# 2014 Networking Outlook

## Key Trends in 2014: Carrier Trends Improve, EMs Remain Weak and Bare Metal Switches Take Off

2014 promises to be another interesting year for Data Networking and Wireline companies in our coverage. We see global carrier capex outperforming weak expectations as rapid growth in Europe more than offsets slowing spend in the US while Chinese LTE builds accelerate. Exposure to Emerging Market carriers, however, looks less attractive to us. We believe SDN finally gets real but we believe this drives a pause in switching and further price declines. We also expect bare metal switches to gain real momentum beyond Web 2.0 users. In our opinion, optical growth continues to accelerate as 100G adoption continues. Finally, the "Snowden Effect" is expected to drive growth in network security spending. In conjunction with our analysis in this report, we downgrade Cisco to UW. Click here for our report on Cisco published today.

- **Switching pricing comes down.** Our detailed comparison of bare metal solutions to Cisco reveals a large pricing gap of 47% to 52%. We expect Cisco to reduce lucrative license and service fees to compensate.
- **EM service providers continue to struggle.** We believe that FX changes drove the rapid dropoff seen by Cisco in October. However, an in-depth review of EM carrier markets yields a less than rosy picture for 2014. We advise avoiding companies like Cisco with heavy exposure.
- **Global carrier capex likely better than expected.** We update our proprietary database of the 34 largest carriers in the world. Global revenue growth is expected to accelerate to 2.5% from 0.9% last year while capex growth is expected to rebound more slowly from 4.0% to 4.8%. Capex/Sales is up but we suspect could still surprise on the upside if forecast revenue growth materializes.
- **SDN pause weakens switching.** We forecast 1.5% growth in the switching marking this year but a 0.1% Y/Y decline in H1 as buyers pause ahead of Cisco product availability. We see downside risk to our H2 forecasts.
- **Bare metal switches momentum builds.** We believe that major brands like Dell who have succeeded in bare metal servers are likely to announce switching products early this year. The addition of these companies' powerful distribution capabilities is likely to accelerate bare metal effects on the overall market in 2014 in our opinion.
- **Optical growth accelerates.** We expect rapid adoption of 100G technology in European core networks in H1'14 followed by US metro adoption in H2'14. We again see this as good news for systems vendors like CIEN and INFN.
- **The "Snowden Effect" drives spending.** We expect Enterprises to enhance spending on encryption as well as deployment of next generation firewall and network protection technologies. We also look for enterprises to seek meta data control technologies to hide communications patterns of senior employees. This latter trend likely spells opportunity for new entrants in MDM in our opinion.
- **Stock picks.** We continue to like exposure to optical via CIEN and INFN though we are cautious on INFN pre-earnings. We also see further upside in JNPR as routing products continue momentum and Elliott forces cost rationalization and cash return. We also continue to warm to FFIV given what we believe are growing security opportunities.

**Data Networking & Wireline Equipment/Telecom Equipment/Wireless**

**Rod Hall, CFA** AC
(1-415) 315-6713
rod.b.hall@jpmorgan.com
**Bloomberg** JPMA HALL <GO>
J.P. Morgan Securities LLC

**Ashwin Kesireddy**
(1-415) 315-6756
ashwin.x.kesireddy@jpmorgan.com
J.P. Morgan Securities LLC

**Greg Schuck**
(1-415) 315-6760
greg.t.schuck@jpmorgan.com
J.P. Morgan Securities LLC

**Rajagopal Raghunathan**
(91-22) 6157-3255
rajagopal.raghunathan@jpmorgan.com
J.P. Morgan India Private Limited

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Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com

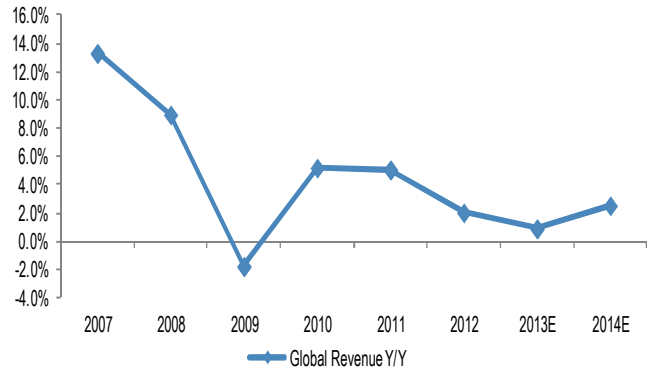




# Executive Summary

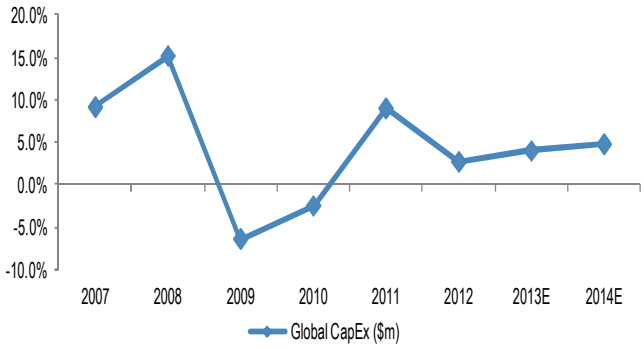
**Global carrier capex likely better than expected.** We update our proprietary database of the 33 largest carriers in the world. Global revenues are expected to grow by 2.5% which creates upside risk to our current capex growth forecast in our opinion. We believe that US based investors are currently over focused on slower growth at AT&T and Verizon. As a result, positive trends in Europe, which we highlight in detail in this report, may go unnoticed. We note that European telco footprints in aggregate cover about the same number of POPs as the US carriers.

**Figure 1: Global Carrier Y/Y Sales Growth Accelerates**




Source: J.P. Morgan

**Figure 2: Capex Growth Also Expected to Turn Up**



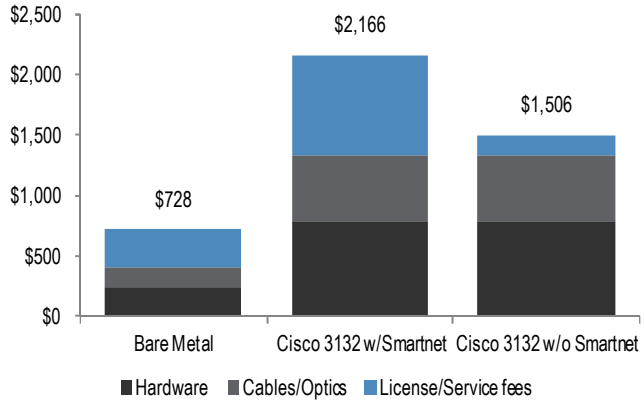

Source: J.P. Morgan

**EM service providers continue to struggle.** We believe that FX changes drove the rapid dropoff seen by Cisco in October. However, an in-depth review of EM carrier markets yields a less than rosy picture for 2014. Specifically, Indian SPs revenue growth is forecast to decline to 5.3% (2013: 8.2%), Russian SPs to 3.4% (5.3%), Brazilian carriers to 3.8% (4.9%), Chinese carriers to 10.9% (14.6%) and Mexican SPs to remain at ~1%. We advise avoiding companies like Cisco with heavy exposure.

**SDN pause weakens switching.** We forecast 1.5% growth in the switching marking this year but a 0.1% Y/Y decline in H1 as buyers pause ahead of Cisco product availability. Our H2 numbers currently correspond to a marked increase in growth. However, we believe the pause in spending ahead of SDN represents a risk that H2 is weaker than we currently model.

