid engineers in their design and manufacture of processors and other integrated circuits (ICs). Semiconductor manufacturers license ARM's IP and incorporate them into their own chips. These designs today power more than 90% of the world's smartphones and tablets.

Payment Networks – Central to Monetization

A payment transaction is an integral and necessary part of commerce. Card networks occupy the central position within the payments ecosystem, which consists of the network, card issuers, merchant relationship acquirers, point-of-sale equipment manufacturers, etc. In the offline (physical) world, the secular theme of the gradual digitization of money has been playing out for many years and will likely continue to play out for many more years, given that the vast majority of payment transactions are still cash-based. The proliferation of the mobile phone, the higher penetration of smartphones and the growth of social media are factors that should support and possibly accelerate the digitization process.

There are some key points to highlight.

The main payments networks – Visa, MasterCard, American Express and Discover – all have ongoing M-Commerce initiatives. China UnionPay and PayPal have their own initiatives as well.

- **Convergence of online and offline commerce** – Consumer convenience is driving it. Consumers prefer not to distinguish between their offline (brick-and-mortar) shopping and their online shopping – there are clear advantages to having customer preferences and data carry over regardless of channel. Moreover, it is a well-known trend that many customers access the web / online store while they are still in the physical store. If the physical store knows the client is there, they can better adapt to this “showrooming” trend.

Card networks are already dominant in the offline world. They have been investing in the online space as well.

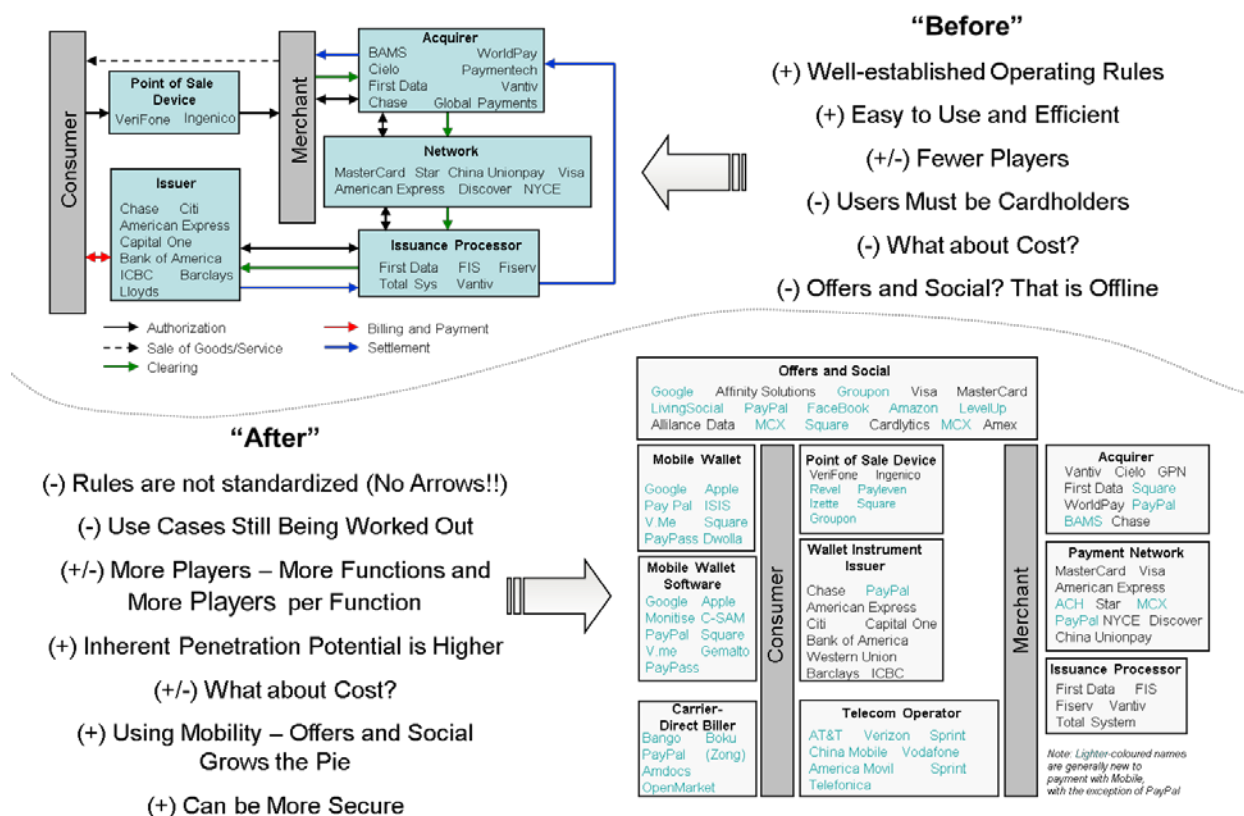
- Visa's 2010 acquisition of CyberSource, a leading online payment processor and subsequent acquisition of PlaySpan, a virtual goods monetization platform, set up Visa as a leader in the online payments market. Visa also has an equity investment in Square, which started life as an innovative device that could convert smart phones into mobile point of sale devices.
- MasterCard's DataCash business is a leading online payments gateway. The increasing adoption of its PayPass capabilities for contactless transactions is another example of their foray into alternative payments.
- PayPal and Discover teamed up to provide the online payments leader access to its offline network for payments processing.

- **Mobile Money – More Traction in Emerging Markets** – Mobile money is one area where emerging markets may be ahead of developed markets. Partly this is because there is a clear need for an alternative to cash in emerging markets. Partly it is due to entrenched nature of contractual relationships and already-existing consumer convenience in developed markets.
 - *Visa acquired Fundamo, an emerging market financial services provider which has access to a large number of closed-loop wallets. It also has an alliance with Monitise, a global mobile bank player and has mobile money relationships with Vodafone, MTN and Orange.*
 - *MasterCard has over 30 active mobile partnerships around the globe, including with Telefonica, Samsung and Deutsche Telekom.*
- **Growth of digital wallets** – Our view is that the mobile device payments' interface, i.e., the digital wallet is crucial to consumer adoption. It must be simple, secure, open (accept multiple payment instruments) and widely accepted.
 - *Visa introduced V.Me, MasterCard has MasterPass, American Express has Serve. All three are legitimate offerings, albeit still evolving.*
 - *There is some precedence to show that wallets (payment instruments, really) for niche applications like public transportation can succeed. Successful use cases exist in Japan as well as in London (Transport for London or TfL)*
- **Data security** – This is a necessary condition to adoption. Banks as well as Card Networks have introduced global standards to enable the physical card number to be replaced by a digital token for online and mobile transactions.

How Can Mobility Change the Card Payments Ecosystem

To illustrate how Mobility might change the payments ecosystem it is useful refer to illustration in Figure 11 which we used in our previous report “Upwardly Mobile II”.

Figure 11. Payments Ecosystem – Before and After Mobility



Source: Citi Research

Heightened Competition and Disintermediation Risk

We discussed the notion of disintermediation risk in detail in our prior report ([Upwardly Mobile II](#))

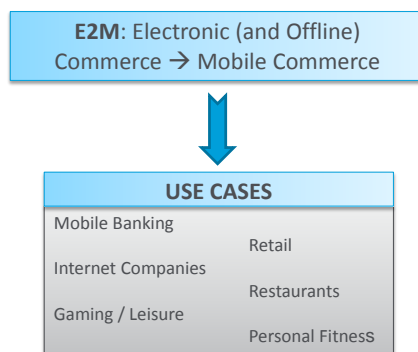
No discussion on mobile payments is complete without broaching the topic of whether the growth of Mobility increases competition and/or somehow disintermediates the networks. We believe disintermediation risk is minimal, especially in legacy markets but we do acknowledge there are likely to be more competitors in the future – the key is that many of these competitors still tend to ultimately transact through the card networks.

- PayPal is a name that frequently comes up as a feisty competitor to the traditional card networks. PayPal's core strength is in online payments but over the past 12-24 months, PayPal has considerably broadened its reach. First, it enhanced its offline distribution, most notably with its Discover Card relationship but also through its direct relationships with a very large list of major U.S. merchants. Second, it significantly improved its mobile capabilities through the acquisitions of Braintree – which is a web and mobile payments gateway and also own a person-to-person (P2P) payments service called Venmo – and StackMob, which gives it in-app expertise that it was sorely lacking in the past.

- Amazon, Alipay and Facebook are clearly leading M-Commerce players but they have tended to be less focused on the specifics of the purchase transaction and more on the other elements of commerce. This could change, of course, with new investments in wallet technology.
- MCX, a consortium of merchants set up in August 2012, is developing an integrated M-Commerce platform, which consumers can conduct financial transactions. FIS will provide MCX with payment processing, routing and settlement for mobile commerce transactions and integrate with the mobile wallet software being developed for MCX by Gemalto.

What are some of the Use Cases?

Figure 12. M-Commerce Use Cases



Source: Citi Research

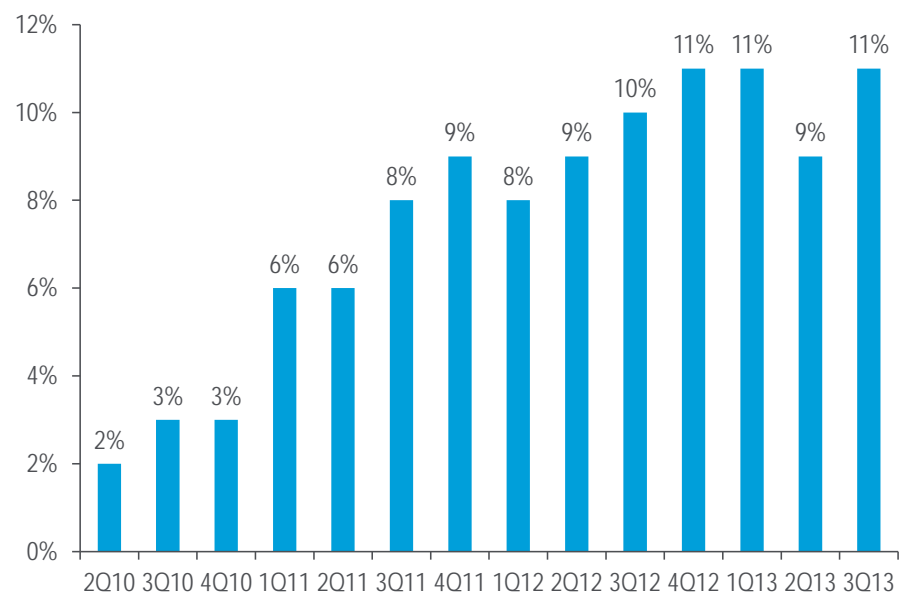
The catchy, oft-repeated, sometimes-parodied and eventually-trademarked “There’s an App for that” tagline illustrates that M-Commerce use cases are possibly limited only by the imagination of users and developers.

Figure 12 to the left shows some of the industrial sectors that have demonstrated use cases. In our view, we are considerably far off from witnessing the full extent of deployable functionality and adoption.

Internet / Media

The Internet sector is unique – here, the enablement of M-Commerce and the use cases converge. Internet companies typically do not just enable a new business or a new business model, they tend to disrupt the incumbent’s business in the process and create a whole new paradigm in the process. Typically, the incumbent is forced to adapt by aligning a part of their business or resources to replicating the Internet company model.

Figure 13. M-Commerce Share of E-Commerce is Rapidly Increasing



Source: Citi Research, ComScore

We look for Mobility to remain a dominant driver of change, disruption and growth for the foreseeable future

The Significance of Mobile

The proliferation of mobile devices and the continued rapid rise in Internet access and consumption on these devices, sometimes at the expense of desktop, is one of the most important factors affecting the Internet sector as a whole. While mobile Internet growth has been rapid, it still only represents an estimated ~13% (as of the fourth quarter of 2013) of overall E-Commerce. So, we look for Mobility to remain a dominant driver of change, disruption and growth for the foreseeable future.

Key Positive Growth Factors

Three factors drive the growth of mobile Internet and M-Commerce.

- **Incremental usage** – Data from third-party measurement companies (e.g., comScore) and directly from Internet companies suggests that Internet consumption has grown incrementally due to the proliferation of mobile Internet devices, and that it hasn't been directly cannibalistic. We agree and note there are three things to consider.
 - “Always-on, anywhere, anytime” promises appear to be playing out as hoped;
 - While it is discussed separately later in the report, the rise of the Internet of Things, which considers the proliferation of all sorts of Internet-connected devices like autos and home appliances, should in turn drive M-Commerce proliferation from those devices; and
 - Given that mobile networks and devices are more prevalent than terrestrial networks in many international countries, the growth of Mobility has expanded the addressable market for consumer Internet companies in these countries faster than previously expected.
- **Enhanced data** – Often, an Internet company's competitive advantage is having some sort of data edge. For instance, Facebook leverages its unique user profile, social and interest graphs to better target ads. A key advantage of the mobile Internet for the entire sector is the new types of valuable data that is now available, such as geo-location and location check-ins.
- **Online / offline convergence** – Mobile Internet devices provide – for the first time – the ability for online companies to start to bridge the gap with the offline world. Many examples exist, in terms of functions like “showrooming” and mobile payments and these represent new revenue opportunities for consumer Internet companies in a mobile environment.

The combination of the above factors gives us greater confidence in our long-term forecasts for the consumer Internet sector. For instance, we forecast a 3-year compound annual growth rate (from 2013-2016) in Internet advertising of 13%, with mobile advertising representing a meaningful contributor (e.g., a 42% compound annual growth rate and 22% of the calendar year 2014 estimated total). Likewise, M-Commerce (including retail transaction) has and we expect will continue to grow faster than overall E-Commerce and be additive to overall industry growth.

Key Growth Challenges or Risks

- **New data / platform standards** – Of course, with the growing importance of a new channel (mobile vs. desktop) comes the introduction of new technologies, platforms and data sources. This can create challenges, particularly for incumbents. For instance, for the most part there are no cookies in mobile whereas they are the foundation of most desktop advertising targeting. Another example is the use of apps and mobile Web, which creates challenges when attempting to optimize for users that may use both, especially if during the same session.
- **Advertising effectiveness** – Somewhat related to new technologies, platforms and datasets are the challenges associated with monetization, particularly using advertising, on such small screens with different (and today often inferior) targeting and measurement capabilities than desktop. Fortunately, companies like Facebook and others have been able to solve for many of these issues faster than most expected.
- **Bandwidth limits** – Mobile data caps and the cost of mobile data is currently prohibitive for streaming a significant amount of video on wireless carrier networks. This can be seen in the data, with Sandvine reporting in the second half of 2013 that aggregate usage on mobile networks in North America was 1% of that on fixed networks, and real-time entertainment services representing a far lower percent of usage on mobile (38%) than desktop (62%).

China: Defining the Frontier of Mobile

In many ways, China is an example of a "leapfrog" market with mobile playing a much larger role in the commercial, Tech/Media/Telecom and lifestyle ecosystems than many developed western counterparts.

China already has a highly advanced consumer technology culture: the Internet represents ~47% of total media consumption time versus about 28% in the U.S. Within this, online video represents 18% of media consumption time versus ~12% for TV (about 30% in the U.S.). This means that for entertainment, China is globally unique in that it is perhaps the only market in the world where people are already watching more video on the web than on traditional broadcast TV. China already has more mobile Internet users than PC users (~450 million vs. ~400 million). In addition, despite only about 25% penetration of smart devices (vs. 65% in the U.S.), mobile's share of media consumption time in China is already 22% (vs. ~15% in the U.S.).

In China, mobile is front-and-center in business models for both online and offline companies.

What are Companies in China Doing?

- *Alibaba via Alipay is defining an open API for Alipay that can be integrated into various online local (and other) apps. Card payment terminal penetration in retailers in China is less than 5%, whereas mass-market proliferation of low-cost, high-functionality Android devices is high. This is a good set-up for mobile devices to become a ubiquitous "mobile POS". On this basis, and with a lack of credit card penetration and culture we believe that Alipay has the opportunity to take a substantial portion of what would (in the U.S.) be considered credit card share of offline transactions. The difference here is that given the online-to-offline (O2O) nature of this, Alipay and other service providers should be able to integrate the ecosystem from advertising / listing through to transaction and hence claim a larger share of the ultimate economic value pie.*

- *Sina Weibo is focused on "Enterprise Weibo" allowing businesses (particularly local small and medium enterprises) to have an online presence with a view to this facilitating O2O commerce (in partnership with Alibaba). Sina is also focused in integrating real world objects into its social and information ecosystem.*
- *Tencent is defining the next phase of online social evolution via WeChat. In a mobile world, users prefer real-time engagement (vs. "turn-based non-real-time social" via traditional PC Facebook, for example). WeChat now integrates payment and barcode functionality allowing for development of O2O.*

Mobile Banking

Mobile banking is a replacement for traditional banking in emerging market and a convenience channel in developed markets

Mobile can be the great equalizer in banks' battle for consumers. The mobile banking app is essentially a "branch in one's hand" which has a tendency to mitigate the competitive advantage of a large physical branch network. This viewpoint may actually run counter to conventional wisdom in many banks which considers mobile banking as an extension of branch-based banking – we believe such a viewpoint negates the power of mobile to considerably expand, not merely extend, the availability of bank functionality. Financial inclusion is one of the powerful possibilities that emerge from this the emergence of mobile.

- *Based on the World Bank's Global Findex database, only ~2 billion (~29%) people from a world population of 7 billion have a bank account. Mobile phone penetration is over ~70%.*
- *Being unbanked is not just an emerging market conundrum. According to the U.S. Federal Reserve, there are ~70 million unbanked and under-banked people in the U.S. Given U.S. phone penetration, most of them have a mobile phone.*

Of course, existing bank consumers who view the mobile banking app as a "convenience channel" are also unlikely to accept sub-par performance from that app – it is, after all, a proxy for the branch and teller, and is expected to perform a wide range of functions in an efficient, zero-tolerance-for-error manner. This means that the banking app, at least in developed markets, must be relatively full-function, and include things such as 360-degree view of the customer, remote mobile payments, bill payments, person-to-person payments, real-time notifications and on-the-go financial planning functionality. This functionality has to be device-independent. When translated to emerging markets with a greater penetration of feature phones instead of smartphones, the functionality has to be in a simple menu-based format with a focus on peer-to-peer money transfers and basic savings capability.