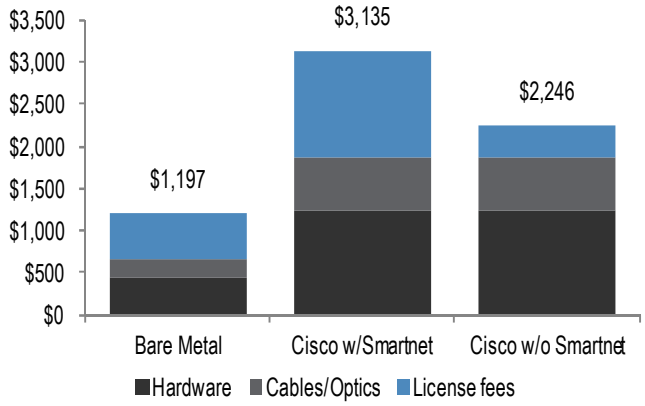
**Switching pricing comes down.** Our detailed comparison of bare metal solutions to Cisco reveals a large pricing gap of 47% to 52%. We expect Cisco to reduce lucrative license and service fees to compensate. Even without these fees our analysis implies that hardware margins are much higher than bare metal competitors. We believe that just a handful of losses to bare metal by Cisco could result in aggressive pricing action on the part of Cisco to maintain share.

Figure 3: Bare Metal 52% Less than Cisco per Server – High Density




Source: J.P. Morgan

Figure 4: Bare Metal 47% Less than Cisco per Server – Low Density

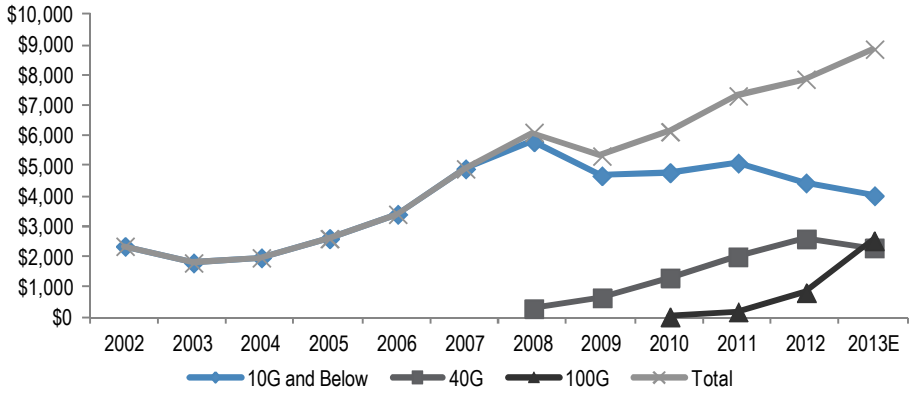



Source: J.P. Morgan

**Bare metal switch momentum builds.** We believe that major brands like Dell who have succeeded in bare metal servers are likely to announce switching products early this year. The addition of these companies' powerful distribution capabilities is likely to accelerate bare metal effects on the overall market in 2014 in our opinion.

**Optical growth accelerates.** We expect rapid adoption of 100G technology in European core networks in H1'14 followed by US metro adoption in H2'14. We again see this as good news for systems vendors like CIEN and INFN.

Figure 5: Optical Revenue Growing as 100G Picks Up Speed




Source: J.P. Morgan, Dell'Oro

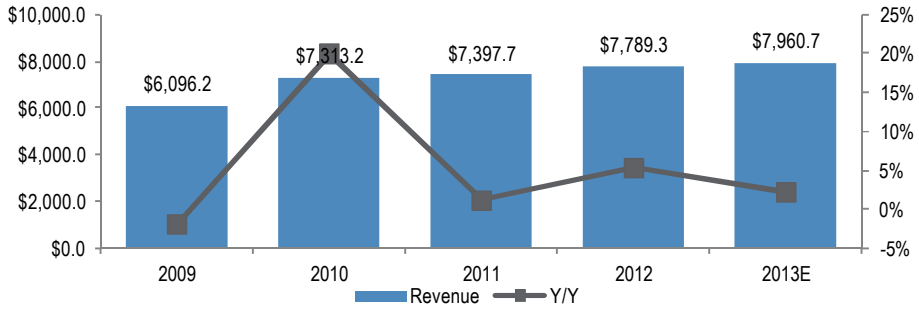
**The "Snowden Effect" drives spending.** We expect Enterprises to enhance spending on encryption as well as deployment of next generation firewall and network protection technologies. We also look for enterprises to seek meta data control technologies to hide communications patterns of senior employees. This latter trend likely spells opportunity for new entrants in MDM in our opinion.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





**Figure 6: Network Security Appliance Market Could Rebound Substantially in 2014**
$ in millions




Source: J.P. Morgan estimates, Dell'Oro Group

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





# White Box vs. Cisco Pricing

On January 17 of 2013 we published a switching market analysis where we argued that SDN would pull through the adoption of bare metal switching which, in turn, would likely result in a large shrinkage of the overall switching market. Since then Cisco has announced its own line of controllable switches and argued that bare metal does not offer cost advantages over its own solutions. In this section we present the results of our own detailed pricing analysis which show that bare metal likely offers large cost benefits over various Cisco solutions. We also highlight what we believe are significant errors in Cisco's own claims.

**Our Approach**

Bottom up pricing comparisons are difficult without a specific networking problem definition. For our purposes we have defined two scenarios – one higher density server configuration and a lower density server configuration. We have not built overlay control costs into any of the solutions since pricing for those products remains in flux and Cisco has yet to release its own APIC controller.

In our high density configuration we price a networking solution to support 10 racks with 36 servers per rack. This higher density scenario also includes two DMZ/services racks with 160Gbps of total capacity support each. In our lower density configuration we assume 24 servers per rack across the same 10 racks. We include the same DMZ/Services rack requirement as in the high density scenario. For both scenarios we assume a 5-year depreciation period for the calculation of TCO for recurring license fees (we add 5x each annual fee).

For most of Cisco's list pricing we assume a typical 55% discount though we believe these discounts may be higher in the case of large, high density deployments. For cabling we assume a higher Cisco discount of 65%. In the case of Cisco optics we are also assuming use of the company's new BiDi optics at roughly 1/3 the list price of existing Cisco 40G QSFP optical modules. This is admittedly an artificial construct designed to reflect future Cisco pricing given some of the Cisco boxes we use do not yet work with BiDi. Cisco gets another advantage here as we are also assuming that cheaper MMF LC optical cabling is used for connection of Cisco 40G uplinks whereas we have used more expensive quad-core optical ribbon cabling for our Bare Metal case. Our cases are highly detailed and, we believe, as close to accurate as current information allows. In the case of newer Cisco equipment we have had to triangulate our discounted pricing estimates between industry sources and prior pricing structures. We also fully expect that Cisco's pricing for these products will rapidly adapt to market realities should bare metal momentum begin spreading beyond large Webscale data center operators.

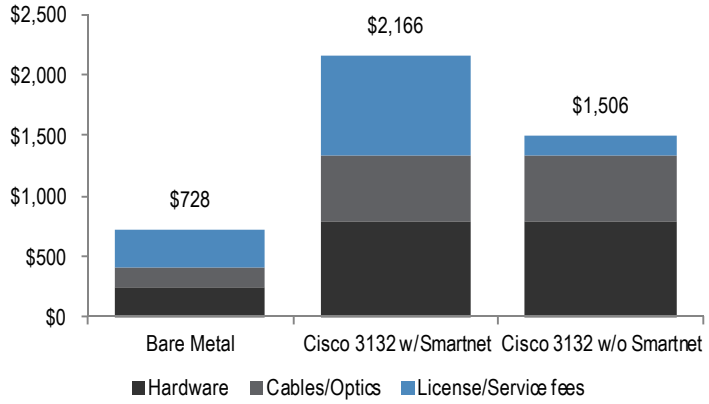
Please feel free to call us to discuss our specific assumptions in more detail.

**Bare Metal Clearly Trumps Cisco on Price**

Using an Apples-to-Apples comparison it becomes relatively obvious that current bare metal solutions price much less expensively than Cisco solutions. However, one of the insights we come away with is that Cisco's services fees and licenses significantly inflate its pricing. Over time we would expect these fees to come under the most pressure as Cisco is forced to compete with lower cost solutions that offer, in many ways, superior operational efficiency.

In the following chart we compare the total cost of high density solutions on a per server basis.

**Figure 7: Bare Metal 52% Below Cisco per Server in Dense Scenario**




Source: J.P. Morgan

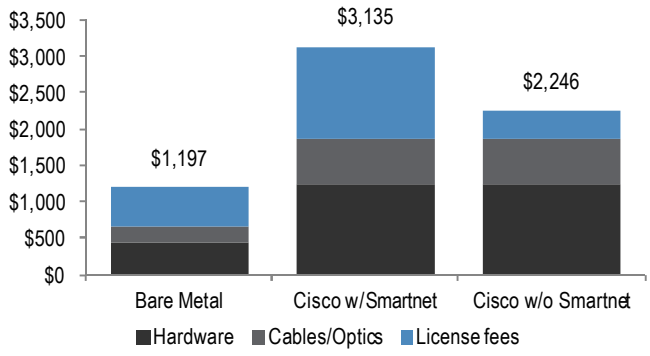
In both our high and low density scenarios we show our estimated Cisco prices both with and without Smartnet support service contracts. Remaining license fees in our non-Smartnet numbers relate to layer 3 licenses required on each Cisco switch.

With this analysis two points become pretty clear to us. First, Cisco solutions priced as they have been historically are significantly more expensive than bare metal even when we eliminate Cisco Smartnet. We note that elimination of L3 license fees would bring our 3132Q based solution down to just $1,326/server, which makes bare metal just 45% less expensive. However, we doubt that Cisco is going to be waiving L3 license fees anytime soon though discounts could increase.

Second, a large chunk of Cisco's price premium is related to Smartnet, which could easily be reduced. In fact, we expect Cisco to waive Smartnet fees for large enterprise customers as a way to maintain share at those customers. However, our analysis shows that, even without this fee, the price difference is material.

Figure 8 below illustrates the outcome of our Low Density case. As expected, lower server density results in a higher price per server. However, bare metal prices still end up well below Cisco.

**Figure 8: Bare Metal 47% Below Cisco in Low Density Case**




Source: J.P. Morgan

Interestingly, Cisco hardware plus cable and optics are a touch below total bare metal pricing though the addition of L3 licenses and Smartnet pushes prices rapidly up. What we find interesting here is that our analysis is yielding materially higher prices, even without L3 and Smartnet, than the $260/port that Cisco indicated at its Insieme launch for a 288 port solution would seem to imply. Unfortunately, it is tough to compare that $260/port number to a fully loaded price per server like the one we have constructed. However, we suspect that that price was intended to reassure Cisco's bread and butter medium sized customers that new Cisco solutions will be priced competitively.

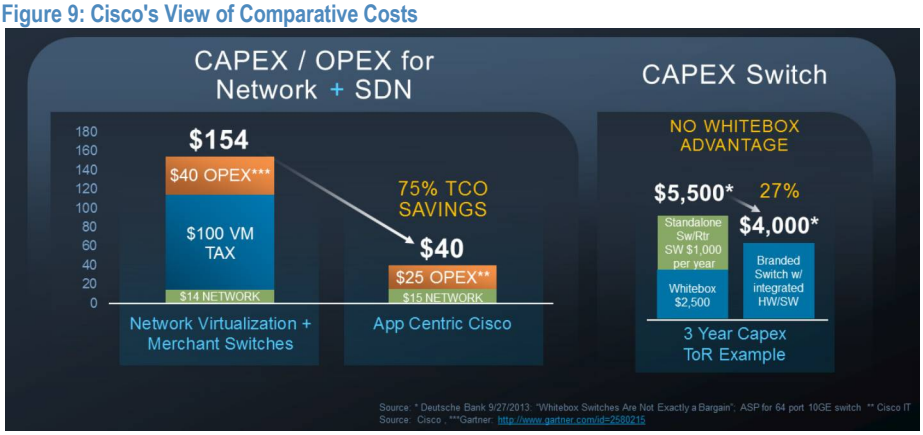
**Services Could Suffer**

Given the large contribution from Smartnet that jumps out from our analysis we believe that these contracts could be the main place where Cisco adjusts its pricing to compete with a growing bare metal threat. We also believe that the operating ease of Linux-based bare metal is a large issue for Cisco. Linux based server administration tools and processes are, in our opinion, much more efficient than comparable processes and tools for legacy data center switching networks. The simplification of operation of these networks that Linux based OSs combined with very inexpensive bare metal hardware challenge the ease of operation of Cisco solutions in our opinion. All of this adds up to the potential for more pressure on Cisco's lucrative services contracts as SDN and bare metal play out.

**…but Cisco Says…**

Some readers may at this point be scratching their heads trying to make sense of our conclusions in light of Cisco's messaging around pricing. We are mainly going to reference the chart on the right hand of the slide shown in Figure 9 below.

Figure 9: Cisco's View of Comparative Costs




Source: Cisco

Cisco here compares, as far as we can tell, an extreme outlier price for hardware ex both L3 and Smartnet licenses to an outlier hardware price for bare metal combined with a mainstream OS license fee.

There is a lot wrong with this analysis in our opinion. First, we believe the $4,000 price shown above is Cisco's absolute rock bottom provided only to hyperscale web customers. Should this sort of price end up becoming the norm for Cisco then our negative earnings calculations will end up looking incredibly optimistic. Second, the price does not appear to include Smartnet or L3 license fees. We agree that Smartnet is likely to be tossed in with larger deals but don't expect that to be the case with L3

licenses. Finally, we believe that the $1,000/yr for the Whitebox OS is inaccurate in this scenario. All other prices being used here would apply to a very high density, high volume customer only. What this analysis fails to take account of is what we believe are standard license fee caps that a large customer like this would likely hit. We believe that the real license fee in that case could drop to something closer to $200/switch/year.