- *Fidelity National (FIS), Fiserv and Jack Henry are the leading bank IT providers in the U.S. that enable the mobile (and other technology) ambitions of smaller and regional banks. Both FIS and Fiserv have a full suite of mobile offerings – FIS currently services over 20 million mobile accounts while Fiserv services over 10 million mobile accounts.*

The use of the camera not just for remote mobile deposits but also for multi-factor authentication and to gather data from forms – for example, to capture relevant know-your-customer information from a driver's license – is also a capability worth considering.

Mobility can also put the traditional role of a bank in a commercial transaction at risk, especially because banks have traditionally been involved only in the purchase transaction, either as the card issuer or the entity that enables the transaction for the merchant. Increasingly however, digital and retail giants are taking actions that lead to the conclusion that payments is no longer the purview of just the traditional financial institutions.

Combining Mobility with prepaid card functionality and direct deposit is already giving non-bank and/or online-only financial institutions the ability to approximate bank offerings – for example, American Express' Bluebird and Serve offerings and Green Dot's GoBank offering are in this category.

Beyond potential competition from non-bank financial services companies, banks must also worry about Internet companies (massive distribution, familiarity with the direction of technology change), telecoms (much wider distribution, with an especial advantage in emerging markets) and retailers (much better grasp of the shopping process). Banks may have less scale but they do tend to have the trust of their account-holders as well as of financial regulators and they are gearing up to defend their existing revenue streams while tapping into new ones such as digital offers. Financial IT vendors are helping this process along — we have mentioned FIS and Fiserv before but also note that banks work with the likes of MasterCard and Visa on digital wallet technology.

Hardline Retailers

Most U.S.-based hardline retailers have a mobile strategy

Most U.S.-based hardline retailers – companies like Home Depot, Best Buy, Staples, AutoZone – have reasonably full-function M-Commerce apps that allow users to purchase products; view in-store availability; get notified of deals; create and view shopping lists; get product information and see reviews when scanning a barcode; choose whether to buy-online and pick-up in store or have it shipped to home; get store location and hours information; and access reward/loyalty account information.

We highlight the unique features of some of the M-Commerce apps first and then Figure 14 provides a broader summary.

- **Best Buy** – Awards My Best Buy points for checking-in while in a Best Buy store, which is an important step in terms of lowering the likelihood of “showrooming”; conducts product scavenger hunts for My Best Buy points to promote the customer to walk around in an engaged way; gives customers the ability to find out if they are eligible for a phone upgrade, etc.
- **Home Depot** – Search products by voice command; view upcoming local workshops; access Home Depot's caliper, calculator & converter tools to ensure adequate project inventory; use the phone's camera to visualize and help select products for your home.
- **Lowe's** – Has a separate app which is an online magazine called “Creative Ideas”, which gives the ability to instantly add featured items from articles to your shopping cart on Lowes.com, customize product options on-screen to create the perfect look, access how-to articles and videos, and explore expanded idea galleries in dynamic articles.
- **Office Depot** – Shows current ink-levels on most HP ePrint Printers so you know when you are running low, find nearby printers and automatically display the correct ink cartridge to buy (Note: WiFi is available at all Office Depot stores)
- **AutoZone** – Access repair guides and search for products by vehicle type

Figure 14. Summary of Key Capabilities of Mobile Apps of Different Hardline Retailers

| | HD | LOW | TTS | BBY | BBBY | MFRM | WSM | DKS | ODP | SPLS | AAP | AZO | ORLY |
|---|---------|-----|-----|--------|------|------|-----|-----|-----|------|-----|-----|------|
| Apple iOS app | X | X | | X | X | | | X | X | X | | X | |
| Google android app | X | X | | X | X | | | X | X | X | | X | |
| Windows app | Limited | | | Coming | | | | | | | | | |
| Browse product catalog | X | X | | X | X | | | X | X | X | | X | |
| See in-store availability | X | X | | X | X | | | | X | X | | X | |
| Set price alerts on favorite products | | | | X | | | | | | | | | |
| Get notified of deals | | | | X | | | | X | X | X | | | |
| Get notified of in-store clearance and open-box items | | | | X | | | | | | | | | |
| Create and view wish list/shopping list | X | X | | X | X | | | | X | X | | X | |
| Read ratings and reviews | X | X | | X | X | | | X | X | X | | | |
| Buy online and pick-up in store | X | X | | X | X | | | | | | | | |
| Buy online and ship to store or home | X | X | | X | | | | | | | | | |
| Store locator, get directions, contact info and hours of operation | X | X | | X | X | | | X | X | X | | X | |
| Locate products with in-store map & aisle location | X | X | | | | | | | | | | | |
| Scan a product UPC to read reviews and get other info | X | X | | X | X | | | X | X | X | | | |
| View upcoming local workshop/events and save to calendar | X | | | | | | | | | | | | |
| Use phone's camera to visualize & help select products for purchase | X | | | | | | | | | | | | |
| View purchase history | | X | | | | | | | X | X | | | |
| Rewards account information | | X | | X | | | | X | X | X | | X | |

Source: Citi Research

Certain stores do not have M-Commerce apps yet, but for the most part it makes sense for these companies. Innovative M-Commerce approaches are always possible in the future, in our view.

- The Tile Shop and Mattress Firm do not have apps, given they sell long-life, non-impulsive products.
- Two of the top three auto parts retailers – Advance Auto Parts and O'Reilly Automotive – do not have a mobile app. We attribute the last of offering to this being a business segment that is perhaps more defensive against digital encroachment, the need-based nature of these purchases and the fact that customers may need to talk to sales associates to figure out which part is right for their problem or vehicle. AutoZone has a mobile app, of course, but it also has a different do-it-yourself vs. professional customer skew compared to the other two auto parts retailers.

According to industry sources TraCline and CEA, consumers are more likely to buy exercise equipment and consumer electronics via digital channels (E-Commerce and M-Commerce) than say, a major appliance or power tools. This can also skew specific corporate strategies with regards to M-Commerce investments – it is more reasonable to expect Best Buy and Dick's Sporting Goods to have a well-executed mobile channel than a home improvement retailer. However, as noted above, Home Depot and Lowe's are both trying out innovative features to drive foot traffic and improve customer satisfaction.

Smartphones are being used in stores to “showroom” as well as get views from social networks more than direct sales

It is clear that different types of stores have different levels of M-Commerce capability. But how receptive is the consumer to these capabilities? There is anecdotal evidence that consumers use these capabilities to conduct on-the-fly product research and to incorporate the views of their social network into their decision, although “buying with the mobile phone” per se does not yet figure as a leading use of the technology in hardline retail.

- A November 2013 survey of 1,500 U.S. and U.K. respondents by M-Commerce technology vendor Usablenet Inc. found that 30% of U.S. and 40% of U.K. shoppers with smartphones use their devices in stores to help with shopping. Consumers who use their smartphones while in a store use them primarily for messaging/e-mailing a friend (84% U.S., 90% U.K.), using social networks (64% U.S., 45% U.K.), comparing product prices (71% U.S., 66% U.K.), and checking customer reviews (51% U.S., 57% U.K.). 48% of U.S. and 46% of UK shoppers would be receptive to receiving personalized messages and promotions in a store.

While having M-Commerce capabilities is not yet a major driver of direct sales, we think it improves the overall shopping experience for customers as it aids consumers in allowing them to easily research products or perform price comparisons either at home, in the office, or in the store. In retail, there is likely a minimal competitive advantage to providing vanilla M-Commerce capabilities as most of the major players have already rolled out apps (and all have mobile optimized sites) which carry most of the core features. A more innovative approach may be needed to be differentiated, but at a minimum, adapting to M-Commerce is a way to stay competitive.

Restaurants

Restaurants have been some of the leaders in investing in mobile/ digital technology and note it is the key to continued share gains

M-Commerce is a highly relevant trend for the restaurant space. Companies like Domino's and Starbucks have led the way in terms of investing in mobile / digital technology as the key to continued share gains. Their view is that M-Commerce can lead to a better user experience and lead to higher ticket, better customer satisfaction and lower cost to serve. It has also been an early-mover competitive advantage against competitors and it can be a sustainable advantage, particularly against smaller or regional chains that cannot make similar scale investments. Domino's, Papa John's and Pizza Hut have 85% of the growing online pizza sales space today.

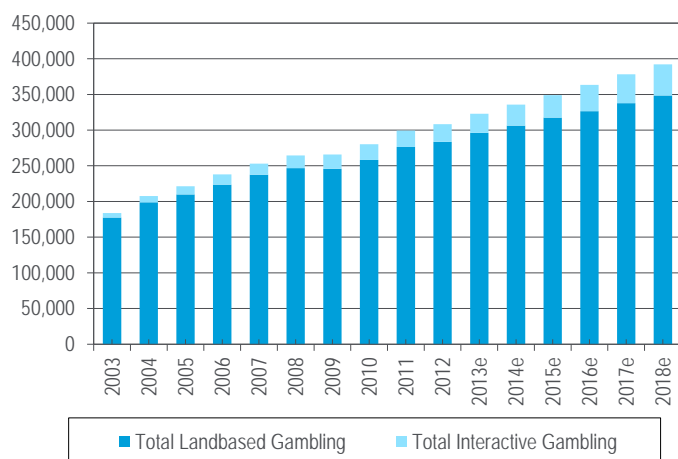
- About a third of Domino's Pizza's business is digital today and there are several reasons for their focus on Mobility and digital in the United States. The company plans to build out digital properties to create a relationship through mobile, in stores, in the car, and in the living room. The company has also found that new digital channels do not cannibalize. In January 2013, they mentioned that 23 of the company's markets have more than 10% digital sales; 3 markets have over 50% digital sales; and that mobile is the fastest growing segment. Dominos is also ahead of competitors in rankings and reviews in digital.
- At YUM! Brands, Pizza Hut generates over \$1 billion in digital sales in the United States and the company is considering publicizing their mobile app more in the future. In China, 70% of Pizza Hut delivery transactions are digital and the company will continue to grow its digital presence with self-order kiosks, and dessert / beverage kiosks. In 2014, YUM! will also have a full digital platform for Taco Bell that has mobile order, pay, and loyalty.

- With regards to digital and Mobility initiatives at McDonalds, roughly 2/3rds of the company's U.S. stores now offer free WiFi and the company is trying a variety of digital initiatives to increase customer engagement. Going forward, McDonalds expects digital innovation to continue, with programs such as customers receiving coupons when they enter a McDonald's restaurant.
- Dunkin Brands announced on its third quarter 2013 earnings call that the company surpassed 4 million downloads of its mobile app and that they were still at the beginning of their mobile initiative. Further, Dunkin's 'DD Perks' program is planned to be rolled out nationally in the first quarter of 2014.
- Starbucks, of course, is a known leader in the customer experience space, as it relates to its market-leading mobile app. Mobile payments accounted for 11% of U.S. transactions in the quarter ending September 2013. On a global basis, the amount of money loaded onto Starbucks cards has increased 68% from fiscal 2011 to fiscal 2013 and the amount of active My Starbucks Reward members in the U.S. has increased 81% during the same period.

Gaming / Leisure

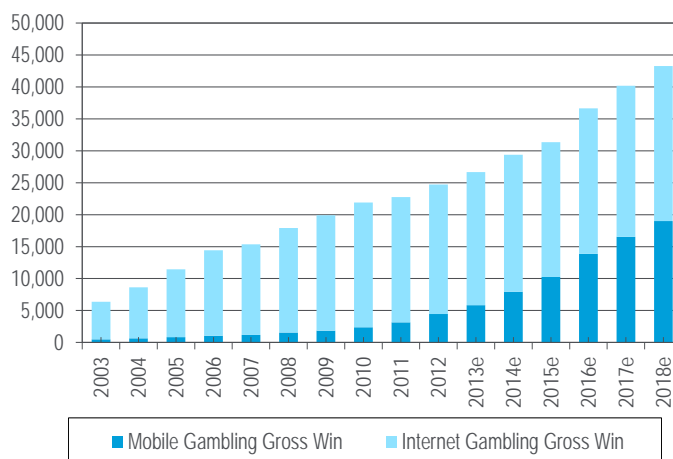
Gambling industry data consultancy H2GC estimates mobile gambling growth rates of ~30% per year vs. ~10% for the overall online gambling market and less than 5% for land based gambling. Despite aggressive lobbying by prohibitionists, Europe and now the U.S. are steadily opening their markets to regulated online gambling as governments recognize the reality that consumers are gambling online regardless of the regulation – that it is far better to tax and regulate the industry for the public good.

Figure 15. Global Gambling Gross Win by Channel (€m)



Source: H2GC

Figure 16. Global Interactive Gambling Gross Win by Channel (€m)



Source: H2GC

Online gambling is expected to expand significantly with the relaxation of regulation

Driven by regulation, we see the most opportunity in Europe which H2GC expects will grow from €2.4 billion (\$3.3bn) of gross win in 2013 to €8.6 billion (\$11.75bn) in 2018. The market in Asia is significant today but mostly reflects personal digital assistant (PDA) activity via the Hong Kong Jockey Club and Japanese Racing Association betting and doesn't reflect a wider liberalization. Within Europe, the UK still accounts for 27% of all European online gambling but favorable regulation (e.g. in Italy and Spain) is spreading across the region and should stimulate growth in other markets too. We expect the U.S. to follow suit potentially growing to €3.9 billion per year (\$5.3bn) of gross wins by 2018 (from €500m today). As well as other smaller states, New Jersey has recently opened for online poker and casino play and we expect others to follow suit following its successful launch.

The above-mentioned fast growth rates partly reflect only a tiny penetration of mobile gaming today. Online gambling today represents ~8% of total gambling activity globally and ~22% of the overall online gambling total. Favorable regulation can actually have a considerable impact on the outcome – in the U.K., for example, online gambling now accounts for 25% of all UK gambling activity and mobile represents 21% of this activity.

- *William Hill, the UK's online market leader now generates about 41% of its online sports bets via mobile devices. Paddy Power, another innovator in the space, generated 45% of online revenues from mobile year-to-date. Having cutting edge technology has enabled these two businesses to generate some of the best revenue growth in the European gaming industry. While both William Hill and Paddy Power look well placed – they still generate 75%-80% of online revenues from the U.K. but are growing into newly regulated markets in Europe and elsewhere. This is enabling them to take share while smaller operators struggle to keep up with the pace of technology development.*

Why is Mobility Important to Gambling Growth?

Mobile technology can drive incremental industry growth, i.e., this is not just about changing the form factor. Consider the following reasons.

- **Convenience** – The anytime anywhere culture that mobile technology brings means consumers can gamble 24/7. This could include at work, at the game or in the pub – times when it would previously been impossible to bet.
- **In play betting** – Betting on events during a game is a market that has really been created by the internet as it offers the immediacy that a land-based business cannot replicate. Mobile is accelerating this trend as consumers now easily place bets while watching the match live. The opportunity is significant, as in-play betting now accounts for up to 50% of online betting revenues in the UK.
- **Geo-location technology** – Mobile technology is enabling sport betting growth in Nevada through its ability to pinpoint the location of a customer. William Hill's Nevada based business is thereby able to ensure that its customers are within state boundaries and eligible to bet online.

Mobile customers tend to be more loyal and higher margin than online customers

Mobile customers also tend to be more loyal and higher margin. Data from William Hill suggests that on average mobile customers have fewer competitor accounts than online customers. We also think consumers are more likely to be impulsive and have less inclination to shop around and get the best prices on mobile devices. Indeed operators report sports margins are 100-200bp higher on mobile than online.

Technology Challenges

Integrating Apps to create a seamless single sign-on and shared wallet across different products (e.g. Poker, Casino, Sports) has proven to be challenging. In addition third-party game developers are often ill-equipped to adapt their games to the mobile environment which can impede innovation. However, we regard these issues as temporary challenges that will be overcome.

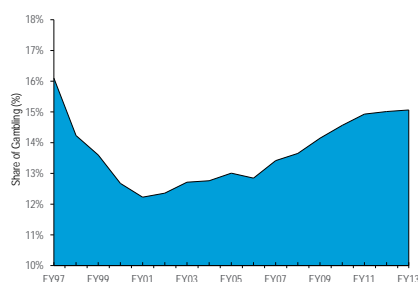
Although these operators have a first mover benefit ultimately we don't see mobile as creating a sustainable competitive advantage. Most operators use third party technology suppliers (e.g., Mobenga) and we expect some competitors in time will catch up from a technological perspective. However customer service, ease of use and marketing will continue to differentiate players and we expect this to remain a scale game.

Australian Wagering Operators Strongly Leveraged to Mobile Growth

Australia is well positioned to take advantage of the growth in mobile betting. According to GSMA, smartphone penetration in Australia is amongst the highest in the world at 65% in 2013 and above the U.K. at 62%. Australian tablet penetration is highest in the world at 31%.

The rapid growth in mobile technology uniquely benefits the wagering and lottery operators in Australia and holds limited benefit to other forms of gambling such as casinos and slot machines. The difference stems from regulation with the Interactive Gambling Act (2001) restricting online gambling to only pre-match wagering events and the purchase of lottery tickets for Australian residents.

Figure 17. Wagering Industry's Share of the Australian Gambling Wallet



Source: ABS, Australian Racing Factbook, Citi Research

We expect advances in mobile technology to have a similar effect on the wagering industry as the early adoption of Internet betting in the early 2000's. This era corresponded with wagering's share of Australian gambling wallet expanding from 12% in 2001 to 15% in 2013. We expect that the wagering industry's share of the gambling wallet to continue rising as mobile betting growth accelerates.

The retail incumbents, Tabcorp and Tatts, as well as the large corporate bookmakers are set to benefit from the growth in mobile betting and the associated increase in brand loyalty. Tabcorp is an early leader and already has over 50% of its online turnover coming from mobile devices. While mobile on its own is not a sustainable competitive advantage we view mobile growth in combination with investment in Customer Relationship Management systems as being an effective tool to offset competition and rising advertising levels within the Australian market, in the short to medium term.

Mobile an Important Enabler for Growth in Social Gaming Markets

As in the real money online gambling markets, mobile is growing in importance in the social gaming industry. Social gaming differs from real money gambling as players do not receive a payout for any wager undertaken. Revenue is generated by a small percentage of players who purchase virtual currency to achieve certain in-game advantages such as extra game time or new levels. With no regulatory barriers that inhibit its development, mobile is an important enabler for continued social gaming industry growth.

Smartphones and tablets provide a more convenient and impulsive medium for players to engage with social casino games. While smartphone players typically play for shorter game durations, the play frequency is greatly increased. Industry feedback also suggests that tablet players are engaged for longer play times and monetize at higher average rates per user than smartphone players.

Social casino industry leaders, Caesars Interactive (owner of Slotomania) and IGT's Double Down casino have mobile devices already approaching 50% of revenue.

Mobile is of growing importance in the social gaming industry as there are no regulatory barriers to inhibit growth

Other

The personal fitness and entertainment / toys markets present interesting M-Commerce opportunities.

Weight loss companies Weight Watchers and NutriSystem are investing in digital initiatives including M-Commerce because (i) they can extend into untapped and less penetrated markets; (ii) customer acquisition costs are lower; and (iii) the option to be part of a community and get social support is appealing to some consumers.

- *Free digital apps (MyFitnessPal, etc.) are likely to remain a threat to the Weight Watchers business model and impact new user trials, but it is unclear whether a proven brand attracts more users than a relatively untested new app.*
- *NutriSystem plans to launch a subscription-based weight loss app towards the end of the first quarter of 2014 which will be available on the web, plus on mobile and tablets. The app will focus on weight loss maintenance methods and will be a transition product since it will be non-food based. Importantly, NutriSystem's app can cater to the "Do-It-Yourself" weight loss market that the company is not currently serving.*
- *In November 2013, Under Armour announced the \$150 million acquisition of MapMyFitness, a fitness technology company offering websites and mobile apps that track and share users' workouts. MapMyFitness already reaches over 20 million registered users and will enable the company to greatly expand its digital capabilities by providing an existing community of global fitness enthusiasts. Similarly, in October 2013, Nike highlighted that they now reach approximately 20mil consumers through its Nike Plus community, plus another 40mil people who have joined the Nike community through its stores or online. Lastly, wireless wearable devices like FitBit are also increasingly popular.*

When it comes to fun and games, kids are playing more digitally, but not at the expense of toy play. For instance, today we are seeing kids migrating from legacy digital platforms to more mobile digital platforms (as screens are replacing screens, not toys).

- *At Hasbro's most recent analyst day, the company mentioned that 66% of all money spent on smartphone and tablet apps were on games and that 33% of all downloads to smartphones and tablets were games. Overall, Hasbro is focused on building its mobile gaming platform and they have created a new Hasbro Mobile Gaming Network that makes it easier for consumers to move between all of Hasbro's gaming apps and is also a platform to cross-sell Hasbro's physical games.*
- *Mattel views digital as a way to enhance customer's engagement with their existing brands and is focused on taking advantage of the increased penetration of digital devices and declining digital costs by increasing the presence of their brands through social media sites, videos, digital games and apps. They have also continued combining digital technology with traditional toy patterns through their Appitivity line with their Barbie Photo Fashion doll and Fisher-Price Appitivity Monkey, although overall results for that line have been mixed.*

Telematics embraces a wide range of applications although it has become more narrowly aligned with automotive around the Connected Car concept

Telematics

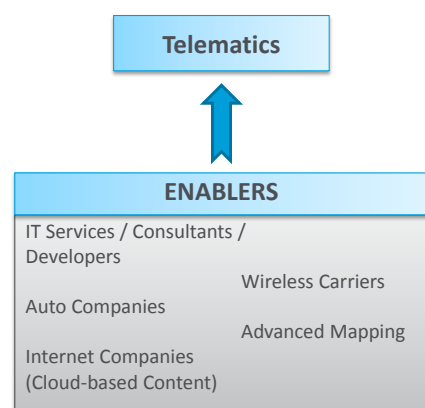
The word “Telematics” is the combination of “Telecommunications” and “Informatics” and was originally coined to reflect the blending of computers and phone networks. The Oxford Dictionary defines Telematics as “the branch of information technology that deals with the long-distance transmission of computerized information.”

This generic definition embraces a wide range of applications, although the term has become more narrowly aligned with automotive or vehicle telematics because so many recent developments revolve around the “Connected Car” concept. This section devotes a lot of attention to the Connected Car concept but we also highlight other Telematics applications in Fleet Management, Rail Transportation, Insurance and Aerospace.

How Does Telematics Work?

The three components of a basic Telematics solution are Platform, Connectivity and Content/Support. This is illustrated in Figure 19 below and the providers of these components are the enablers shown in Figure 18 on the left.

Figure 18. Telematics Enablers

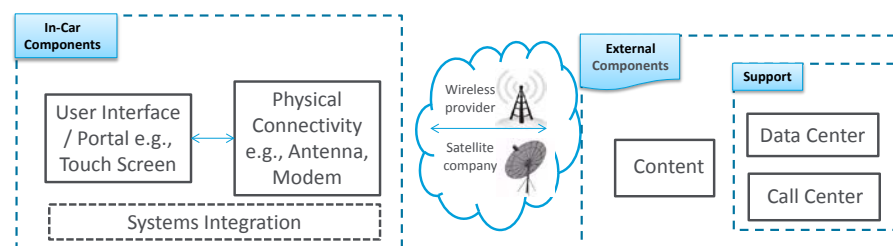


Source: Citi Research

- **Platform** – The user interface or portal – typically a touch screen nowadays – helps the user (driver or passenger) communicate with the system, accepting inputs as well as displaying outputs / responses to requests.
- **Connectivity** – The connection to the external components.
 - The physical connection device, e.g., antenna, modem, etc.
 - The wireless provider or the satellite company.
- **Content / Support** - The external components – this can include OEM-specific and other content, the back-office support and call center support functions.

A lot of the content, especially for the entertainment portion of “infotainment” is not differentiated for a Telematics platform. The two key enablers that we discuss, from the list shown in Figure 18 on the left, are the wireless carriers and the Auto companies, which often make the platform decision – even when that decision is to leave the choice to the car buyer, they often have to enable that choice.

Figure 19. Telematics Components – Platform, Connectivity and Content/Support



Source: Citi Research

The Role of Wireless Carriers in Telematics

Wireless carriers are a key enabler of the Telematics trend because they are in a position to participate in two distinct elements of the Telematics value chain, one of which (connectivity) is a no-brainer, while the other (content and support) may require more investment and partnering with others in the ecosystem. Each of these carries a very different revenue and margin profile.

The Provision of Network Connectivity / Bandwidth

Network / Transport Layer: Low ARPU / High Margin

At a minimum, wireless networks provide the bandwidth and connectivity to facilitate the use of telematics. This is the “dumb pipe” role.

Based on conversations with industry contacts, we believe the connectivity layer, whether as a wholesale solution or part of an integrated service offering, generates a low average revenue per user (ARPU) (e.g. \$1-\$2 per month), but a high margin (e.g. 80-90%), given there are no equipment subsidies, and the nature of Telematics to-date has been primarily over 2G and 3G networks.

The Provision of Value-Added Services

Services / Application Layer: Higher ARPU / Lower Margin

The total addressable market for Telematics has expanded over time due to the provision of increasingly customized value added services. With the introduction of 4G LTE technology, we would expect the range of services to continue to increase. From the use cases in this section, we can glean that such services include safety and security, infotainment, hands-free calling, navigation, tracking, diagnostics as well as customized solutions. While many of these services can be provided by wireless carriers, they are not alone in their desire to be the provision hub for value-added services. OEMs, aftermarket companies, handset manufacturers and other niche players are also making a play for all or part of this opportunity. From a business model perspective, the ability of wireless carriers to maintain long-term subscription-based relationships with consumers – something that none of the other participants have experience in – is an advantage.

Generally, these services generate a much higher ARPU (e.g. \$20-\$35 per month), but require a significant support function (call center support, application design, licensing fees), and thus we believe carry a much lower margin (e.g. 20-30%) in a scaled business model. To date, Verizon has had the most success at horizontally integrating and offering value added services, helped by its 2012 acquisition of Hughes Telematics.

Verizon – Example of Wireless Carrier Offering Value-Added Services

Verizon provides a full-suite of Telematics services for Mercedes-Benz, called mBrace, including:

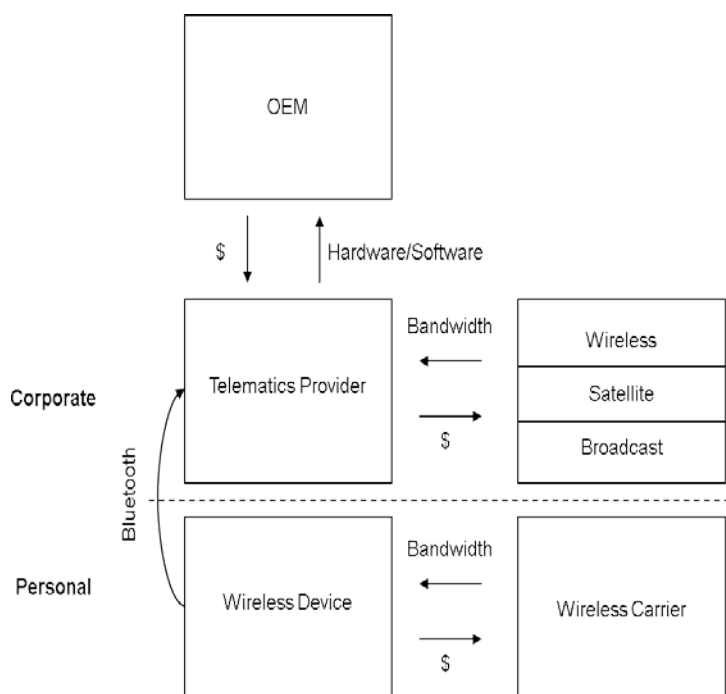
- **Safety and security features** – automatic crash response, roadside assistance, emergency services (including provision of location), speed monitoring, and GPS location tracking to prevent theft.
- **Remote access features** – remote vehicle controls, maps, and vehicle diagnostics, and hands-free mobile calling.
- **Travel and assistance features** – navigation, concierge services, virtual co-pilot, weather services, traffic reports and routing assistance.
- **In-Vehicle applications** – Internet based apps, Infotainment, Google search, food recommendations, Facebook, etc.

Telematics Ecosystem from Wireless Carrier Perspective

The Telematics space is complex, partly due to the number of industry participants that seek to benefit from it. This list includes the car manufacturer (OEM), the Telematics provider, the consumer's wireless device, the consumer's wireless carrier and firms that supply the content to the Telematics device (via wireless, satellite or broadcast radio).

Figure 20 below depicts the wireless carrier perspective of Telematics. Later on, we show how this changes when the OEM / aftermarket perspective is considered.

Figure 20. Telematics Business Relationships and Players — Wireless Carrier Perspective



Source: Citi Research

The boxes above the dotted line represent business-to-business relationships (B2B). The boxes below the dotted line represent business-to-consumer relationships (B2C).

The B2B / B2C distinction is important for a couple of different reasons. Firstly, as mentioned above, wireless carrier business models incorporate both these model types in a subscription format while other participants can be said to have a less frequent interaction. Secondly, as telematics becomes more pervasive, consumers may not be able to use their existing data plans for telematics services unless the consumer's wireless device is synchronized with the in-car telematics hardware.

The deployment and adoption of faster and lower latency 4G LTE networks should provide a favorable growth outlook for the Telematics segment given the increased opportunities to layer on content applications and value added services.

Wireless Carriers can Leverage Existing Network Investment to Create New Growth Opportunities

We believe telecom carriers increasingly need to address how the combination of innovation in their business models and investment can improve their revenue growth prospects. We expect wireless carriers to increasingly move upstream into value-added services by adding over-the-top applications and cloud-based services to their core network offerings for both the residential and business market. While Telematics remains in its relative infancy, and is not currently a major contributor to industry wireless revenues or profits, it represents an opportunity to leverage existing network investments and potentially create new business models and billing relationships.

Can Wireless Carriers Win in the Telematics Market?

From the network perspective, the wireless carriers seem to be well positioned to benefit from the adoption of Telematics. The adoption of cloud computing services and increasing data usage should drive a favorable adoption curve. However, we believe there are a number of risks associated with the successful deployment of value-added Telematics services by the carriers.

- **Cautious company culture** – Traditionally, telecom companies have not proven adept at offering value-added services outside of the role of network provider. For example, application platforms and device makers (Apple, Samsung, Google) have captured the lion's share of incremental value creation from Smartphone adoption. Over time, we expect that less emphasis will be placed on the brand of the Telematics provider and more on the content provided.
- **Limits to wallet share gain** – The average spend on communications services is increasing due to the introduction of more expensive handsets, metered usage and an increasing array of connected devices (tablets, smartphones, etc.). We are also encouraged by their new business relationships that Telematics can foster, including Insurance Solutions, which offer better data analytics for the assessment of risk within insurance policies. However, if the wireless provider is the collection point for all these services, we worry if “sticker shock” on the telecom bill would hold back Telematics revenue growth.
- **OEMs May Have Disproportionate Control Over Destiny** – To be successful, Telematics providers will likely need strong relationships with a limited number of car manufacturers. In addition, embedded telematics solutions often carry long duration contracts (3-7 years), thus the opportunity to gain share may be more difficult.

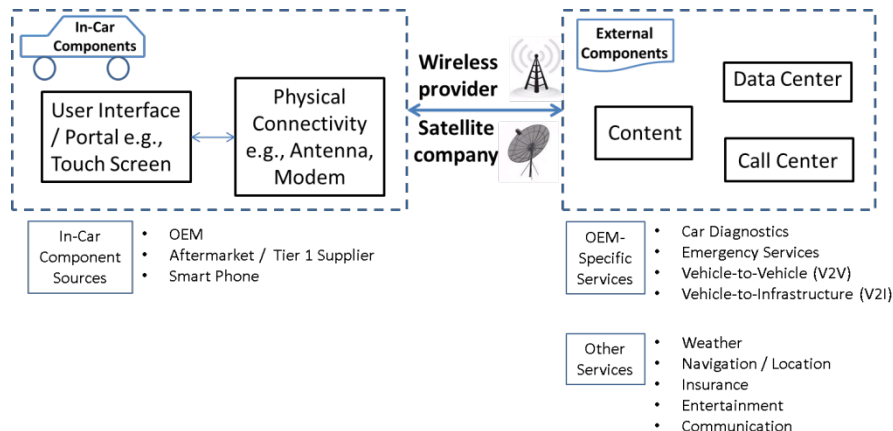
Auto Companies as Telematics Enablers

Auto manufacturers are key enablers of the Telematics trend

Vehicle Telematics brings Mobility and its benefits to the automotive environment. Given Auto companies fashion that environment and the users' experience, they are obviously key enablers of the trend.

Figure 21 below shows the various Telematics building blocks and services. We have discussed the basic elements – Platform, Connectivity and Content / Support before. This section discusses how it all comes together.

Figure 21. Automotive Telematics Building Blocks and Services



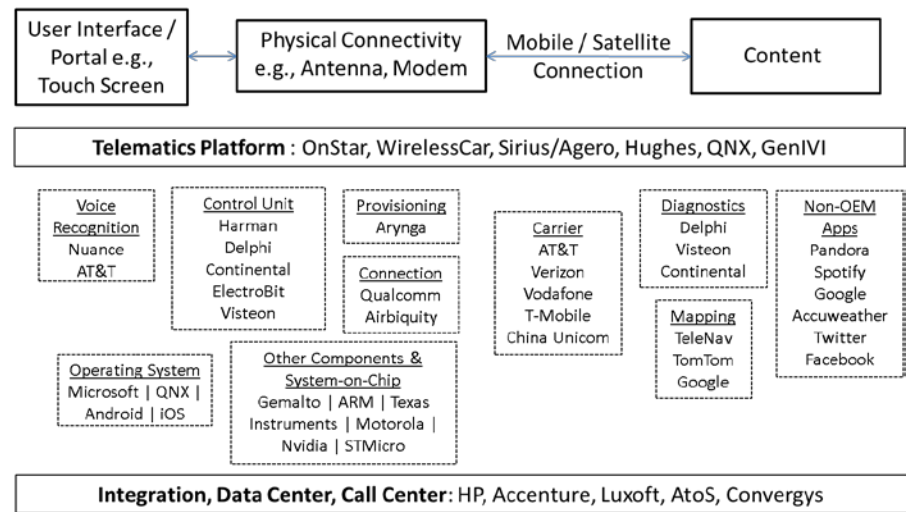
Source: Citi Research

The lower left of Figure 21 above illustrates that the in-car components can be installed directly by the OEM or the user can have them installed using an aftermarket product or in some cases, the user's smartphone could serve as the portal.

The lower right of Figure 21 above makes the point that certain services like car diagnostics, seem to be best provided by the OEM. At the same time, we believe that the OEM has no particular advantage providing services like weather, entertainment or navigation since commonly-available mobile apps can serve the purpose quite well in those cases.

Figure 22 below shows the Connected Car Value Chain, including some representative players. The list of companies is not comprehensive.

Figure 22. Automotive Telematics Value Chain and Representative Players

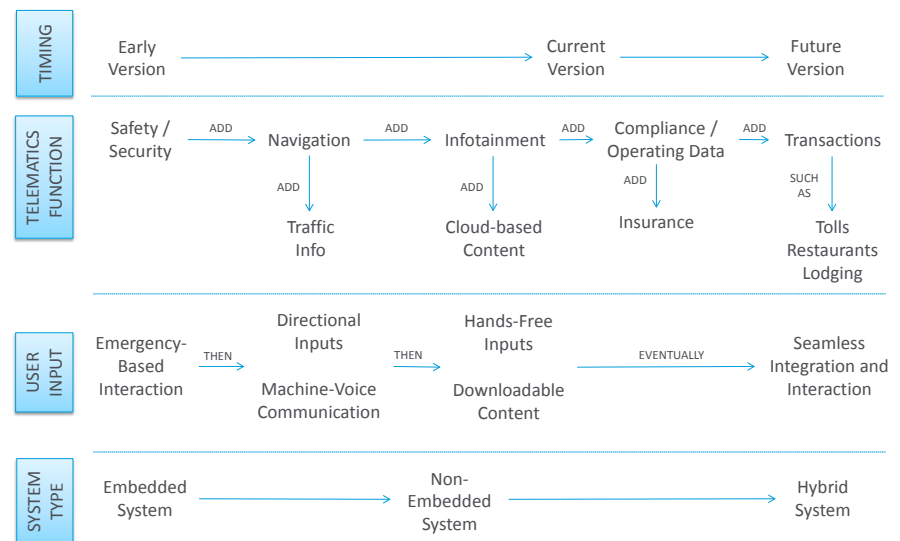


Source: Citi Research

Evolution of Connected Car / Vehicle Telematics

Specific to the Connected Car concept, Vehicle Telematics refers to an increasingly broader set of solutions that use information that is transmitted to and/or from the car, with or without direct human intervention. Figure 23 is a representation of the evolution of these solutions.