We also want to address the so-called “VM Tax” shown in the left hand side of the slide above. While we believe this accurately reflects current pricing we note that the marginal cost to provide the software products in question is very low. Given this we would fully expect vendors to adjust pricing to market realities and do not see this “VM Tax” as a real impediment to the adoption of bare metal solutions.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com



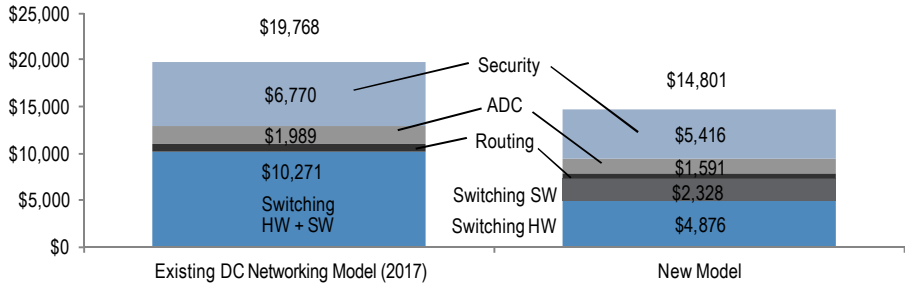


# SDN Market Impact Update

Assuming no changes due to SDN, we now estimate that the data center oriented networking market should grow to roughly $17.5bn by 2015 and $19.8bn by 2017. To provide some idea of what the impact of commoditization from SDN + bare metal might be we have adjusted both our 2015 and 2017 market numbers assuming data center market pricing has been fully impacted by bare metal switch availability. Importantly, we do not assume here that Cisco loses substantial market share - rather than the size of the data center switching market from both a profit and revenue point of view is materially decreased. Since we rolled this thesis out in early 2013 we have had many discussions around timing for SDN. We have held the position that it will be a matter of a few years before the entire market is affected but that effects should begin in 2014. However, the aggressive stance on pricing that Cisco appears to be taking with Insieme suggests to us that assuming more material market impact by 2015 is within the realm of sanity. Our summary point for this analysis remains that SDN equates to a substantial reduction in data center switching expectations in future years. In 2015 our market estimate would be impacted by 21% while in 2017 the impact is around 25%.With SDN changes applied our medium term data center networking market expectation comes down to $13.9bn for 2015 in a central case from $17.5bn in a no SDN scenario. For 2017 the change is from $19.8bn to $14.8bn – a 25% size reduction.

Our analysis is meant to give the reader some idea of how large we believe the eventual impact might be. Interestingly, the $13.9bn SDN translated market in 2015 is 9% smaller than what we believe will end up around a $15.2bn data center networking market in 2013. We continue to believe that SDN could severely cap growth for the overall data center networking market and, in the case of switching, could actually drive total market size declines even as capacity demand continues to grow.

**Figure 10: 2017 DC Networking Market Size Estimates: Central Case**
$ in millions




Source: J.P. Morgan estimates

## Our Central Case

We realize that there continues to be a debate over whether SDN will really lead to commoditization of the switching market. We are convinced that the current business model of the switching industry, primarily in the data center segment, will be disrupted with maturing white box switching solutions and an enabling software ecosystem. In our opinion, the reality is that without Cisco's market power the switching market would already have seen greater commoditizing effects driven by the continued progress of Moore's Law when it comes to switching chips. In our

opinion, even Cisco is now and has been making more and more use of chips produced by designers like Broadcom and leaning less and less on their own ASICs which historically had been the key to their market dominance. Cisco's launch of Insieme Nexus switches at considerably lower price points than existing Nexus deployments validates this thesis in our opinion. In addition, we find it ironic that Cisco has decided to largely base their latest switching product line on the very same Broadcom silicon that bare metal players are using. Of course these products will also contain a Cisco ASIC but we see the added value of this custom chip as diminished when compared to prior product lines. We also believe that the features of this year's ASIC are likely to be incorporated into next year's Broadcom or Fulcrum(Intel) chip making it tougher and tougher to argue that the ASIC is needed at all.

The key assumptions in our central case are (1) continued growth in switch ports as the upgrade of ToRs to 10G and beyond is well underway and (2) rapid deterioration of port ASPs. We believe that in a data center environment the value of control plane functionality in L2/3 hardware switches will decline significantly which will naturally lead to lower prices and lower margins than current levels.

All of this adds up to a world where organizations cap legacy switching platforms and grow on completely redesigned SDN driven networks. Since this means most will be starting with a clean slate of paper we expect many to opt for a reference design ToR based on off the shelf silicon combined with a third party OS to run the hardware with. Even if these customers decide to go with Cisco we believe they will demand pricing much closer to what bare metal implementations are able to offer (see prior section of this report for detail).

## Calculating SDN Impacts on the Switching Market

To quantify the scenario we describe above we needed to estimate an ODM price for a HW only 48 port 10GbE ToR switch and then estimate the price for an OS to run it. To compare back to the "non-SDN" market we then simply multiply by unit number forecasts generated from data in our switching market model.

Over the last few months we believe that Cisco has substantially muddied the water over the comparison of bare metal solutions with their own new Insieme solution. We see this debate as interesting but less important than the question of what bare metal pricing looks like relative to current average Cisco revenue per port. It is this latter point that we are addressing in this section.

It turns out that estimating the delivered price for a white labeled ODM switch is relatively straightforward. Today we believe that 48-ports of 10GbE assembled into a finished product will run around $4.2k. For our 2015 and 2017 calculations we assume this decreases by 5% annually.

Last year we had no actual OS pricing so were forced to guess based on the proportion of the hardware cost that we believed customers would be willing to pay. Our central case assumption was $1,500 for a three year TCO. Rolling the clock forward we now have quoted pricing from Cumulus for their Linux based OS at $699/instance/year for a 10G ToR which equates to a 5-year TCO of $3,495. For an Aggregation switch, the quoted price is $999/instance/year which equates to a 5-year TCO of $4,995. While we believe that the OS pricing average is likely to end up below the $699 and $999 levels due to absolute revenue caps for large customers, we use this list price in our calculations this year.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com



Up to this point we have only discussed ToR 10GbE switches. However, our market definition includes aggregation layer switches that typically make use of more expensive 40GbE optical ports (or will in the near future). To arrive at a hardware cost for these products we replaced 10GbE component costs with 40GbE and scaled up other systems components like chassis, etc. We used a similar approach to calculating software costs though these probably end up closer to the average software cost for the ToR switch.

We then combine all of this together to arrive at a market size estimate. In Table 1 below we show how total market size varies with different assumptions for blended HW ASP and average software pricing. This table shows a range of market sizes from about $4.8bn up to ~$9.6bn depending on which assumption is used.

**Table 1: DC Switching Market Size Sensitivity**

$ in millions except per unit/instance price

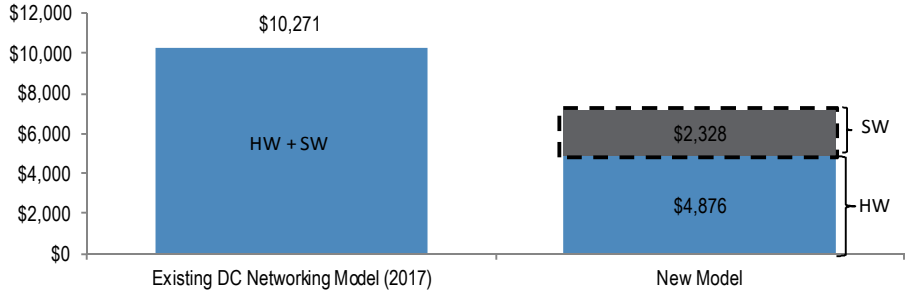
| | Average software cost ($) | | | | | |
|---|---|---|---|---|---|---|
| | | $1,963 | $2,463 | $2,963 | $3,463 | $3,963 |
| Price Per Switch ($) | $4,207 | $4,847 | $5,240 | $5,632 | $6,025 | $6,418 |
| | $5,207 | $5,632 | $6,025 | $6,418 | $6,811 | $7,204 |
| | $6,207 | $6,418 | $6,811 | $7,204 | $7,596 | $7,989 |
| | $7,207 | $7,204 | $7,596 | $7,989 | $8,382 | $8,775 |
| | $8,207 | $7,989 | $8,382 | $8,775 | $9,168 | $9,560 |

Source: J.P. Morgan estimates

Building from this we are able to calculate a central case market size post SDN effects of about $7.2bn – 30% less than our estimated market without these effects. Note that this is a worse impact than we had originally calculated last year. The key change is that public Cumulus pricing for 40G spine/aggregation switches is considerably lower than what we had anticipated though actual 10G pricing is roughly in line with what we had assumed last year. The results of this analysis is then folded back into our larger rollup of the data center networking market which includes less radically altered markets for security, routing, and ADC.