Figure 23. Evolution of Connected Car Feature / Functionality



Source: Citi Research

Early Telematics had limited appeal but technology and market advances have moved it from a niche market to mainstream

Vehicle Telematics has been around for a while, but the early versions had limited functionality and consequently, also had limited appeal among consumers. General Motors' initial 1996 implementation of OnStar provided accident notification and emergency use. BMW was the next market entrant, in 2001. Over the last decade several technological and market advances have taken this from a niche offering to the verge of becoming mainstream. The primary change was the proliferation of mobile phones, which led to an increased desire among consumers to be always connected.

The rise of smart phones further fueled this trend – the Telematics system no longer had to be embedded, i.e., built into the car and non-embedded systems with access to Internet-based applications became a possibility. The growth of non-embedded systems also opened up the market to aftermarket players in addition to Auto companies. The increasing functionality and consumer demand led to a larger number of Auto companies launching their own Telematics offering.

- *BMW and GM modified their existing offerings in 2007 to include embedded Infotainment. Mercedes and Lexus followed suit. Also, that same year, Honda / Acura introduced non-embedded (mobile) Infotainment.*
- *In 2008-09, Ford introduced their non-embedded “Sync” system. GM standardized its OnStar offering on a wider range of cars in 2009.*
- *In 2010, BMW started offering a non-embedded option for Infotainment. The same year, Infiniti started offering an embedded Telematics option. Toyota brought the Lexus telematics functionality down-market.*
- *2011-13 saw widespread Telematics adoption as well as increased use of the non-embedded option as Hyundai, Subaru, Kia, Chrysler, Volvo all jumped in. So, the last few years have seen near-universal adoption by global auto companies, partly driven by several governments – the EU with its eCall directive and Russia with its Automated Crash Notification (ACN) push – raising the possibility of mandated Telematics in the future, at least for the safety / security function.*

OEM vs. Aftermarket in Europe

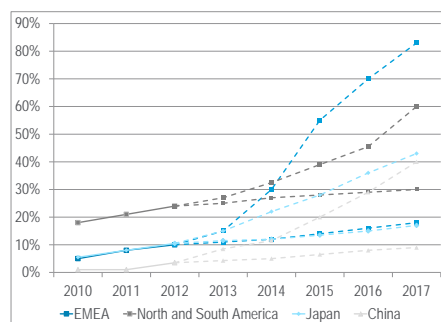
European auto suppliers are the primary beneficiaries of changing technology for cars such as Infotainment

In Europe, Automotive suppliers may be the primary beneficiaries of changing technology for cars. The main megatrends relevant to Europe are (i) need for greater fuel efficiency, (ii) safer driving and (iii) growth in Infotainment (connecting cars with information infrastructure, other cars and the expansion of multi-media).

We believe that European OEMs will have to adopt content for regulatory needs and to meet changing customer tastes that they predominantly do not manufacture themselves but which is made by Automotive suppliers such as Continental. In Europe, Continental, Robert Bosch and to a lesser degree Valeo are most active.

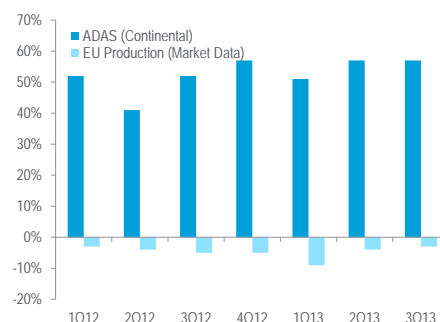
Product examples include lane departure warning systems which Continental sees as likely to generate about 30% CAGR in volumes from 2011-2020, Advanced parking assistance (~28% CAGR 2011-2020), Advanced voice recognition (~16% CAGR 2011-2020) & APP interface solutions (~13% CAGR 2011-2020).

Figure 24. Increase in Installation Rates of Embedded Telematics



Source: Citi Research, Continental *Different assumptions for forecasted years

Figure 25. Volume Development (YoY % change)



Source: Citi Research, Continental

Advanced Driving Assistance Systems (ADAS) which incorporate some of the technologies mentioned above is a particularly hot topic. ADAS product includes adaptive cruise control, emergency brake assist, blind spot detection, lane departure warnings, intelligent headlamp control, traffic sign recognition. ADAS also remains in its infancy and is expected to progress into areas such as Automated parking assist, tight spot assist, automated traffic jam assist, rear end collision avoidance braking and ultimately fully automated driving. In Europe once again Continental seems best positioned to benefit from growth here.

Telematics Use Cases

The basics of Automotive Telematics are discussed above. Here we discuss some of the pros and cons before we dive into non-automotive Use Cases.

The Case for Automotive Telematics (Positives)

Automotive Telematics has shown a steady growth trajectory which should continue. We attribute this to the following reasons.

1. Improves the customer relationship by engaging more frequently with the customer, based on usage data;
2. Tracks customer usage of car features to determine use frequency, which can eliminate wasted features or highlight less-used features that should be modified;
3. Remote diagnostics based on car operations data can lower warranty cost;
4. Potential for new revenue streams – premium features like streaming audio, video (to back seat) and usage-based insurance;
5. Lowers maintenance cost as some updates and changes can become software-based rather than hardware-based, which would imply they can be done over-the-air (OTA);
6. Legal requirements; and
7. In the case of electric vehicles, promotes peace of mind by providing a current map of charging locations.

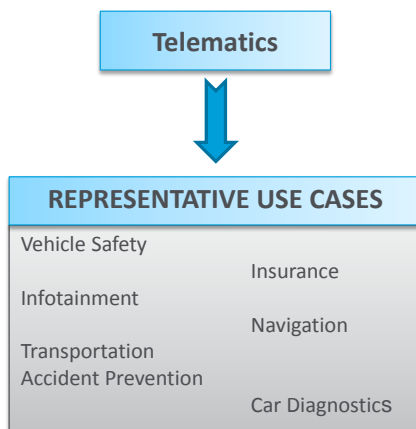
Risks - Could Telematics Momentum Stall?

The skepticism around Telematics largely stems from the fact that users have so far been resistant to subscriber-based payment models – in other words, it is not clear how the investment could be effectively recouped.

Competition from non-embedded systems (smartphones) is also a concern but we do not buy this because fully functional Telematics systems should have access to car operations data and that can arguably be better accessed via embedded systems. We do believe, however, that a lot can be done to improve the current user experience associated with a Telematics system by making the look and feel similar to popular smartphone interfaces.

Lastly, privacy concerns are also a potential mitigating factor to the trend.

Figure 26. Telematics Use Cases



Source: Citi Research

Telematics within transportation has been driven by public safety motives

Transportation – Telematics for Railways and Truck Fleets

Telematics applications within transportation seem to primarily have a public safety motive. For example, the U.S. Rail Safety Improvement Act of 2008 requires all Class I railroads and passenger railroads to implement a Positive Train Control (PTC) system by December 31, 2015 on all main line tracks where intercity passenger railroads and commuter railroads operate, as well as on lines carrying toxic-by-inhalation hazardous materials. The legislation was passed by Congress primarily due to the high-profile collision in September 2008 of a Metrolink passenger train with a Union Pacific freight train in Chatsworth, California.

Positive Train Control (PTC) systems are integrated command control, communications, and information systems for controlling train movements with safety, security, precision and efficiency. PTC systems are designed to improve safety by reducing the probability of collisions between trains, casualties to roadway workers and damage to equipment.

PTC is different from Automatic Train Control (ATC) and Automatic Train Stop (ATS), both of which are reactive in nature since they require train engineer input to prevent accidents. PTC involves robust technology that analyzes/signals upcoming condition and takes control of the train when needed. It is expected that PTC could prevent about 3 percent of the accidents that occur on freight lines, which although seems like a small number, these accidents can involve major damage and even fatalities. Along with addressing safety concerns, PTC assists railroads in measuring and managing costs and improving energy efficiency. However, of the four major railroads included in the U.S. Government Accountability Office's review – includes BNSF, Union Pacific, CSX, and Norfolk Southern – only one expects to meet the December 31, 2015 deadline. These delays are because many PTC components are still being developed, components need to be tested more thoroughly, and the Federal Railroad Administration's (FRA's) limited staff cannot verify all field tests in a timely manner.

Integrating the PTC system is a requirement for all Class I rails. While currently the PTC mandate has a very poor expected economic return (nearly \$38 spent for every \$1 of benefit), we expect a fully functional PTC infrastructure would modestly improve accident / casualty statistics for the rails as well as benefit the performance metrics in terms of train speed, dwell time and even utilization. Rails prioritize their reputation for favorable safety metrics and the move to PTC will assist in this regard. Arguably, the biggest benefit could come from reducing the number of catastrophic accidents – while this is a very small number, these events get outsized attention and have the potential for damaging knee jerk regulatory responses. Further, rail performance metrics and energy efficiency will benefit with PTC's integration, which each rail company wants to continually improve. Over the longer term it is possible that successful implementation could allow for one-person crews (down from two) on certain routes, potentially yielding meaningful cost savings.

Barriers to entry are already high in the railroad business, but now they will be even higher with the adaptation of PTC. Since all Class I rails are required to meet PTC requirements, competitive advantages are not expected to be isolated to a particular company; however, major developments in certain components of PTC may lead to efficiency gains and overall operational advantage. Effectively there may be select companies which more greatly harness its potential for operational improvement, but it is too early to tell.

The various untested systems that interlock to make the PTC network could initially reduce capacity and shift traffic to less safer modes of transportation. Since PTC technology is still being developed, non-human errors may be expected in the short-run. Also, the rail industry is expected to commit approximately \$12 billion in capital, which potentially ties up funds from other growth initiatives (\$2.7 billion has been spent thus far). Further, the FRA Rail Safety Advisory Committee identified several thousand PTC preventable accidents on U.S. railroads over a 12-year period, and the cost analysis determined that the accumulated savings to be realized from all the accidents was not sufficient to cover the capital requirements to accommodate PTC across all Class I railroads.

Figure 27. Benefits and Risks of Telematics for Trains

| Benefits | Risks |
|--|--|
| Reduce Probability of Collisions | Could Initially Reduce Capacity |
| Reduce Probability of Casualties | Could Shift Traffic to less Safer Modes of Transport |
| Reduce Probability of Equip. Damage | Non-Human Errors |
| Reduce Probability of Over Speed Accidents | Opportunity Cost of Expected Capital Spend |
| Accurately Locate Train Position | May not be Economical |
| Improved Energy Efficiency | |
| Higher Utilization | |
| Greater Track Capacity | |
| Better Cost Management | |
| Improved Energy Efficiency | |

Source: Citi Research

Insurance

Usage-based insurance could be the “killer app” in Telematics

Insurance Telematics, also called usage-based insurance (UBI), is often touted as an emerging “killer app” within the Telematics family of applications. In our view, it is best thought of as a natural evolution in the advanced statistical modeling that has been in use in auto insurance pricing since the 1990s. Telematics continues the process of making auto insurance pricing more granular and accurate. Carriers encourage policyholders to put a device in their car that allows the insurance company to track driving habits. If the driving habits result in better claims experience, consumers benefit with lower pricing.

Today, all else being equal, insurance premiums are based on historical (backward looking) driving record and self-reported factors like age, gender, marital status and location. Telematics technology can arguably provide more current driving behavior, which can be used in addition to the other factors to reward good behavior (i.e., safe driving) and change risky behavior for the better. Varying degrees of data can be made available – basic location data for potential theft prevention; pay-as-you-drive models that track fuel consumption and distance driven; or more advanced models that track the nature of driving including the frequency of hard brakes, cornering speeds, etc.

User Perspective and Insurance Company View

In fact, a 2012 Towers Watson survey of 7,500 consumers indicated that 90% would consider UBI if there was no risk of premium increasing; 80% were interested in value-added services such as vehicle-theft tracking and 81% of parents would be willing to pay extra for telematics-based safety-related products for their kids.

The theory is that the presence of a telematics-based feedback loop to drivers improves behavior. So, several insurers have adopted a strategy of offering prospective and existing policyholders a discount for joining a Telematics program. This can attract safer or low-usage drivers to the insurance company offering the discount, leading to market share gains. Insurance companies that do not offer a Telematics offering can end up with a riskier book of drivers.

Telematics has the potential to be more accepted over time, as rating factors are intuitively related to driving. This is in contrast to credit-based pricing, which is effective in predicting auto insurance claims behavior, but isn't directly related to driving, and consequently seems unintuitive to many drivers.

The main concern with Telematics is privacy. Consumers are skeptical with placing a tracking device in their car that will monitor their whereabouts and driving habits. Telematics is attempting to balance implementation with privacy, and if the privacy concerns can be overcome, there may be additional uses beyond pricing. As an example, Telematics could allow for more accurate predictions of seasonality, allowing premiums to fluctuate more closely with usage. In time, auto insurance bills could behave similarly to monthly utility bills, with higher bills in higher usage months, and lower bills in lower usage months.

Another risk is that Telematics tracked by devices could be over-emphasized, inappropriately overriding other relevant factors. Insurance only works under the assumption that many accidents are truly accidental. If the industry starts ascribing causality to certain behaviors, it's no longer insurance, and this could produce regulatory backlash if availability or affordability problems result.

U.S. Market for UBI

The U.S. uses Telematics in insurance to enhance their statistical monitoring

Progressive, a U.S. based auto insurer, is a leader in Telematics and auto insurance pricing generally, beginning with statistical modeling in the 1990s, then moving to credit-based tiered pricing in the 2000s, with most other insurers following in due course. Progressive holds patents on their telematics systems, but has recently offered to license the technology to the rest of the industry. The device plugs in to a car's diagnostic port, and keeps track of driving habits automatically. Basic metrics such as brake usage, miles driven and driving times are used to price insurance policies more accurately.

While Telematics are a small percentage of current auto insurance, some observers think this could change rapidly. Technology research group ABI Research estimates that current global insurance Telematics market of 5.5 million policies at year end 2013 could balloon to 107 million by year end 2018. Ptolemus, another technology research group, estimates that there will be over 100 million UBI (usage-based insurance) policies by 2020 with premiums of over \$36 billion. It remains to be seen whether such ambitious forecasts come to fruition.

European Market for UBI

Uptake in Europe is less as the cost of implementing is high versus and it is unlikely to offer lower premiums

So far the take up of Telematics in the U.K. motor insurance market has been relatively modest compared with other markets, particularly the U.S. Telematics customers represent around 1-2% market share or 200k-400k policies in UK. For most U.K. customers there's little upside in changing to Telematics now because it is unlikely to offer lower premiums. The cost of implementing a Telematics device in a car is estimated at ~£200 (\$325) which is relatively high when compared with average comprehensive premium of £652 (\$1,068) and this explains the appeal for higher premium drivers. Rather than having a broad appeal, the product has been targeted towards younger drivers because they face significantly higher premiums – the average premium for a 17-25 year old man is £2,345 (\$3,843) and woman is £1,862 (\$3,051).

The EU may fare better, helped by the recent EU Gender Directive which has removed gender as a rating factor and encouraged younger female drivers to use Telematics as a way of avoiding significant premium increases. Indeed, a recent Towers Watson study showed that interest in Telematics is considerably higher in other European countries (e.g., Italy ~75% consumers) compared with UK (~50% consumers). We also note the recent EU directive (eCall) which recommends that all new cars have a 'black box' device from 2015. Nevertheless, we think Telematics needs to offer a broader range of services (e.g., roadside assistance) to achieve a wider following.

We are seeing greater adoption in Italy, and the U.S. and U.K., either due to the level of car theft (Italy), the ability to provide larger premium discounts to attract business from competitors (U.S.) or to make premiums affordable for young drivers that would otherwise be unaffordable (U.K.).

Beyond the U.S. and Europe

Beyond the U.S. adoption is very low

Beyond these countries, adoption is even lower. For example, Australian UBI adoption lags because car theft is not high enough, and premiums are still relatively affordable for young drivers — mainly because the bodily injury component of motor insurance is separated out into a separate policy and has fairly strict underwriting limitations by state governments, resulting in cross subsidies between age groups.

M2M – The Next Generation

Over the history of computing hardware, the number of transistors on integrated circuits doubles approximately every two years – Gordon Moore, Intel co-founder (Moore's Law)

The value of a telecommunications network is proportional to the square of the number of connected users of the system – Robert Metcalfe, Ethernet co-inventor (Metcalfe's Law)

While mobile phones allow people to communicate with other people and/or computer systems whilst on the move, Machine-to-Machine (M2M) technology lets machines transfer information between one another using the same underlying mobile networks.

Regardless of the specific terminology used to describe it, we think of the next generation of M2M technology as the powerful intersection of Moore's law and Metcalfe's law. We have smaller, more computationally-intensive and more connected machines or things resulting in a high-value outcome.

Machine-to-Machine (M2M) can narrowly refer to the underlying technology, which provides for the automated exchange of information between devices, or more broadly refer to the concept, which is best brought to life by the following paraphrased Wikipedia description. The M2M concept comprises a device (such as a sensor or meter) to capture an event (such as temperature, inventory level, etc.) that is relayed through a network (wireless, wired or hybrid) to an application (software program) that translates the captured event into meaningful information (for example, items need to be restocked) that causes relevant action to be taken. For example, vending machines can monitor stock levels, conduct market research on relative product popularity and order refills, all within an entirely automated process. Similarly, medical patients using M2M devices can have their vital health metrics observed in real time and an automatic alert sent to emergency services if they develop dangerous symptoms.

The future of M2M envisages many millions of interconnected devices, all communicating simultaneously in order to optimize resource allocation, service provisioning and economic efficiency. This new technological paradigm has been dubbed the "Internet of Things" by some and the "Industrial Internet" by others.

Terminology Debate – M2M; Internet of Things and Industrial Internet

The term "Internet of Things" originated in 1999 at P&G and over time has been co-opted by technology companies like ARM and Cisco to represent the end-state of a world that consists of billions of interconnected devices / machines / things. The "Industrial Internet" is a term General Electric (GE) coined more recently. Both rely on the same concept – the growth of M2M. However, purists do get quite worked up over the exact definitions and semantics of these similar terms.

Our view is that the Industrial Internet and the Internet of Things represent what the prior generations of M2M technology are evolving to – hence the title for this section: "M2M – The Next Generation". The use of the word "Industrial" could be considered to be limiting, and contextually seems to emphasize industry / manufacturing / commerce. The "Internet of Things" is broader and can be considered to encompass almost anything that communicates with another entity. From this remarkably broad standpoint, it can be considered non-specific enough to actually include all of M-Commerce as well as telematics.

M2M Evolution – Why Now?

The basic M2M concept has been around for at least a couple of decades. What is different now?

- **Proliferation of mobile Internet connectivity** - According to digitalbuzz, there are now 1.2 billion people accessing the web through their mobile device and 50% of the average global web users now use mobile as either their primary or exclusive means of going online. Global mobile traffic now accounts for 15% of all Internet traffic.
- **Developments in computing** - Moore's Law may not be a physical law but it has been a reliable indicator with regards the steady march towards the availability of microchips with lower power consumption, greater embedded intelligence, smaller size and lower cost.
- **Government mandates** - Examples of recent government mandates include smart metering legislation, which require utilities to implement smart-grid technologies is one example and safety initiatives in the Connected Car realm. We discussed Connected Car earlier in the Telematics section, but as explained in Figure 2, Telematics is often regarded as a key part of the overall "Internet of Things" picture. The Affordable Care Act (ACA) in the U.S. may also spur healthcare technology investment in the U.S., including investments in remote monitoring.
- **Innovation with devices** - This particularly applies to the advances in just the past few years with regards to user interfaces and the user experience (UI/UX) and the growth in real-time analytics and the capability to handle Big Data.
- **Search for new growth markets** - Telecom providers are looking to reverse their historical "dumb pipe" role by entering new markets. Large legacy technology companies are looking for their own growth recovery and the "Internet of Things" — with its implied proliferation of devices to sell and monitor — is an attractive opportunity. Large industrial companies like GE see the potential to tap into new services-based opportunities as well as the safety-enhancement and cost-takeout potential inherent in M2M due to the elimination of manual intervention.
- **Progress towards standards** - Fast and global standardization is a key enabler to remove technical barriers and ensure interoperable M2M services and networks. The aim is to standardize M2M platforms to promote competition in the industry and reduce the level of fragmentation across different services. In July 2012, seven standards organizations agreed to an initiative, called OneM2M, which aims to develop specifications which provide:

"...a common platform to be used by communications service providers to support applications and services as diverse as the smart grid, the connected car, eHealth and telemedicine, enterprise supply chains, home automation and energy management, and public safety" www.onem2m.org

Market Sizing

Various corporations and industry analysts arrive at vastly different conclusions when they attempt to size the overall M2M opportunity – the commonality is in the "up and to the right" nature of their estimates, with truly large size estimates and robust growth projections.

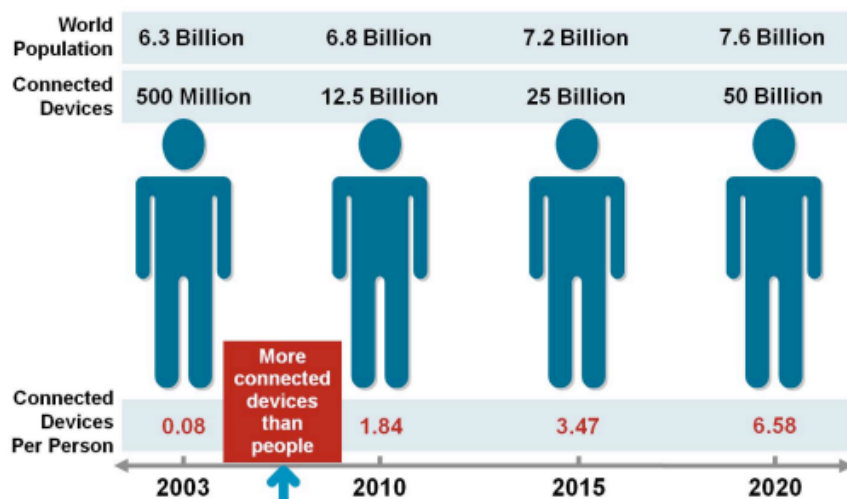
The market size for M2M is difficult to measure due to different definitions of M2M and vastly applications and business models that could be developed.

The difficulty in arriving at a market size estimate for M2M starts with the definition. How do you define “Thing” within an Internet of Things framework or “Machine” within the M2M terminology? Along the way, one has to tackle questions like, “How does one put a revenue estimate on applications and business models that have not yet been developed?”

Here are some of the common and widely-quoted estimates.

1. Strategy Analytics, November 2013 – The number of M2M connections worldwide is set to rise to 2.9 billion in 2022 from 368 million in 2013, a compound annual growth rate (CAGR) of approximately 26%.
2. Machina Research, January 2013 – The number of M2M connections is forecast to grow to 18 billion by 2022 from 2 billion in 2011, a CAGR of ~22%. This includes both short-range and long-range connections. Note that the short-range connections, which mostly use WiFi, will form ~73% of the total and are less important to a horizontally-focused connectivity provider such as a mobile carrier.
3. Machina Research, January 2013 – Wireless wide area network (WAN) connections are set to grow at a ~33% CAGR, reaching 2.6 billion by 2022 from 146 million in 2011. Of these, 45% are expected to use 3G and 41% to use 4G LTE.
4. ABI Research, 2013 – Cumulative global cellular M2M connections should rise to 364.5 million in 2016 from 110.6 million in 2011, a CAGR of ~27%.
5. Cisco IBSG, April 2011 – Probably one of the most widely repeated estimates, Cisco predicted 50 billion connected devices by 2020. Certainly in the developed world, 6.58 connected devices per person does not seem too aggressive in a world when many of us have multiple ways to stay connected to our friends and family and Amazon sells more Kindle electronic books than paper-based books.

Figure 28. Cisco Predicted 50 billion Connected Devices by 2020



Source: Cisco IBSG, April 2011

The conversion of M2M connections or connected devices into revenue estimates is even tougher because it depends on a variety of factors. A non-comprehensive list of factors would include the specific business model that prevails, the presence (or absence) of government regulation, the complexity of the value chain, the telecom cost curve by country and the technology capability / cost curve.

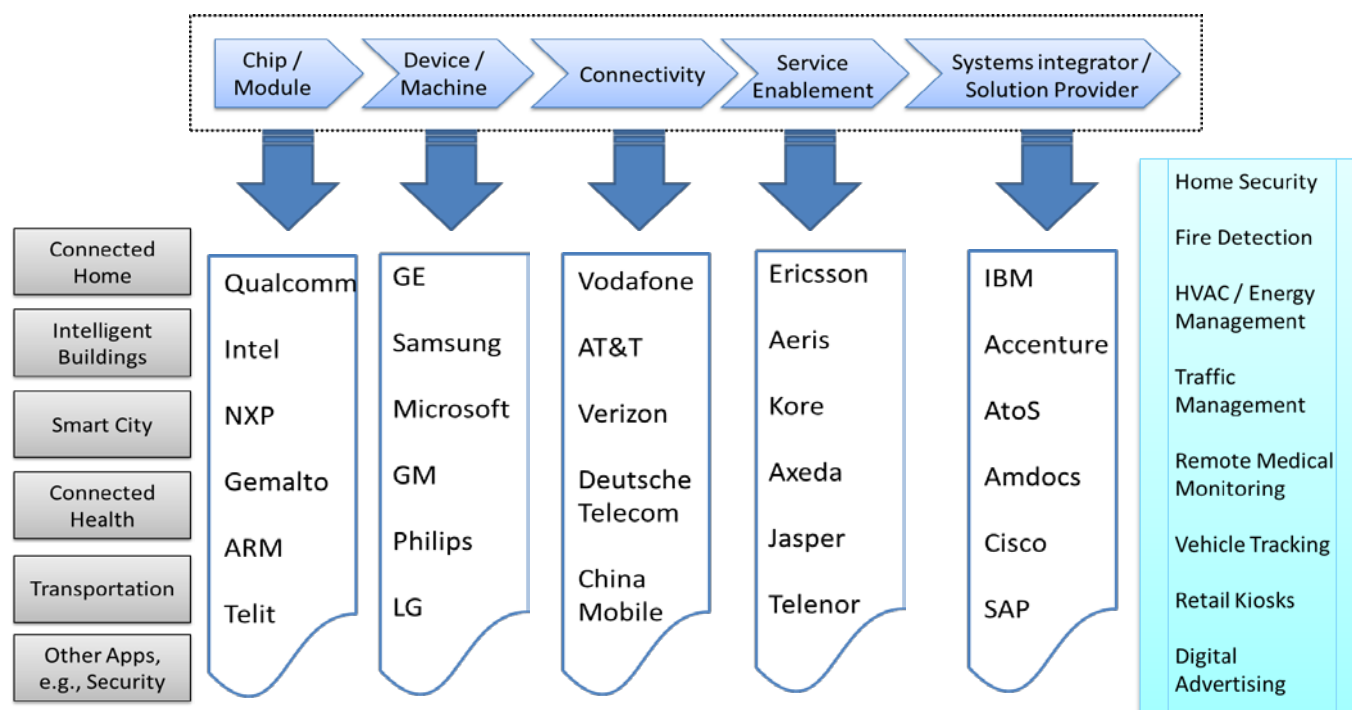
Having said this, revenue estimates do exist even if the range is wide – here are some of the common and widely-quoted estimates.

1. Strategy Analytics released a report in January 2014 saying the M2M industry will grow at a CAGR of 18%, to \$242 billion in 2022 from \$45 billion in 2013. Their definition of M2M is broad and includes Telematics.
2. Infonetics Research, October 2013 – M2M Services revenue should hit \$31 billion by 2017, with M2M connections topping 4 billion. The 2012 revenue from M2M Services was ~\$15 billion, across ~1.4 billion connections. Most of the current revenue is from short-range connections, but the fastest growth is likely to come from Wireless WAN connection growth at a ~24% CAGR from 2012-2017E. In terms of current revenues, about 33% was from automotive, transportation and logistics and another 16% was from M2M backhaul services.
3. Machina Research, 2013 – The top 20 mobile operators will share €25 billion (\$36bn) of M2M revenues. Importantly, of the total anticipated \$400 billion of M2M services revenue in 2022, \$9 billion is expected to come under the provision of basic connectivity. The overall M2M value chain is put at a remarkable \$1.2 trillion in all areas, with the remainder being secured M2M specialists, equipment suppliers, or by operators who are able to vertically expand their offering beyond connectivity.

Business Models / Value Chain Complexity

Our analysis indicates that the 'Internet of Things' is too broad a concept and we are too early in the development of the current evolution of M2M to neatly illustrate the business model as a simple flow diagram. Instead we have found a variety of approaches and ways to succeed in the market.

Figure 29. M2M Value Chain – Vertical and Horizontal Models and Examples



Source: Ericsson; Amdocs; Citi Research

Horizontal vs. Vertical Approach to Markets

At a high level, the market participant can do one of the following

- Horizontal Approach** – Provide the devices or the connectivity or the integration across a wide range of end-markets. A clear example might be a telecom provider's choice to provide connectivity across a range of markets and devices. This approach assumes that the proliferation of devices is a big enough opportunity that a horizontal or functional specialist can make a good living from it. While many industry analysts believe that providing just connectivity is a much smaller market, there is some level of skepticism associated with the assumptions related to the size of the vertical market opportunity.
- Vertical Approach** – Provide end-to-end vertical-specific capabilities. This needs a deeper understanding of the specific industry and the requirements of those particular end-users. In other words, for a provider that is traditionally a horizontal function provider (e.g., connectivity with particular service level agreements) there is an investment required. This is the riskier approach due to uncertainties associated with the eventual market size as well. But the opportunity is to charge for value-added services and to be more entrenched at the customer.

Should M2M Components Always Connect to the Internet?

Using the terms "Internet of Things" or "Industrial Internet" could imply that all these devices should connect to the public Internet. This is far from the truth. It is also not implied here that these devices should all be connected to each other. Sometimes the best approach may be a peer-to-peer connection, with the narrow intent on providing a specific input up the value chain. Sometimes it may be optimal to connect to other devices that are close by. An example may be in the "Connected Home" realm. Various sensors – for example, attached to doors and windows, for

security; or multiple room-level power- and light-management sensors – might communicate with a local dashboard as part of a local network. Not all of this data needs to always be uploaded externally. This matters because the specific level of connectivity and control specifications can imply different solutions and operating systems, which benefit different vendors.

How Does the End-User Pay for the M2M Solution?

The underlying economic model for M2M is still evolving and there are several different go-to-market approaches possible.

1. Several market participants are hardware-only providers and they may sell their individual components, such as sensors, actuators or microprocessors on an ASP basis.
2. Some providers are attempting to move higher up the value-chain by buying and assembling the components and selling solutions. There are many ways to price such solutions – as a subscription based on duration usage, or as a pay-as-you-go solution based on traffic, or as a one-time payment. Some providers are using the M2M solution as a discounted value-add offering to gain share in the selling of the market participant's core offering.
3. There are some highly customized scenarios wherein the end-user may employ a do-it-yourself approach and source the needed components or solutions themselves. In this situation, external integrators like IBM, AtoS, Hitachi and CGI (Logica) might often be hired. Such integrators often charge on a time-and-material or per-contract basis.

Who Enables M2M?

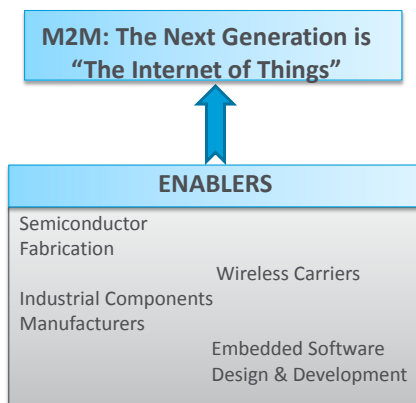
Based on the M2M value chain illustration in Figure 30, one can surmise that chip manufacturers and telecom companies are clearly core M2M “enablers”. This section provides some information on these enablers.

Building Block #1 – Chip Manufacturers and Module Suppliers

The “Internet of Things” has sensor-enabled physical objects at its core. The everyday interaction of these physical objects (“machines”) with end-market solutions and services is dependent on a network infrastructure that allows universal device connectivity. Chip and device manufacturers like Qualcomm, ARM, ST Micro and Intel manufacture (or provide the IP for) the “sensing / measurement” that is at the core of the “Internet of Things” – different sensors for HVAC systems, industrial processes, healthcare, etc. – as well as the devices that enable connectivity.

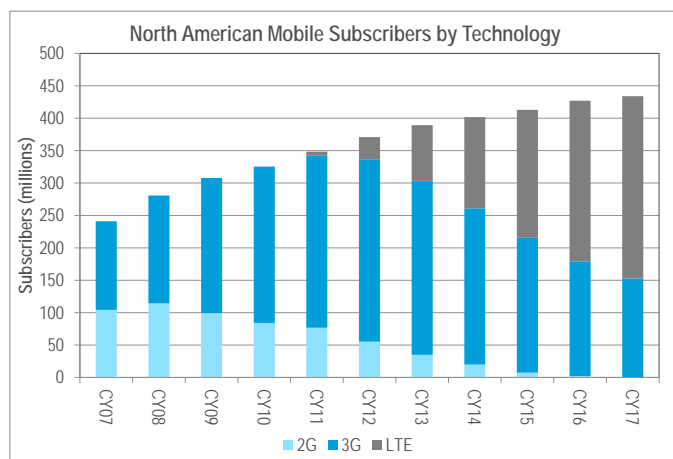
While previous generations of networking infrastructure (2G/3G) connect some devices, the proliferation of LTE and LTE-Advanced revolutionizes device interconnectivity as data speeds are able to provide real-time updates and handle exponential growth in data traffic.

Figure 30. M2M Enablers



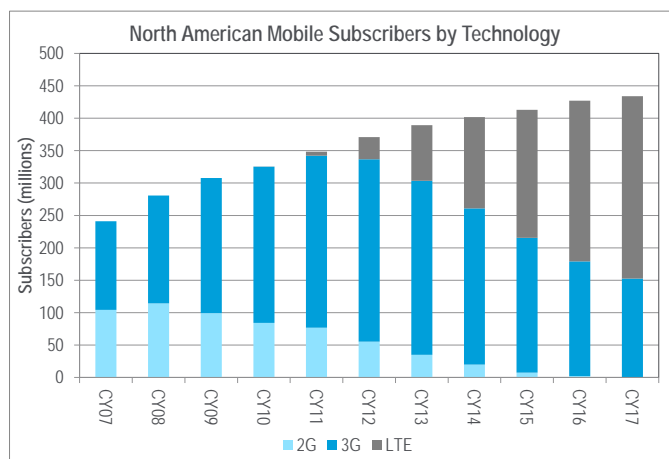
Source: Citi Research

Figure 31. World-Wide Mobile Subscribers by Technology



Source: Citi Research, Infonetics

Figure 32. North American Mobile Subscribers by Technology



Source: Citi Research, Infonetics

Figure 33. Commercial LTE Network Launches, Cumulative Totals



Source: Citi Research, GSA Evolution to LTE report – December 5, 2013

In developed markets, we are approaching mass adoption of LTE, which provides an underlying marketplace for M2M applications. While 2G/3G subscribers still dwarf LTE subscribers globally (see Figure 31); in developed markets, LTE subscribers will represent the majority of subscribers by 2016 and 65% of subscribers by 2017 (Figure 32).

Carrier spending has focused on LTE rollouts with over 260 networks already launched and nearly 500 commercial network commitments in 143 countries. Industry sources estimate that LTE will cover 65% of the world's population by 2019. The next step in this evolution is LTE-Advanced which increases spectrum efficiency, provides better capacity through carrier aggregation and improved coverage with the deployment of small cells. A key element of coverage is tighter WiFi interworking, which allows seamless offload and connectivity to the macro cell from public and private WiFi networks.

The establishment of LTE and Advanced-LTE networks allows M2M applications to transition from localized connectivity and niche markets (i.e. health & fitness wearable devices) to more ubiquitous applications. Below, we detail implications for semiconductor companies.

Implications for Chip Companies

M2M and the "Internet of Things" imply the convergence of three key functions.