**Figure 11: DC Switching Market Size Estimates: Central Case**

$ in millions

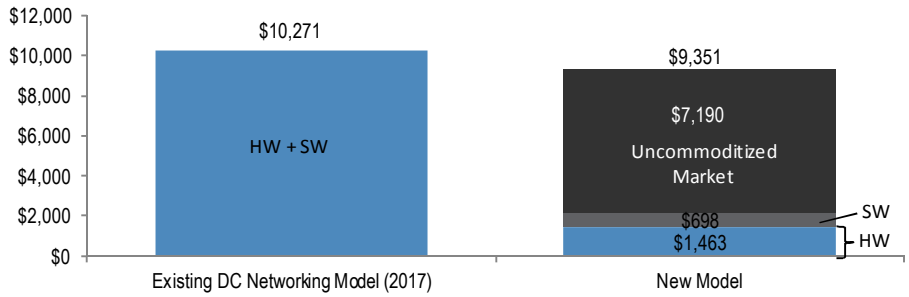



Source: J.P. Morgan estimates

This $7.2bn market compares to an estimated DC switching market that is roughly $8.0bn in 2013. Needless to say, we do not believe many observers expect the DC switching market to decline over the next 3-5 years but our analysis suggests this scenario is a real possibility if things play out along the lines of our central case.

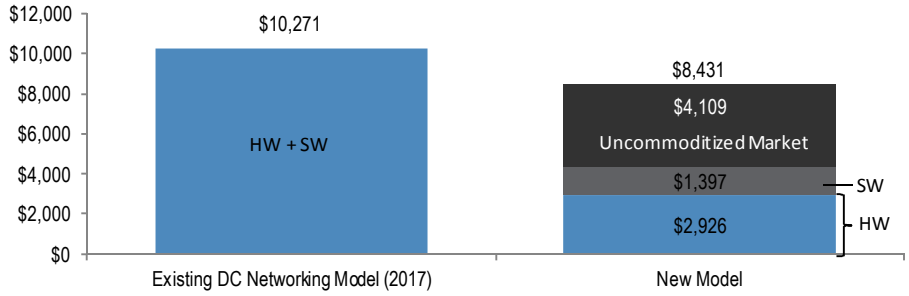
In our early 2013 analysis we had built scenarios based on various pricing levels for switch OS software since prices had not yet been set by companies like Cumulus Networks. The actual outcome ended up being a touch worse than our worst case scenario from last year. For this year's analysis we present multiple cases based on the percentage of the market that has been affected by lower switch pricing driven by the bare metal revolution.

**Figure 12: 2017 SDN Market Impact: 30% of Market Affected**
$ in millions




Source: J.P. Morgan estimates.

**Figure 13: 2017 SDN Market Impact: 60% of Market Affected**
$ in millions




Source: J.P. Morgan estimates.

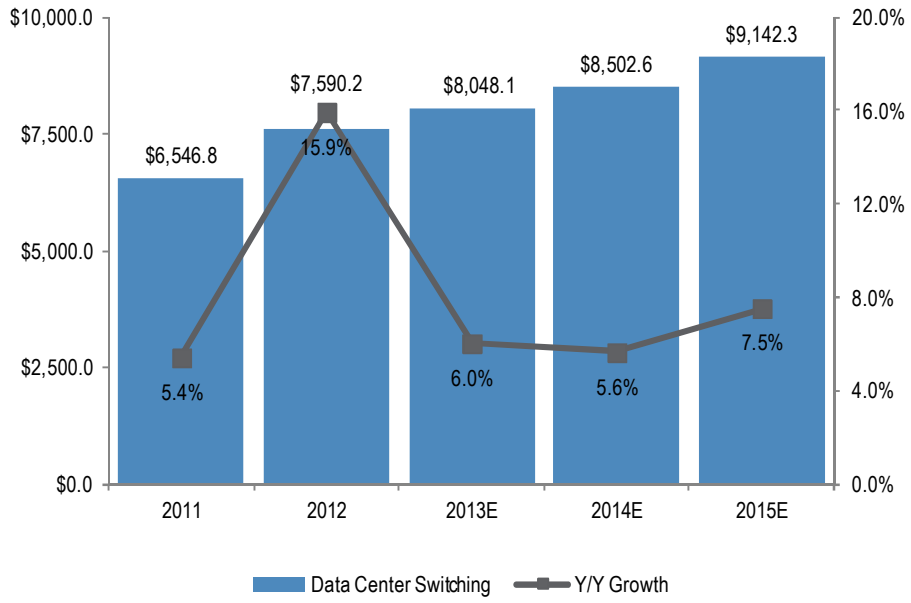
## Market Sizing Starting Points

In this section we describe how we arrive at our starting point market sizes, which we then adjust for SDN.

### Data Center Switching

We estimate the data center switching market accounted for 37.0% or $8.0bn (+6.0% Y/Y) of the total Ethernet switching market in 2013, up from 36.3% in 2012. We expect data center switching to continue to increase as a percentage of the total switching market and forecast a data center switching market size of $9.1bn in 2015, resulting in a 2012-2015 CAGR of 6.4%.

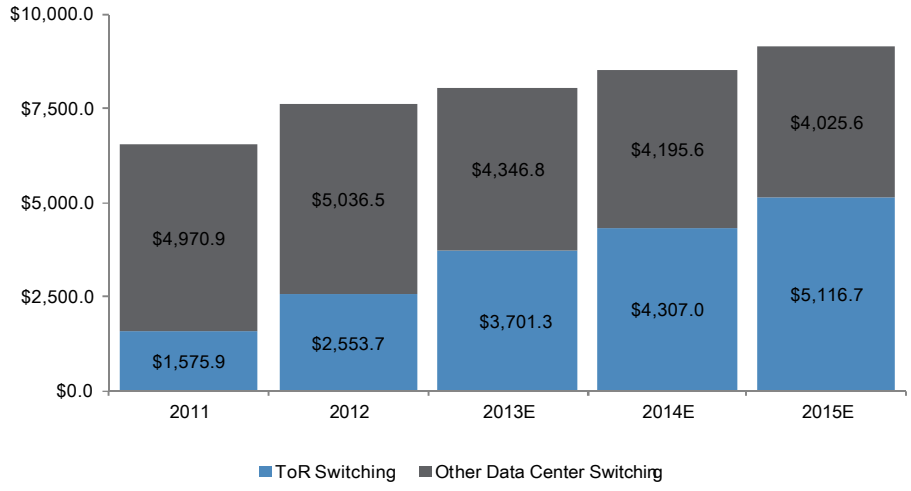
**Figure 14: Data Center Switching Forecast Calls for a 6.4% CAGR in 2012-2015**
$ in millions




Source: J.P. Morgan estimates, Dell'Oro Group

Within data center switching, we split the market into two key categories – top of rack (ToR) switches and other switches. Given the architectural changes and disruptions taking place in the data center from virtualization adoption and flattening networking topology, we expect ToR switches to be the primary growth driver in data center switching. We project the ToR switching market will rise to $51.bn in 2015 from $2.6bn in 2012 for a 26.1% 2012-2015 CAGR. We're less bullish on the other data center switching and expect a 7.2% market decline throughout our forecast period for a 2015 market size of $4.0bn ($5.0bn in 2012).