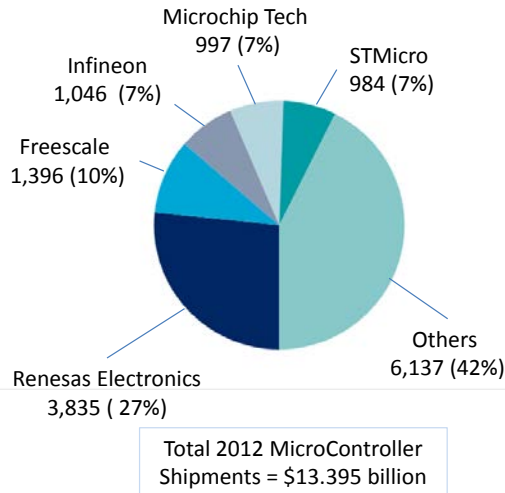
1. Data collection and storage;
2. Data analysis; and
3. Data transmission and feedback.

Those companies that bundle multiple solutions (sensors, connectivity & logic) will be better positioned to win sockets. As passive devices transition to include computation and connectivity, we believe the defining characteristics for a successful offering will be low cost, small size and low power consumption. Consequently, in a market defined by "small and cheap", semiconductor companies will only be able to benefit if they are able to sell a lot of units.

Low cost, small size, and low power consumption are keys to successful bundle solutions

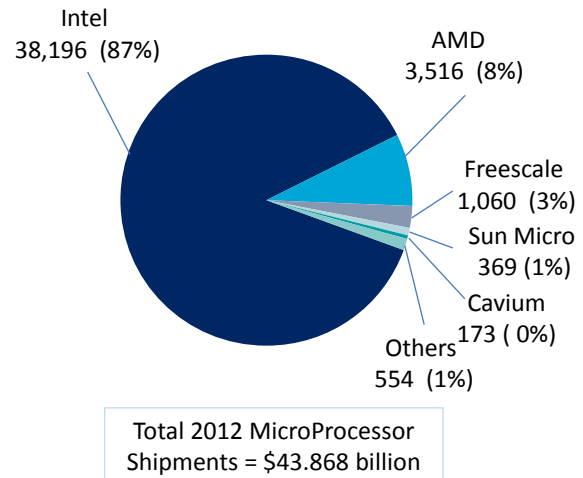
In general, the widespread availability of a higher number of microprocessors (MPUs), microcontrollers (MCUs), field-programmable gate arrays (FPGAs), systems-on-chip (SoCs) and sensors is an important building block for M2M growth.

Figure 34. Top Companies from Shipments of MicroControllers



Source: Citi Research, Gartner

Figure 35. Top Companies from Shipments of MicroProcessors



Source: Citi Research, Gartner

Figure 36. Top Companies from Shipments of FPGA/PLD

| Company | 2011 Revenue | 2012 Revenue | 2011 Share (%) | 2012 Share (%) |
|--------------|--------------|--------------|----------------|----------------|
| Xilinx | 2,270 | 2,195 | 47% | 50% |
| Altera | 1,993 | 1,730 | 41% | 39% |
| Other | 557 | 501 | 12% | 11% |
| Total Market | 4,820 | 4,426 | 100% | 100% |

Source: Citi Research, Gartner

Incumbent semiconductor vendors will benefit in connectivity

In connectivity, we expect the incumbent mobile semiconductor vendors will benefit from an early technology and certification leads. Below, we list top vendors for both mobile phones and 4G technologies.

Figure 37. Mobile Phone Semiconductor Revenues by Vendor, 3Q13

| 3Q13 Rank | Vendor | 3Q13 Revenue (\$m) | 3Q13 Market Share (%) |
|-----------|------------|--------------------|-----------------------|
| 1 | QUALCOMM | 3,972 | 39.3% |
| 2 | MediaTek | 862 | 8.5% |
| 3 | Broadcom | 583 | 5.8% |
| 4 | Intel | 4,503 | 5.0% |
| 5 | Apple | 482 | 4.8% |
| 6 | Samsung | 402 | 4.0% |
| 7 | Avago | 347 | 3.4% |
| 8 | Spreadtrum | 293 | 2.9% |
| 9 | Skyworks | 286 | 2.8% |

Source: Citi Research, IDC

Figure 38. 4G Mobile Phone Semiconductor Revenues by Vendor, 3Q13

| 3Q13 Rank | Vendor | 3Q13 Revenue (\$m) | 3Q13 Market Share (%) |
|-----------|--------------|--------------------|-----------------------|
| 1 | QUALCOMM | 2,053 | 58.5% |
| 2 | Apple | 382 | 10.9% |
| 3 | Samsung | 189 | 5.4% |
| 4 | Avago | 111 | 3.2% |
| 5 | Broadcom | 103 | 2.9% |
| 6 | Cirrus Logic | 86 | 2.5% |
| 7 | Skyworks | 83 | 2.4% |
| 8 | RFMD | 73 | 2.1% |
| 9 | Maxim | 57 | 1.6% |
| 10 | Triquint | 54 | 1.5% |

Source: Citi Research, IDC

And incumbent players in WiFi, NFC and Bluetooth will also benefit from new M2M applications

Incumbent players in WiFi, NFC and Bluetooth will also benefit from the proliferation of M2M applications. Below we list key Semiconductor vendors in these fields.

Figure 39. Worldwide Connectivity Revenue by Vendor, 3Q13

| 3Q13 Rank | Vendor | 3Q13 Revenue (\$m) | 3Q13 Market Share (%) |
|-----------|-------------------|--------------------|-----------------------|
| 1 | Broadcom | 433 | 35.6% |
| 2 | MediaTek | 171 | 14.1% |
| 3 | QUALCOMM | 68 | 5.6% |
| 4 | Marvell | 68 | 5.6% |
| 5 | Maxim | 45 | 3.7% |
| 6 | CSR | 39 | 3.2% |
| 7 | Texas Instruments | 25 | 2.1% |

Source: Citi Research, IDC

If we go one level below the above-mentioned Different M2M applications require different power-performance characteristics and ARM's wide-ranging portfolio of processor designs is well-suited to serve as the basis of compute capability across nodes spanning sensor to server.

Beyond the above-mentioned hardware (such as microcontrollers and FPGA), the definition and implementation of standards and protocols for connecting such hardware components to the Internet is also important. ARM (through its acquisition of Finnish startup Sensinode) is involved in this market. In 2012, 8 out of top 10 microcontroller vendors shipped ARM-based products. Gartner estimates that ARM-based chips make up 67% of 32-bit microcontroller volumes.

Building Block #2 – Mobile / Telecom Carriers

The involvement of a mobile carrier in M2M is obvious – this is the entity that provides connectivity (at a minimum).

M2M could be a new source of revenue for mobile / telecom carriers

However, telecom companies globally are paying especial attention to the M2M / “Internet of Things” opportunity. Especially among European telecoms, declines in core business revenues, falling EBITDA and dividend cuts have hurt over the past few years and therefore sources of new revenue are increasingly sought after. M2M is a significant opportunity in this area and, unlike other targeted new businesses; it relies on existing networking infrastructure and does not require additional capital expenditures. In addition, whereas mobile phones have high churn rates, M2M contracts tend to be significantly longer in term. This provides a security of revenue streams which has been lacking in more traditional businesses.

- **Mobile operator positioning in the M2M ecosystem** - Three major characteristics are important when determining the significance of an operator's positioning in the M2M ecosystem: (i) the degree of vertical integration and targeting of end-to-end services; (ii) international network coverage; and (iii) likely magnitude of contract wins.

There are two breeds of mobile operators in the M2M space. Operators such as Vodafone, Deutsche Telecom and Telefónica, and to a lesser extent France Telecom, are going beyond connectivity to provide tighter sector-specific applications, custom M2M product design or systems integration. On the other hand, operators like KPN and TeliaSonera are primarily focused on providing basic connectivity across a wide range of industries.

- **The International imperative** – One characteristic of the M2M marketplace is the necessity to provide international network coverage. Clients typically require access to multiple markets. For example, a large auto manufacturer which sells cars in many countries and wishes to commission a uniform M2M tracking and tracing application across its products will need it to function within the local networks of each market.

Of course this can be achieved by a single operator through traditional roaming charges, but a service on this level lacks control and makes SLA-type guarantees more difficult. Also, the forecast scale of M2M connectivity means that roaming arrangements will struggle to cope with traffic demand. In order to achieve M2M application homogeneity across borders, there has been a drive towards multi-operator partnerships such that devices which show up around the world can be covered by different carrier networks

- **Likely magnitude of contract wins** – Smart metering and other utility-based M2M solutions are at one extreme, where national or city-wide contracts are available as one-off proposals which are of considerable value to operators. Automotive deals are similar since they are only ~20 substantial manufacturers and a correspondingly limited number of M2M contracts available.

At the other end of the scale, there is the possibility for many thousands of smaller contracts with individual companies producing niche services. At the moment, this SME market may not attract the larger operators due to distribution costs and the competitive imperative to develop the larger account capabilities first. As new large contracts slowly begin to dry up over the course of the next 5 or so years, there is likely to be a progression towards this end of the market. For the moment, we expect the SME sector to be served by M2M resellers.

- **M2M economics – Impact on telecom ARPU** – According to Ericsson, M2M average revenue per user (ARPU) is about 10% lower per connection than that of a typical mobile handset subscriber, an estimate we regard as high compared to indications we have received from operators. Analysys Mason expects M2M ARPU to fall throughout the next decade, from a worldwide average of \$4.71 per month in June 2012 to \$1.98 in 2021. This will be due to increasing price pressure and growth in the number of M2M device connections in emerging markets, where ARPU rates for M2M applications are typically lower.

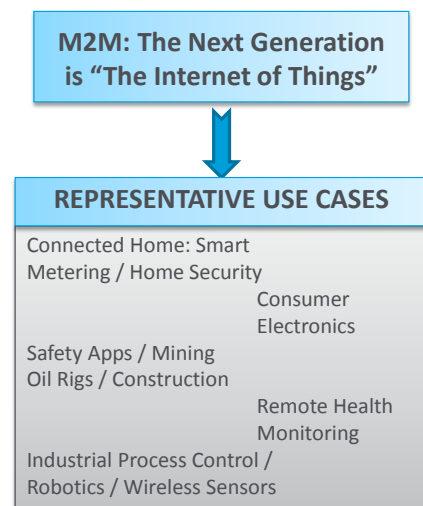
In our view, guidance on M2M ARPU is inexact since numbers will vary considerably between the service offering. For example, the per connection price of a smart meter transmitting low data volumes periodically will be much less than a tracking and tracing device in a car. Indeed, contract value is in any case probably a more meaningful measure for tracking purposes.

- **M2M economics – Impact on telecom margins** – For incumbent operators, the provision of basic M2M connectivity is a high-margin business. The service relies on their existing network, so the additional capital expenditure required to provision an M2M offering is minimal. A key attraction for the operators of the technology is this ability to bring online a new source of revenue at minimal risk in comparison to other new business areas.

However, as highlighted above, simply providing connectivity has a major class ceiling in terms of revenues. Lower margins are available on vertically integrated solutions, but much more significant sales opportunities are possible.

M2M customers are typically on long term contracts, meaning that, relative to mobile, there is a relatively low churn. With high churn rates across mobile businesses, M2M offers some revenue stability.

Figure 40. Representative M2M Use Cases



Source: Citi Research

Representative M2M Use Cases

The use cases below highlight the diversity of M2M applications. It also becomes clear that M2M capabilities have existed for many years, but both the scope and the adoption potential of the next generation of M2M is much greater than what exists in the field today.

Industrial / Manufacturing Process Controls

This was one of the original use cases of M2M and a wide range of corporations continue to make interesting strides in this area.

Robotics

Robotics is an obvious area of M2M growth. It is well-documented that as devices have become smarter, interacting with each other and making intelligent decisions, there is a reduced necessity for human labor to be present on the factory floor.

- *Fanuc's six axis parallel link robots at work in pharmaceutical factories and Yaskawa's dual-arm robots at work in its own factories are good examples. Supporting the growing diffusion of industrial robots on the factory floor is a wide range of discrete components from programmable logic controllers (PLCs), sensors, servo motors and also software which comes both from in-house at Fanuc and Yaskawa, but also from suppliers like Keyence, Omron, Mitsubishi Electric.*
- *Omron recently show-cased its vision guided robotic loading cell at a System Control fair in Tokyo (using a Yamaha parallel link robot). Their machine automation platform "Sysmac" is an open system, something that is still rare in Japan, but will bring them more into competition with Rockwell Automation, Siemens and Schneider in North America and Europe. At the same time, Omron is also promoting the concept of low-cost automation in China with a focus not just on replacing human labor on the factory floor but also increasing the use of machine-based inspection systems in the back-end of the assembly process.*

Wireless Sensors

There are three major benefits of M2M technology for process customers:

1. Lower capital expenditure costs related to installation, due to low wire content;
2. Increased efficiency and uptime resulting from metrics being measured in places that were previously unreachable; and
3. Reduced operational costs as readings can be remotely monitored and adjusted.

Key applications of these wireless sensors in process applications include heat exchanger monitoring for improved energy efficiency; sensors on tanks to determine mass, volume, or density, rotating equipment for better temperature reading and furnace and boiler tubes to prevent hot spots from bursting.

- *Emerson was an early adopter of wireless sensors and automation technology in its market leading Process segment and is among the leaders in the space today. The company boasts over 80 unique customers in over 80 unique applications, although wireless monitoring was at first met with skepticism by customers due to the critical nature of the processes.*

- *Murata Manufacturing's acquisition of RF Monolithics (RFM) improves its position within wireless M2M connectivity and its acquisition of VTI boosts its position within the sensor market.*
- *Honeywell also provides wireless process capabilities within its Automation & Control Solutions unit.*

Process customers are still early in their adoption of new technologies given the critical nature of these applications as well as the lengthy 20-year replacement cycle. That said, overall wireless sensors have gained acceptance in certain critical applications, namely in “greenfield” builds and efficiency improvement, and we expect this trend to continue.

General Electric's Broad Role in M2M

GE is widely attributed with coming up with the term “Industrial Internet” and has invested heavily in this area

GE has been extremely committed to M2M – in fact, it is widely attributed with coming up with the term “Industrial Internet”. It has aggressively invested in its software capabilities as it differentiates its industrial product and service offerings. GE's objective is to create intelligent real-time connected equipment and systems using integrated sensors and controls. GE estimates that there is roughly \$150 billion of waste that can be eliminated by the “Industrial Internet”, and that its applications could touch nearly half of the global economy. Examples of M2M communication can be found throughout GE's businesses.

- For gas power turbines, GE uses embedded sensors for remote diagnostics and preventative maintenance. This enables a field technician to go out to a remote piece of equipment (like a wind turbine) only when known maintenance is required; they are equipped with a manual that is loaded onto an iPad that can be updated continuously.
- The real-time monitoring on power generation equipment is a key differentiator of GE's Flex Efficiency gas turbines. The technology enables power plants to react to changes in power demand, grid conditions, and fuel supply in real time.
- GE's Fuel and Carbon Solution (F&CS) uses onboard computers and analytics to optimize fuel use for jet engines. GE estimates that if the average airline used its F&CS systems, it would achieve a 2% fuel savings.
- In Aviation, GE also uses embedded sensors that continuously relay engine conditions (such as temperature and vibration) that can be used to predict part failure and for preventative maintenance.
- Rail optimization applications include the same preventative maintenance products and sensors discussed above for turbine or jet engine applications. There are also fleet utilization applications to deliver real-time assessments of a network of locomotives. It is estimated that rail operations and maintenance costs are roughly \$245 billion per year, and GE estimates that 2.5% of these costs (or \$5.6 billion) are the result of system inefficiencies.

Connected Home Use Cases

Connected Home represents a broad set of use cases. It essentially consists of various devices for security, convenience, energy management and other functions that are connected to the Internet and can presumably be controlled and/or monitored remotely using a mobile device. Smart appliances and accessories that enhance convenience and reduce operating costs represent an important and fairly large use case and so they are separately discussed below. Security and identity management is another application area.

This is not about your refrigerator sending grocery lists to your phone. Homeowners can control the functionality of lights, pools, security, and HVAC from their mobile device. Bite-sized applications for home security (turning on a video recorder remotely when a motion sensor is triggered at an unexpected hour), safety (smoke alarm alerts to your phone when the battery runs low or there is a fire) and energy efficiency (controlling the thermostat or the porch lights or ambiance in your dining room) are steadily becoming a reality.

Home Automation and security can come in various flavors. It can represent an opportunity for companies in multiple different industries.

- *Telecom Services vendor Amdocs has a cloud-based M2M service that enables its primary clients (telecom companies) to generate incremental ARPU by offering subscribers home monitoring and energy management solutions.*
- *In September 2013, Deutsche Telekom launched QIVICON, an alliance with appliance maker Miele, utility EnBW and Italian group URMET. Together they will develop a platform for energy efficiency and security for the home market.*
- *Honeywell, Tyco, United Technologies and Pentair are also beneficiaries of trends in wireless home automation.*
- *Panasonic is working to increase energy efficiency by linking smart appliances and other household equipment with a home energy management system (HEMS). Currently, Panasonic features HEMS-compatible smart products in air conditioners, electronic water heaters, and inductive cooktops, but going forward it aims to expand this into kitchen appliances and also to enable linkages with storage batteries and solar cells. In October 2013, Panasonic developed a new residential distribution panel board called "Smart Cosmo", which according to Panasonic, will play a central role in the distribution and information management in future homes and allow users to better understand their energy use. Panasonic also wants to beef up maintenance and after-sales service (product monitoring, etc.) via equipment networking instead of its current "sales-only" model for household appliances.*

While home automation is becoming more widely accepted, it has yet to be fully incorporated in commercial buildings. There are scalability issues with remote control and monitoring especially in the security space when a typically commercial installation can have hundreds of cameras and multi-door access control.

The need for convenience, efficiency and managed security solutions is increasing the demand for secure identity solutions

Identity / Security Solutions

Demand for secure identity solutions is rising due to the need for convenience, efficiency and managed security solutions. The global entrance automation industry is sizeable, at €20 billion (\$27bn).

Sweden's Assa Abloy Group, the world's largest lock manufacturer by sales, launched Seos in September 2012. It is billed as the world's first commercial ecosystem for issuing, delivering and revoking digital keys on mobile phones with NFC technology. With Seos, mobile phones can replace mechanical keys and access cards and open doors to homes, hotels, offices, hospitals, universities, industries and commercial buildings.

Figure 41. How Does Seos Work?