**Figure 15: ToR Switching Fuels Data Center Switching Growth**
$ in millions




Source: J.P. Morgan estimates, Dell'Oro Group

**Data Center Routing**

Analyzing the data center routing market is an inexact science given that vendors generally have limited visibility on how enterprises and service providers actually deploy routers. As a result, we've made educated assumptions based on subjective input and factors on what portion of a particular market would actually be used to address WAN connectivity. For instance, certain routers such as Cisco's ASR 1000 and Juniper's M Series are large revenue generators, but don't have the capacity and feature sets to provide data center connectivity. In addition, we've come across varying service provider definitions as vendors may or may not include content providers, CDN, cloud service providers and Internet service providers as part of the historical telecom service provider category.

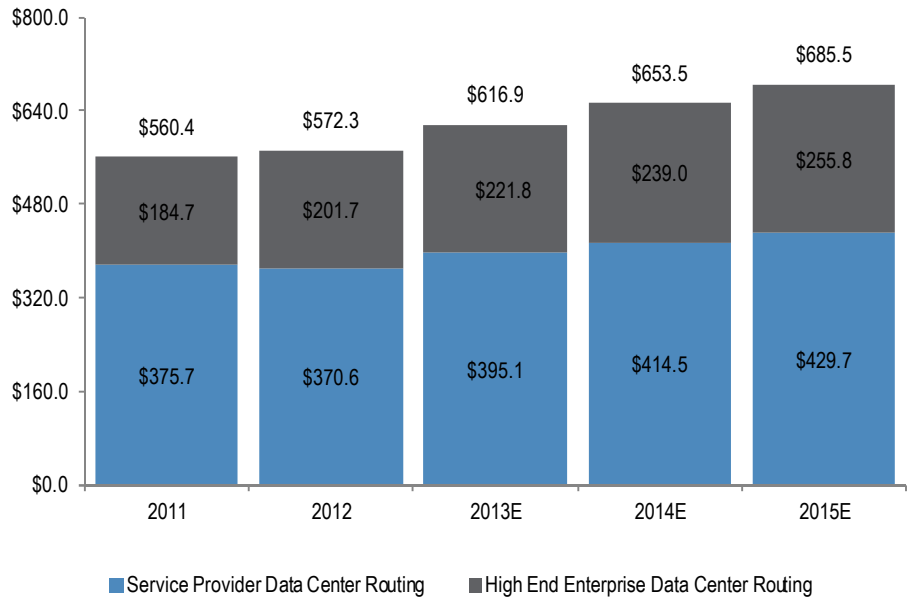
A router may be used for WAN connectivity, but the categorization of the type of deployment blurs as routers integral to a data center core network generally serve multiple functions like aggregation and WAN connectivity. So, this could technically be considered a data center routing deployment or a typical infrastructure deployment. Adding to the ambiguity, routers and certain Layer 3 switches may be used for WAN connectivity and vendors may interchange routers and switches depending upon on the enterprise's or service provider's network architecture and preferences. A couple of examples where we've seen this is occur is between Cisco's ASR routers and Nexus switches, and Juniper's MX routers and EX switches.

Our rough assumptions on data center routing are as follows:

- 25%-30% of high end enterprise routing
- 3%-5% of service provider routing

Based upon this and using the midpoint of our assumptions, we calculate a data center routing market of $572m in 2011. We project the data center routing market will expand to $685m in 2015, representing a 2012-2015 CAGR of 6.2%.

**Figure 16: Midpoints of Data Center Routing Estimates Suggest a 6.2% CAGR for 2012-2015**
$ in millions




Source: J.P. Morgan estimates, Dell'Oro Group

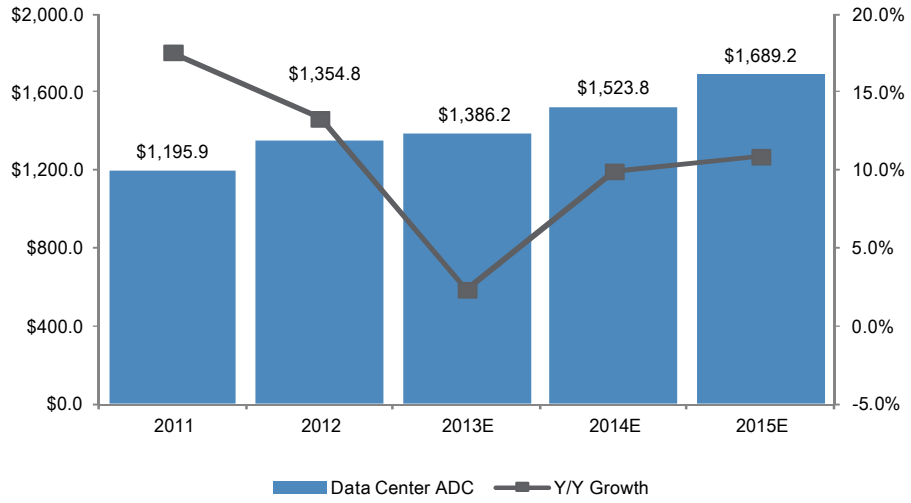
**Application Delivery Controllers (ADC)**

We believe the ADC market, outside of service providers, is primarily data center focused and thus largely exposed to potential disruption from SDN adoption. ADCs are typically deployed in the data center as hardware appliances or software based virtual ADCs. For the purposes of our analysis, we are assuming the vast majority of ADCs deployed in service provider networks are not data center purposes.

We've used F5, the leader in the ADC market, as the basis for our service provider ADC analysis. The telecom/wireless vertical accounted for 22% of F5's FY'12 revenues, implying the remaining 78% were enterprise and data center related. Given F5's market leadership and strong traction with service providers with the VIPRION, we think it is reasonable to conclude that service providers contribute less than 22% of the overall ADC market.

Taking into slight consideration that some service providers may deploy ADCs in their internal data centers and/or provide managed services, we estimate roughly 15% of the ADC market is non data center related. Based on this assumption, we calculate the data center portion of the ADC market was ~$1.35bn in 2012. We forecast this will rise to $1.69bn in 2015 for a 2012-2015 CAGR of 7.6%.

**Figure 17: Roughly 85% of the ADC Market Is Data Center Focused**
$ in millions




Source: J.P. Morgan estimates, Dell'Oro Group

**Network Security**

In addition to the network equipment discussed above, we believe SDN will also heavily impact the network security market. It's too early to tell how security deployment methods might change, but it's clear to us SDN networks are very different from traditional networks and hence will require new protection methods.

Given the possibility of new threats to SDN networks, we believe there is a solid chance SDN creates more demand for overall network security as security threats can rapidly developed and the error of magnitude is greater as SDN is deployed across larger network infrastructure. The SDN controller must be authenticated and secure with the end devices like switches and applications, which may serve multiple tenants. In our opinion, the SDN enables a multitude of specialized security applications and analytics to be developed.

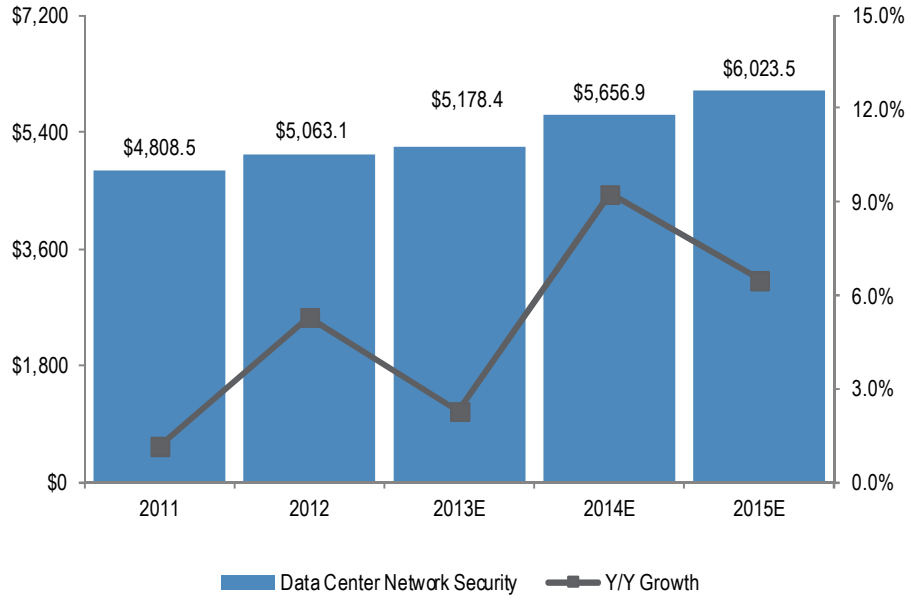
According to Dell Oro, the total network security market totaled $7.8bn in 2012. For the purposes of our analysis, we assume that 65% of this is data center oriented spending. With Dell Oro projecting a 6.0% CAGR from 2012-2015 for the network security market ($9.3bn in 2015), we calculate data center network security will reach $6.0bn in 2015.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





**Figure 18: Network Security Remains a Critical Part of Data Center Spending**
$ in millions

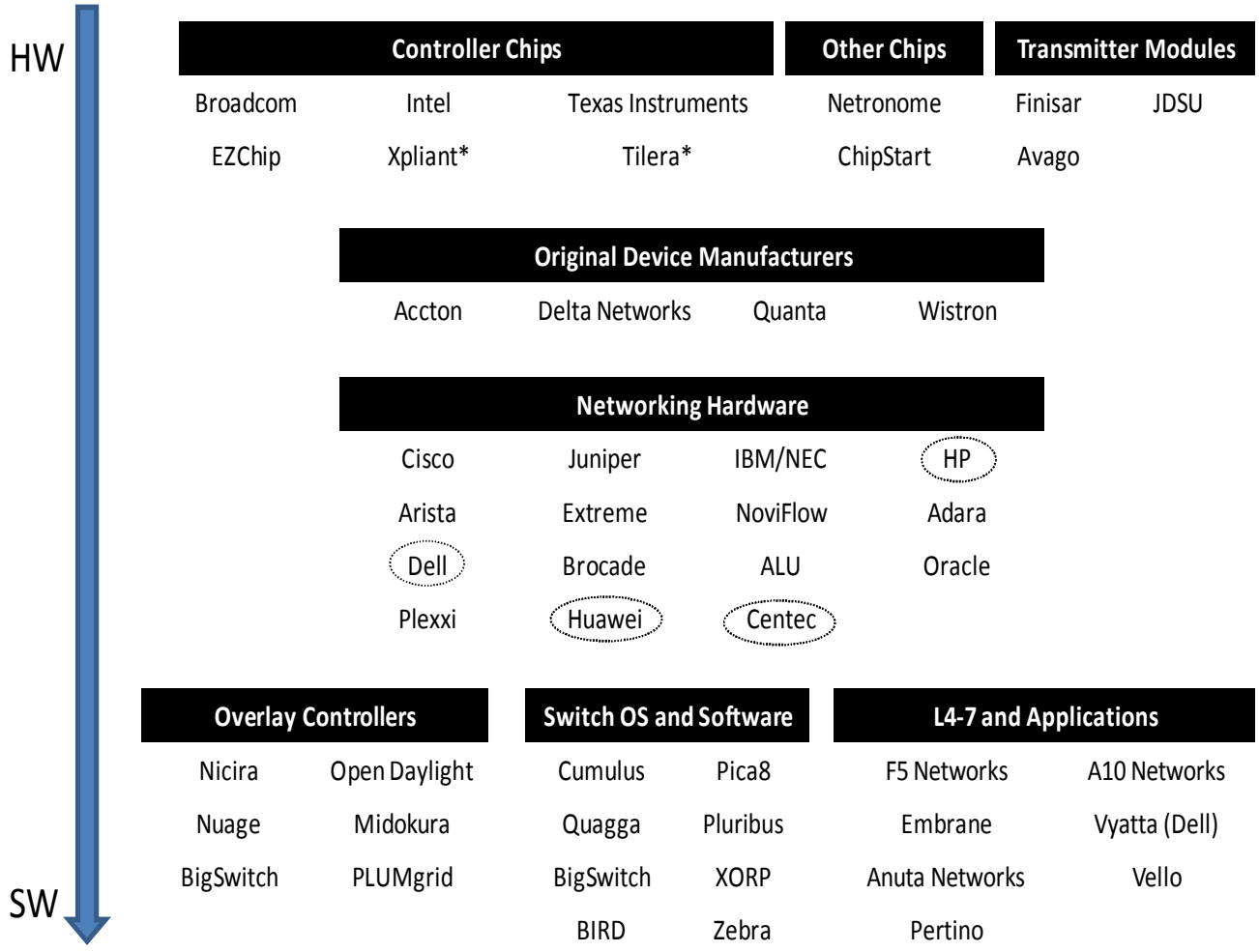



Source: J.P. Morgan estimates, Dell Oro.

# SDN Ecosystem Overview

In Figure 19 below, we summarize the various parts of the emerging SDN ecosystem as it pertains to data center networking. Much of this overlaps with the existing networking industry, but there are some key differences emerging and many new potential competitors for incumbent vendors. One point we highlight in Figure 19 below is the fact that, so far, no major hardware vendors have begun producing what amounts to bare metal equipment with their brand and distribution behind it. We expect this to be a key development in early 2014 and have highlighted Dell, HP, Huawei, and Centec as likely suspects with emphasis on US vendors Dell and HP since they are closest to SDN innovators.

**Figure 19: Ethernet Switch Ecosystem**




Source: J.P. Morgan. Dotted circle indicates vendors who either already or can potentially provide support for white box switches.

## Vendor Snapshots

**ADARA Networks**

ADARA Networks is a provider of commercially available SDN and cloud computing solutions via its Full Stack Engine platform. The ADARA Networks Horizon Series Software Defined Networking Platform is an open standards based platform product that dynamically creates and delivers cloud computing, and other implementations of SDN. The company has <50 employees and is headquartered in San Jose, California. Eric Johnson is the current Chairman and CEO of Adara Networks.