Source: Company reports

The Seos ecosystem includes a standards-based smart card technology designed for Mobile Access Control which is portable for use on NFC smartphones so that customers can utilize smart cards, mobile devices, or both within their physical access control system. The Seos Trusted Service Manager securely manages Seos digital keys on NFC mobile devices and enables a single point of entry to multiple global communication networks for the access control community.

- Using either Seos or the Yale Digital Door Lock system (Yale is a Seos brand) homeowners can send temporary digital keys to visitors, handymen and babysitters from their own mobile phones. Issued keys can then be revoked through the same interface so that owners no longer have to lend out physical keys and worry about them being lost or copied.
- Similarly, using Essence by VingCard (another Seos brand), hotel guests can check in and out with their mobile phones and receive digital hotel room keys before arriving at the hotel.
- In offices and commercial buildings, Seos can be used to manage access to rooms and cabinets centrally. Security staff will be able to send temporary digital keys to visitors and service staff wirelessly without having to manage physical keys and access cards and, where additional security is required, Seos digital keys can also be protected by mobile phone PIN codes.

Smart Appliances

Major appliance makers are committed to smart appliances

Smart Appliances can be linked to smartphones, storage batteries, solar cells, and energy management systems. They enable a more comfortable living environment than traditional household appliances thanks to features like remote control using smartphones and “collaboration” between different appliances. Another key benefit is reducing power consumption via a link to smart meters or home energy management systems (HEMS). Finally, networking can make it easier to spot problems and to know when replacement is necessary. This can help spur customers to take advantage of a company's maintenance and after-sales services, as well as to upgrade or replace their existing equipment.

Major appliance makers such as Panasonic, GE, Toshiba, LG and Samsung are committed to this market. In particular, Japanese manufacturers have identified an investment in Smart appliances and Connected Home as sources of post-structural reform growth.

- Panasonic, Japan's largest household appliance firm (and No. 2 in the world; based on 2012 data), began introducing smart appliances in its air conditioner and washer offerings in 2012. By installing a special application, a customer can access information about and change usage settings for appliances using a smartphone. A, smartphones can be used to control air conditioners remotely.

- In October 2012, Toshiba introduced an air conditioner that could be controlled remotely using a smartphone. In the fall of 2013, it launched smart versions in a number of product areas in addition to air conditioners, including refrigerators and washers. These products automatically save electricity by linking up with HEMS, and can also alert a customer of problems via an email. Going forward Toshiba plans to launch a smart version of the microwave oven and expects smart appliances account for 20% of total appliance sales in 2014.
- Since April-2013, General Electric (GE) has worked with Quirky, the creator of WINK, to develop a number of connected home solutions which are now available at Home Depot, Amazon and Best Buy. These are incorporated in GE home and countertop appliances.
- At the 2012 CES LG and Samsung announced smart household appliances with wireless networking capabilities and could be controlled via smartphones. They have also introduced refrigerators, washers, and air conditioners that can be controlled with LG or Samsung smartphones, as well as products that enable energy saving via control of networked household appliances.
- MELCO, traditionally a strong player in heavy electronics, announced its foray into the smart appliances business in August 2013. MELCO intends to launch its HEMS and seven smart appliance models (in air conditioners, refrigerators, LCD TVs, and IH cooktops). These appliances link to the HEMS via wireless local area network (LAN) and this enables automatic monitoring of power consumption and cuts to power usage. At the same time, these appliances offer comprehensive tablet PC-based control (although not yet when outside the house).
- Daikin, the world's largest specialist air conditioner manufacturer, launched the smartphone app "Daikin Smart App" in December 2012. The company is working to link its air conditioners to smartphones via the app and allows users to see operating conditions (temperature, humidity, and electricity consumption) as well as operate the air conditioners remotely via their handsets.

Risks / Challenges to Smart Appliance Adoption

1. **What is the killer app beyond energy efficiency?** - A lot of functionality has been proposed in smart appliances, but in our view smart appliances such as air conditioners that can be operated remotely by smartphones or HEMS-linked energy-saving appliances that can help lower electricity bills best address the needs of customers today.
2. **Non-standard communication protocols** - This can prevent linking HEMSs and smart appliances of differing manufacturers. Japan's Ministry of Economy, Trade and Industry (METI) has introduced a smart appliance communication protocol called "ECHONET Lite", but due to differing communication standards at the interfaces, products of differing manufacturers cannot communicate with each other. So far, one could say that the products speak a common language but the way they express themselves is quite different depending on the maker. In South Korea, KEPCO, Samsung Electronics, and LG Electronics began trials on a smart appliance communication protocol in September 2013 toward implementation by July 2014.

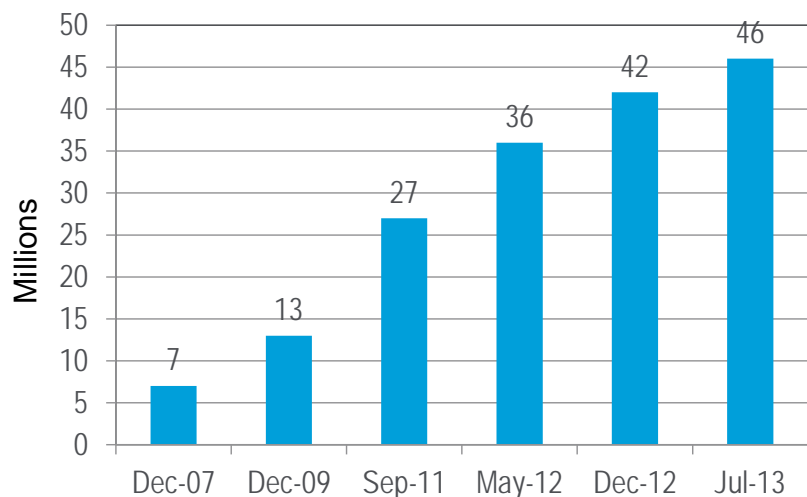
3. **Presence of regional players and non-traditional competition** - We can see from the diverse locations in this report itself where we mention smart metering and smart appliances that a lot of different players from many different industries are interested in this market. Who should control the revenue stream when a smart appliance is controlled over a wireless network using a smartphone with the objective of providing energy efficiency? Is it the appliance manufacturer, the telecom, the handset / tablet manufacturer, the mobile OS developer or the utility? This is a good question. The “Balkanization” of the home appliance market, with the presence of strong regional / niche players in many countries adds a layer of complexity to the outcome as well.
4. **Smart appliance price point** - This will likely be less of an issue longer-term but the initial price points for smart appliances can be steep. For example, it is in the ¥200,000-¥300,000 range (\$1,900-\$2,900) in Japan

Utilities and Alternative Energy

Multiple factors are leading to the wider deployment of M2M technology within the Utilities industry, centered on “smart” offerings.

- **Heightened concerns over energy bill affordability, particularly in Europe** - According to the Association of European Utilities (Eurelectric) M2M should become a €30 billion (\$41bn) annual revenue market by 2030 in Europe and will also allow them to compete more effectively for new services.

Figure 42. Smart Meter Roll-out in the U.S.



Source: The Edison Foundation in its Innovation Electricity Efficiency report in August 2013 (http://www.edisonfoundation.net/iee/Documents/IEE_SmartMeterUpdate_0813.pdf)

- **Regulatory impetus** - In most countries adoption of M2M technologies is driven by regulation and national targets. Starting from almost zero, countries around the world are setting targets on smart metering, with the UK targeting 30 million homes to be covered by 2020, France targeting 3 million smart meters by 2016 and 35 million by 2020, Germany targeting about 20% coverage by 2022 (~10m) and the U.S. installing smart meters at a pace of 8-10 million annually. In China smart meter installations stand at 90-100 million per year in the last few years with most industry players projecting high single digit growth in the coming years.

At this stage, even though the smart meter roll-out has been accelerating, the total investment in the smart meter space is negligible at just €6 billion (\$8.2bn) cumulatively over the last decade in Europe vs. annual investment from energy utilities of >€60 billion (>\$82bn). Based on commitments made by European countries, the European Commission's Joint Research Centre estimates smart metering investments to reach cumulatively €30 billion (\$41bn) by 2020.

- **Development of M2M capabilities, including two-way communication -** Advanced smart utility meters will be able to (i) collect data on energy usage both for monitoring and billing purposes and (ii) improve the reliability of the grid and the security of supply. Both of these functions translate to lower system costs that will give first movers a cost advantage and upon more widespread take-up should be driving consumer prices lower.
- **Fear of non-traditional competition -** While the industry in general has been slow in embracing M2M, we expect utilities to change their approach by trying to offer new services before other industries, such as the telecoms industry, crowd them out of that space.
- **Growing penetration of distributed energy on both sides of the Atlantic –** more details on renewable energy are presented below.
- **Rising consciousness over energy usage and carbon emissions globally.**

What Are the Risks / Challenges to Adoption?

- **M2M deployment can cut power consumption and also affect margins -** The demand of a utilities core service – the supply of energy – drops as consumers get a better understanding of their consumption profile through smart meters or even automatically as smart appliances regulate power use. For example, M2M technology involving smart chips in a home appliance (e.g. a fridge) can detect when optimum temperature is reached and then power down until it is required to power up again. Because utilities typically charge on per-MWh basis that will result to lower overall profitability.
- **M2M can change the traditional business model -** This can be a benefit to an early adopter but is likely a risk longer term. In addition to changing how and at what cost existing utilities functions are delivered, M2M can also facilitate new business models, such as differentiated pricing based on timing of consumption and availability of service, and new offerings such as WiFi communications via smart meters.
- **The downside of forced adoption -** Utilities do not own smart meter technology, so they have little direct monetary benefit from expanding coverage. For example in France, the initial roll out of smart meters was done for free.

Incremental Thoughts on Renewable Energy and M2M

How generation is distributed is important for solar and this is controlled via M2M

One of the most exciting aspects of renewable energy, in particular solar, is that much of this generation is distributed, i.e. it is located at the point of use. This offers the potential for households to decide whether to export energy back to the grid, or whether to use it themselves, and to control this via M2M.

This potential grows even further when storage is considered. The problem with solar is that it generates most of its electricity in the middle of day, when many households are typically empty, and hence is exported back to the grid. Smart metering and M2M control gives the potential not just for appliances to be turned on to use this solar electricity (which is in many countries now cheaper than socket electricity) but to either export the

electricity to grid if demand and prices are high, or to store this electricity and to use/sell back to the grid at a later more financially lucrative time. While storage is currently in its infancy, it is notable that the German government has just introduced the first subsidy scheme in the world for residential electricity storage, much as it did with solar a decade ago. This is in our opinion a tacit recognition of the issues that solar is causing for the German electricity market, where on sunny days all of peak demand has gone over to solar (from gas). Storage potentially provides a (partial) solution to the issue of underutilized conventional generation (stranded assets) which would have to be maintained for use in winter, and would therefore require capacity payments to render them economic (thereby pushing up bills further). While storage capacity is very small currently, the effect of a subsidy scheme on solar provides a valuable insight into how quickly this technology could be adopted. Although widespread adoption has not happened yet, electric vehicles are often seen as the holy grail of storage given their capacity and the fact that they are charged at home, i.e. distributed energy storage.

In this way, distributed generation and storage offer the potential for individual households to become effectively small energy traders themselves via M2M technology. They can choose whether to turn appliances on and off, to store electricity from their own generation or even from the grid, and if/when to sell this electricity back to the grid. As discussed earlier this has significant implications for utilities given the potential to flatten the demand curve, reduce the number of conventional generation stranded assets, as well as increasing the efficiency of a price-governed market via a significantly higher number of market participants (who may be individual households, or indeed grouped households whose demand, generation and storage is managed by a third party).

Medical Technology

Remote monitoring in healthcare – for the heart, diabetes and other chronic disease is a key area on M2M

Remote monitoring of patient health has been a use case for the prior generation of M2M technology for some time. In fact, there are over 600,000 patients with pacemakers and 300,000 with implantable cardiac pacemakers and defibrillators (ICDs) that utilize remote monitoring where the data is wirelessly synced to a company's database and is then packaged for the patient's physician to monitor.

As the industry adapts to become more of a solution to lower health care costs, it is paying more attention to technology approaches like M2M. The primary examples where we expect to see more Mobility-based monitoring/solutions are in the areas of congestive heart failure (CHF) and diabetes.

- *For CHF, we estimate that roughly 200,000 of the 900,000 pacemakers and ICDs that are remotely monitored include left-heart cardiac resynchronization and in some cases technology to monitor fluid levels. This technology has proven to be especially valuable for patients that are in rural areas, who find it burdensome to visit a medical facility. They can have their device interrogated for checkup and/or when an issue pops up. Medtronic currently dominates this space with over 50% of the implants that use remote monitoring.*
- *Privately-held Cardiomeems – which St. Jude Medical has the right to acquire – has developed the Champion HF sensor/monitoring system, which is awaiting FDA approval. Champion's sensor is a tiny implantable device that measures pulmonary artery pressure which can potentially be an early signal of fluid buildup which in turn can lead to an acute episode of CHF and an unexpected trip to the emergency room. With this system, the patient is required to wave a wand over the implant daily and this information is sent via a special transmitter to Cardiomeems which packages the data and sends it to the patient's physician. Assuming FDA approval is granted, we would expect a second generation version to eliminate the need for wand.*

In the area of diabetes, there is more potential based on the number of people afflicted with the disease and the need for more continuous monitoring. An estimated 26 million people in the U.S. have diabetes including 1.5 million with Type 1 (requiring daily insulin injections) and another 3.8 million who have Type 2 diabetes, require insulin, and are not at ideal A1C (blood glucose) levels. In diabetes, both insulin delivery and blood glucose monitoring have the potential for mobile monitoring/treatment. On the insulin side, about 40% of the Type 1 diabetics in the U.S. use continuous insulin pumps for delivery equating to a \$2.4 billion global market. On the monitoring side, both Medtronic and DexCom have continuous blood glucose monitors (CGM) and Medtronic also controls a 60% share of this nearly \$400 million global market.

- *In September 2013, Medtronic's 530G pump and EnLite sensor were approved, a big step in terms of approved M2M scope. These have the ability to suspend insulin delivery sensor data indicates that a low level glucose threshold is reached. This represents the first situation where one device directly controls the functionality of another device without the patient acting as an intermediary which has garnered FDA approval. Ultimately, Medtronic hopes to layer on additional clinical trials and approvals to create an "artificial pancreas" where the two devices work in tandem to maximize insulin delivery without any patient interaction.*

It will require rigorous clinical trials and FDA approval to create M2M interaction between pumps and sensor, but the sensor/glucose testing component of the market should be able to move toward a simplification with mobile devices.

- *Johnson & Johnson received FDA approval last year for a traditional blood glucose testing meter system (i.e., finger stick analysis) called OneTouch Verio that syncs via Bluetooth with an app called OneTouch Reveal to track glucose levels on an iPhone. This device launched in January 2014.*
- *We also believe that both DexCom and Medtronic are working on next-generation sensor systems that will sync with via Bluetooth LE to show continuous glucose levels directly on a mobile phone vs. on a stand-alone handheld. We would expect to see at least one of these companies garner FDA approval for a device within the next 2 years.*

"Telehealth" hit the med tech radar screen with Medtronic's \$200 million acquisition of privately-held Cardiocom in August 2013. Cardiocom is the market leader in the area of telehealth / remote monitoring and addresses the costly chronic disease states of CHF, chronic obstructive pulmonary disease / asthma, diabetes, hypertension and obesity. Cardiocom is not necessarily cutting-edge technology – it is primarily a service business that offers patients access to a network that can answer their questions and several devices that the patient can use to check their weight, blood glucose, blood pressure, and oxygen saturation – data that is then sent to the company and packaged for the physician. Unlike products and apps such as Withings and FitBit which have WiFi and Bluetooth accessories that can also take these measurements, Cardiocom provides the interface between the patient and physician and receives a fee for this assistance. While Cardiocom is still relatively small – we estimate a \$40 million annual run rate in sales currently – we believe that over the long-term Medtronic plans on using this platform to integrate in the data from its "smart" implantable devices as well.

Finally, M2M is being used extensively in the area of hearing aids.

- GN Store Nord will launch the first 'Made for smartphone' hearing aid over the next few weeks. LiNX is based on GN's third generation wireless chip platform, SmartRange. The device, when synched to a smartphone can automatically be controlled through an app — 'ReSound Amart App'. LiNX, running on the Smart Range wireless platform will be unique and management does not expect competitors to be able to launch rival devices for at least 2 years. The main feature that the mobile connection uses is the use of the smartphone's GPS functionality to remember and activate different hearing aid settings for different locations (such as the cinema, a restaurant / bar and home). Given its premium pricing to GN's current high-end product portfolio, the company expects to drive both mix and margin benefits from the launch of LiNX. Beltone, GN's U.S. brand is also expected to launch a 'Made for Smartphone' aid in the U.S. in the first quarter of 2014.

Mining

Komatsu pioneered the development of un-manned dump trucks to help its mining clients drive operating cost efficiencies. Codelco's copper mines in Chile were the first use-case with seventeen trucks in operation to-date. In late 2011 Rio Tinto signed a memorandum of understanding (MOU) to deploy at least 150 of these trucks at their Pilbara iron ore operations in Western Australia. We understand that, at present, there are around 50 trucks in operation.

- For Rio Tinto, Komatsu's so-called Autonomous Haulage System (AHS) are operated and controlled using a supervisory computer from a remote location which, in the case of the trucks in operation in the Pilbara, is more than 1,000km away in Perth. The trucks are equipped with a GPS system, an obstacle detection system and wireless network all developed by Komatsu.

A portion of Komatsu's 15,000-strong global mining fleet is equipped with its newer "Komtrax Plus" monitoring system – Komtrax is Komatsu Machine Tracking. It ascertains operational status and performance, using a GPS antenna and wireless communication technology. Komatsu shares live-time data (location, fuel consumption, maintenance alerts, etc.) to clients and distributors, but also uses this information for its own data analysis.

Construction

Komatsu's standard Komtrax (Komatsu Machine Tracking) system was developed more than ten years ago and is installed in more than 300,000 pieces of construction equipment worldwide. This was the legacy M2M generation.

- Komatsu launched its intelligent machine controlled bulldozer (D61 PXi) with the first fully automatic (hands free) blade control. The GPS system for this was developed by Topcon, which also helped develop KomTrax. Both Topcon and its main U.S. competitor, Trimble Navigation, work with customers such as Komatsu, Caterpillar, Deere and Kubota to automate more processes for mining, construction and agricultural equipment.
- Volvo Construction Equipment is developing an Intelligent Transport System (ITS) which could reduce fuel consumption by up to 30% in certain haulage apps.

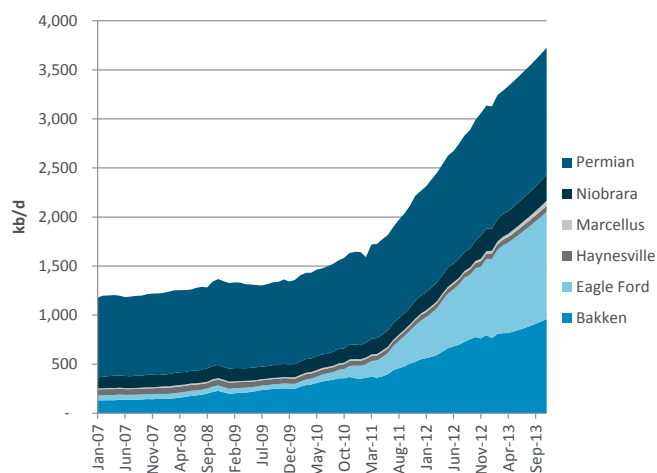
Energy

Mobility has been a driving factor in the surging oil production in U.S. shale as mobile technology drives tracking, processes and monitoring

For the energy industry, particularly the oil/gas exploration and production sector, the move to Mobility is critical to finding new areas, boosting production and lowering costs.

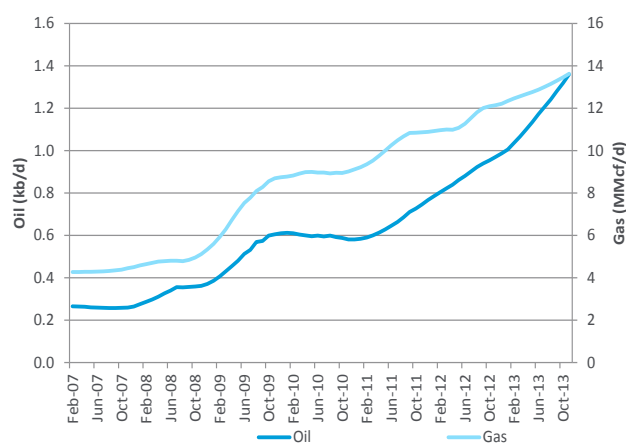
The oil and gas industry is in fact a high-tech industry. Technology tracking and interacting with various processes in not only deep water drilling but also onshore shale exploration are resulting in huge efficiency gains. Having Mobility allows drilling and other work to be conducted 20k feet down and being able to “see” what’s going on. The North American energy revolution continues to surprise to the upside because of advancements in technology, particularly mobile applications.

Figure 43. Surging Oil Production Driven By Technology



Source: EIA, Citi Research

Figure 44. Rapidly Rising Production Helped By Mobile Technology



Source: EIA, Citi Research

With rising oil demand and the constant search for new oil supply, oil companies have been going after deep water resources known to have large production potential but the technology in the past did not allow for cost effective exploration. Fast forward to the present, oil production from deep water basins (e.g. Gulf of Mexico, offshore Brazil) is rising rapidly and could contribute nearly 10% of global oil production just after the 2020 time frame. Mobile technology is making this happen. Examples of technology include the use of deep underwater sensors and mini-sub to go close to the seabed, where no humans can survive, for offshore drilling. These technologies allow operators to station on land in control-rooms miles away. There are many instances where sensors are subject to 500F of temperature and between 30,000 to 35,000 psi of pressure. Some sensors have to be permanently installed at the well and be operable for 40 years.

The shale and energy revolution in North America is not only about the use of horizontal drilling and hydraulic fracturing, but it involves the advancement of other mobile technologies that continue to boost productivity. The productivity gain has kept on surprising to the upside in the last few years and is expected to rise for the foreseeable future. Such productivity gains are driving costs of production down to make North American shale oil and gas production much more competitive globally – down from the top-end of the global cost curve to the middle part of the curve in just a few years.

Some of the mobile technologies involve include logging-while-drilling, the use of RFID and tiny sensors thousands of feet below ground that provide data back to the surface. These advancements are all making a difference in boosting efficiency and productivity. Geologists and engineers can monitor multiple drilling sites and adjust in real-time how and where to drill, so that a wellbore thousands of feet below ground can be directed to rock layers in the vicinity that are richest in oil and gas content. In addition, media tablet and smartphone applications give operators the ability to closely monitor drilling and production progress, so that adjustments can be made accordingly.

Such ability allows shale production to surge, leading to the energy revolution in North America. These real-time monitoring of “downhole” activities, combined with sophisticated analytics, which could be derived from petroleum engineering principles or using pattern recognition, could automate some tasks and help operators decide the best course of action. Nonetheless, an operator’s experience and knowledge remain critical to the success of any drilling and production program.

Big Data

What is Big Data?

Big Data is a category of computing that was born from innovations in the consumer Internet a decade ago. Whereas the previous generation of enterprise databases and analytics software was built to handle computing problems with well understood data inputs and transaction patterns, the explosion of volume, variety, and velocity of data in consumer Internet applications has outstripped the capabilities of existing enterprise software—at least in a commercially viable form.

Big Data has a few salient characteristics.

Big Data is, Well, It is Big

IBM, an early thought leader in Big Data, has estimated that 2.5 billion gigabytes of data is created each day. It is generally estimated that 80%-90% of the world's data was created in the last 2 years. Mobility and related technologies contribute greatly to this Big Data explosion. Consider just the data exchange related to an individual's mobile phone each day – texts, searches, social media posts are just the start. If we add to this the profusion of data that has begun to emanate from Mobile Devices, it is easy to reach the conclusion that the numbers will likely get bigger.

Big Data is mostly Unstructured

A variety of technology providers – IBM, SAS, SAP, EMC – have provided estimates that imply that 70%-80% of all data is unstructured. This is not a surprise because a lot of data today is text-heavy – from sources such as Twitter feeds, Facebook, blogs, etc. are good examples. Such data needs newer data mining and visualization tools – see the section below for some Big Data innovations – and to gain true insight from it, one needs to unify unstructured data with structured data.

Most Big Data is Perishable

1010data, a leading provider of cloud-based analytics for Big Data estimates that ~70% of data is stale after 3-6 months. We agree with this notionally, considering the source and intent of most data is extremely sensitive to current context – it naturally becomes outdated when that context no longer exists with the passage of time. However, there is still value to stored data, in terms of behavioral- and trend-analysis, even after the specific event that generated the event has passed.

Big Data Evolution and Innovation

Early versions of today's Big Data technologies originated at Google (MapReduce), Amazon (Dynamo), and Yahoo (Hadoop). These capabilities are beginning to find a need in bleeding-edge enterprise companies, in addition to the consumer Internet world. Common applications include web visitor analytics, anti-fraud and sensor-generated data. In our view, there are three key areas of innovation in Big Data:

- **NoSQL databases** – Web 1.0 companies used the “LAMP” stack, consisting of open source technologies Linux, Apache, MySQL, and PHP/Perl/Python. The weakest link was MySQL—relational databases like MySQL were optimized to store structured data (e.g. zip codes, dates, bank balances) in a way that ensured that that data was always consistent (i.e. ACID compliant). Applying this “first class” database to an “economy class” problem like consumer e-mail or video sharing is clearly suboptimal, resulting in astronomical costs or databases unable to respond to a massive volume requests for, say, cat videos. New, non-relational data stores have mushroomed to take advantage of this opportunity.

Amazon, which faced the problem of serving up millions of product images every hour, published a seminal paper on its key-value data store called Dynamo, which sacrificed ACID compliance but achieved other goals including high availability and low costs. MongoDB, Cassandra (originated at Facebook), Couchbase, and HBase are examples of Dynamo derivatives in a category of databases called NoSQL (Not Only SQL).

- **MapReduce** – Google faced the problem of indexing unstructured information (i.e. the Web) using expensive server hardware. Google created MapReduce, a way of linking together significant numbers of commodity servers to work on a single query. This kind of clustering offers incredible computing power at low cost. Yahoo created a MapReduce competitor called Hadoop and contributed the code into an open-source software project. Private companies have been first to commercialize this open-source technology and include Cloudera and Hortonworks. Public companies such as Oracle, Teradata, and EMC have generally partnered these open-source companies to introduce MapReduce into their analytical platforms.
- **New analytical tools** – While born after the above two innovations and not as traceable to a single whitepaper, the innovations above have given rise to a new generation of analytical software to shorten the analytical time required to gain insights from data. This broad range of innovations includes software such as vertical column stores (HP's Vertica, SAP's HANA) and in-memory visualization and data discovery (Qlik, Tableau).

Mobile Commerce Applications to Big Data

Mobile devices create an even greater volume of data—especially unstructured data—to analyze, including location information (e.g. Yelp, Google, FourSquare), increased volumes of commerce transactions, increased volumes of social media that originate on mobile devices (Facebook and Twitter), and unstructured information such as Instagram photos. Retailers can create business models around mobile (e.g. ShopKick) or take advantage of the greater volume of mobile-generated streams. Companies can deploy software to do social media monitoring (salesforce.com's Radian6, Jive Software's FiltrBox, Oracle's Vitruve) or to do the raw big data analytics on increasing volumes of unstructured data (Oracle's Big Data Appliance, EMC's Greenplum and Pivotal, IBM's Netezza/PureData, Teradata's Aster Data).

- *Bank of China is using IBM's expertise so it can exploit the proliferation of customers' online and mobile data on transactions, real-time market feeds and customer service records, so it can offer a better user experience.*
- *MasterCard announced it will mine its trove of customer card payment data to build a site which will provide global travelers with a ranking of popular restaurant destinations in cities worldwide.*

M2M Applications to Big Data - Agriculture

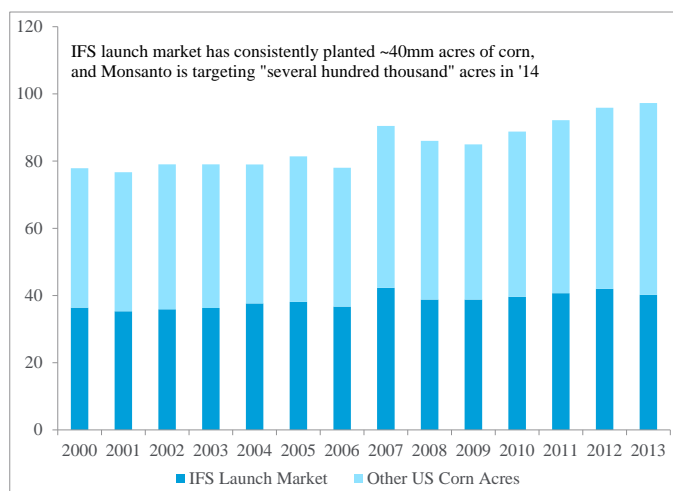
Agricultural M2M is billed as the next revolution in Agriculture. Several globally recognized players from multiple industries have expressed interest, including Monsanto, Deere and Dupont.

Monsanto and the Precision Agriculture Opportunity

Biotech seed producer Monsanto is investing in opportunities beyond seeds and crop chemicals and is expanding into precision agriculture and “big data” farming services. We think the company is positioning itself to be a “farmer’s caddy” by helping farmers with the 40 key decisions they make each season while growing their crops. Over the past several years Monsanto has accelerated their R&D efforts in this area. In addition to internal R&D, the company acquired Precision Planting, a company which builds tools to help farmers plant seeds in more efficient patterns (for approximately \$250mm) and Climate Corp, which offers advanced weather analytics (for \$930mm). In 2014 Monsanto will have two new portfolios of precision agriculture products for farmers to purchase. While these new programs will not have any significant impact on the company’s bottom line over the next couple of years, we think this market for analytics driven services could be a \$1B+ revenue opportunity for the industry over the next 5-10 years.

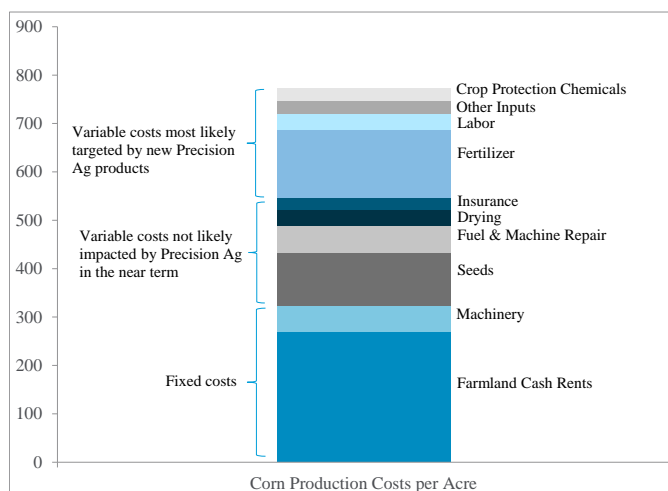
In 2014 Monsanto will launch Integrated Farming Systems (IFS) in 4 US states which have recently accounted for 55-60% of the corn area grown in the US (Iowa, Illinois, Indiana and Minnesota; see Figure 45). IFS provides variable seed planting solutions to farmers. Historically, farmers have planted a fixed number of corn seeds per acre (30k, 34k or 38k). IFS provides farmers with a digital roadmap to vary the number and spacing of seeds planted per acre, using Monsanto’s proprietary algorithms (developed during its own field trials) to optimize seeding density based on the type of corn seed planted. These planting “road maps” are then delivered directly to the farmer via the IFS app on their iPad, which can be installed into the planter. When the farmer harvests the crop, yield data is sent back to Monsanto to improve the algorithms for the next season. Based on Monsanto’s field trials, this technology can improve corn yields by 5-10 bu/acre (\$20-\$40/acre or 3-5%/acre of revenue), at a cost to the farmer of \$10/acre.

Figure 45. US Corn Acreage and IFS Launch Opportunity (mm acres)



Source: Citi Research, USDA

Figure 46. US Corn Farmer Cost Structure (\$/acre)



Source: Citi Research, Iowa State University
Note: Assumes cash renter farmer in Iowa

Within the next 3-5 years the next step for IFS would be international expansion into other key farming countries like Brazil, Argentina, and Canada. Over time, we also think this platform could be expanded to help farmers apply the correct amount of fertilizer and water, and could include other crops like soybeans and cotton, which account for ~30% of a corn farmers overall costs, and ~50% of variable costs (see Figure 46).

While IFS focuses on the planting and the harvesting of a corn crop, Climate Corp's real time, in-season data platform will help farmers actually grow a crop. The Climate Pro app for mobile devices will provide field-specific temperature and precipitation projections, in-season insect pressure identification, nitrogen fertilization needs, agronomic modeling, and other tracking modules which will help the farmer decide on any given day how to spend their time and resources. The Climate Pro app will be offered in 2014 at \$15/acre and Monsanto believes that it could benefit a farmer by as much as \$100/acre in reduced operating costs and higher yields. Similar to IFS, Climate Pro is not expected to make a major contribution to Monsanto's earnings, but the company believes it could be accretive by 2016.

While these two platforms are potentially transformational for Monsanto in the long term, we do see three major risks to farmer adoption.

1. According to the U.S. Census, the average age of a farmer in the US is 57 years old (~15 years older than the average worker in other industries), and may not be technologically sophisticated enough to add these tools to their toolkit;
2. U.S. farmer profitability peaked during 2013, and with lower grain prices expected in 2014, farmers may tighten their belts and not spend on "supplemental services" like IFS and the Climate Pro apps; and
3. Competition within the precision agriculture sector is already heating up, with DuPont and Deere recently announcing a partnership within DuPont's Field360 services, while companies like Agrium are already leaders in soil fertility testing and moisture monitoring with a product called NutriScription.

Other Interesting Solutions

Brazil-based Cargo Tracck™ uses Gemalto's M2M technology together with local cellular networks to send location updates from sensors in trees to a central server allowing officials to remotely track trees removed from protected areas in the Amazon rainforest. The solution is covertly installed in trees located in active harvesting and sends alarm notifications and exact location information to officials in real-time as trees pass within 20 miles of a cellular network, so that law enforcement officials and environmental protection agency agents can trace the loggers to sawmills and prevent the sale and profit from illegally harvested lumber.

Index of Sector Mentions

| Sector | Page |
|-------------------------------------|------------|
| Agriculture | 68 |
| Appliances | 58 |
| Autos | 10, 37, 40 |
| Banking | 9, 25 |
| Connected Home | 57 |
| Construction | 64 |
| Energy | 65 |
| Gaming | 29 |
| Handset Manufacturers | 18 |
| Healthy Lifestyle | 32 |
| Identity / Security Solutions | 58 |
| Industrial Manufacturing | 55 |
| Insurance | 42 |
| Internet | 22 |
| IT Services | 14 |
| Media | 22 |
| Medical Technology | 62 |
| Mining | 64 |
| Operating System (OS) Manufacturers | 18 |
| Payment Networks | 9, 19 |
| Railroads | 41 |
| Renewable Energy | 61 |
| Restaurants | 28 |
| Retail | 9, 26 |
| Semiconductors | 50 |
| Software | 15, 16, 67 |
| Trucking | 41 |
| Utilities | 60 |
| Wireless Telecom Operators | 17, 35, 53 |

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Notes

Notes

NOW / NEXT

Key Insights regarding the future of Mobility



TECHNOLOGY

In the current environment, developed markets are approaching smartphone saturation, average selling prices are poised to fall, innovation in smartphones is elusive and margins in the supply chain is at risk. / **The introduction of Mobility as a key component in a multitude of sectors could be the next driver for the “enablers” of Mobility — companies in the Technology, Technology and Software space — leading to an extension the smartphone device cycle**



REGULATION

Historically, adherence to government mandates involved self-reporting and estimation with regard to successful implementation. / **Mobility is facilitating the roll-out and measurement of government mandates in areas such as electricity monitoring through smart metering, safety initiatives through Connected Car and healthcare technology investment through remote monitoring.**



SHIFTING WEALTH

Traditionally, consumers shopped for purchases in a local store or retail mail and paid for their purchases using cash or credit cards. / **Mobility is changing the way that consumers shop as purchases are increasingly made over mobile devices as opposed to in-store and online through a PC. In addition mobile devices are being increasingly used for price comparison.**