**Arista Networks, Inc.**

Arista Networks is a provider of software defined cloud networking solutions for large data centers and high performance computing environments with primary focus on hardware systems. The company's EOS (Extensible Modular OS) architecture helps separate the networking state from the processing plane. The company's headquarters is based in Santa Clara, California. The company was founded in 2004 by Andy Bechtolsheim, who is also the current Chairman and Chief Development Officer. Jayshree Ullal, an ex-Cisco networking veteran is the current President and CEO of Arista Networks.

**Anuta Networks**

Anuta Networks is a provider of end-to-end network services virtualization solutions for large, medium enterprises and service providers. The company's Network Services solutions help organizations of all sizes accelerate deployments of network infrastructures and bring agility to the network. Anuta's partnerships with industry leaders such as Cisco Systems, F5 Networks, VMware and many others further enable customers to rapidly transform their network services in agile infrastructure deployments. Anuta was founded in 2010 by industry veterans with deep expertise in Enterprise, Data Center, Virtualization, Network and Systems Management. The company is headquartered in Silicon Valley with offices in Japan, Australia, Ireland, France, Spain and India.

**Big Switch Networks**

Big Switch Networks is an emerging SDN player and OpenFlow specialist. The company uses an Apache licensed SDN Controller called Floodlight for its commercial control platform. Big Switch Networks was founded in 2010 by SDN pioneer Guido Appenzeller, who led the Clean Slate Lab at Stanford University, and Kyle Forster, a Cisco wireless veteran. The company is based in Palo Alto, California.

**Embrane, Inc.**

Embrane is a provider of Layer 3-7 Networking SDN solutions for service providers and enterprises. The company is leveraging its Heleos distributed software platform that enables on-demand virtual networks services, including server load balancing, firewalls and VPN termination. Embrane was incorporated in 2009 as is based out of Santa Clara, California. Dante Malagrino, CEO, and Marco Di Benedetto, CTO, are the co-founders of Embrane.

**Extreme Networks, Inc.**

Extreme is a provider of Ethernet networking solutions for enterprises and service providers. The company recently announced several initiatives to broaden its SDN offerings by providing OpenFlow support across its ExtremeXOS-based Ethernet

switch portfolio. Extreme also announced support for multiple OpenFlow controllers including Big Switch. Extreme Networks also plans to introduce a plug-in for OpenStack, an open source OS for cloud networks, to manage network switches using Quantum APIs. On similar lines, Extreme is launching a new Web portal called xKIT, aimed at sharing SDN applications. The company was founded in 1996 and is based out of Santa Clara, California. Oscar Rodriguez is the current President and CEO of the company.

**Huawei Technologies Co., Ltd.**

Huawei is a member of the ONF and, in our opinion, is clearly thinking about OpenFlow implementation in its switching hardware. As a relatively new entrant to data center switching, we believe early adoption would be in Huawei's advantage and could even act as a catalyst to help Huawei gain a stronger foothold in switching.

**F5/LineRate Systems, Inc.**

LineRate is a provider of Layer 7+ SDN solutions. The company's LineRate Proxy suites of solutions provide dynamic application traffic steering and management and a fully-programmable data path. The company was founded in 2008 and is based in Colorado. Steve Georgis is the current CEO. LineRate Systems was acquired by F5 Networks in Feb 2013.

**Midokura**

Midokura is a global startup focused on SDN solutions. Its flagship product is MidoNet, a network virtualization platform which integrates with cloud platforms such as OpenStack. Midokura was founded in 2009 and its headquarters is located in Tokyo, Japan. Tatsuya Kato, a co-founder of Midokura, is the current CEO. The company also has offices in Barcelona and San Francisco.

**NoviFlow Inc.**

NoviFlow is a Montreal based company developing software for the emerging OpenFlow Ethernet switching market. The company's NoviFlow Switch is capable of delivering 100GbE using OpenFlow. Dominique Jodoin is the company's current President and CEO.

**Pertino**

Pertino is an SDN startup focused on cloud based networking solutions targeting SMBs with 10 to 250 users. Pertino's technology creates virtual networks that overlay existing IP access and transport networks. The company was founded in 2011 and is based in Los Gatos, California. Craig Elliott, former CEO of Packeteer and former international general manager of Apple's Internet and online services business, is Pertino's CEO.

**Pica8 Inc.**

Pica8 is a provider of SDN solutions focused on developing low cost network switches. Pica8's switches are loaded with merchant silicon and its Xorplus software, which supports many traditional Layer 2-3 protocols as well as OpenFlow. The company was founded in 2009 and was spun out of server vendor Quanta in 2012. The company's headquarters is in Palo Alto, California and it also has a Development Center in Beijing, China. James Liao is the current CEO.

**Plexxi**

Plexxi is another upcoming SDN startup which uses an approach called "affinity networking" – the ability to understand what kinds of applications are running in data centers, and also how to fit them to a network more efficiently. The company, founded in 2010 by Dave Husak and Ephraim Dobbins, is based out of Cambridge, Massachusetts. In June 2012, Plexxi confirmed a $20.1m round of funding for its venture, taking its total investment to $48.5m.

**PLUMgrid, Inc.**

PLUMgrid is a network infrastructure software vendor, selling network virtualization solutions to companies building and managing data centers. While exact product specifications are not known, it is developing an OS for managing a grid of distributed data planes with an integrated application ecosystem. It will be a runtime environment in which the PLUMgrid I/O system controls network, storage and application protocols. The company was founded in 2011 and is headquartered in Sunnyvale, California. Awais Nemat, one of the co-founders of PLUMgrid, is the current CEO. The company recently appointed former VP/GM of Cisco, Lele Nardin as the Vice President of Engineering.

**Pluribus Networks, Inc.**

Pluribus is a provider of OpenFlow/SDN enabled virtualized switches and a distributed Netvisor operating system for network virtualization. The company was founded in 2010 and is based in Palo Alto, California. Robert Frost, an ex-Sun Microsystems veteran is the current CEO.

**Vello Systems, Inc.**

Vello is a provider of OpenFlow based SDN solutions that help simplify storage and compute management for service providers, enterprises and government institutions. The company leverages is VellOS to power its Data Center Gateway (DCG) and Vello System Manager (VSM) products. Founded in 2009, Vello is based out of Menlo Park, California. Karl May is the current President and CEO of Vello.

**Vyatta Inc.**

Vyatta is a provider of solutions for both virtual and non-virtual environments that fit very well into the evolving SDN phenomenon. The company's Vyatta Network OS can be directly deployed on virtual hypervisors as well as x86 servers and turn them it into a router, firewall or a VPN. The company was founded in 2005 and Kelly Herrell, an ex-Blue Coat veteran, is the current CEO. Vyatta was acquired by Brocade in November last year.

## SDN Oriented M&A Activity

Along with the growing importance of SDN, incumbents made strategic acquisitions to either remain ahead of the technology curve (example, VMW-Nicira) or in an attempt to not fall behind (example, Cisco-Insieme). VMware's acquisition of Nicira for $1.26bn in July 2012 marked the beginning of SDN related acquisitions and also changed the landscape of acquisitions in an otherwise stale data center networking space. For 2014 we believe that Cumulus is a key company to watch as we see a lot of synergy with VMware's stack. We also believe that Cisco is going to feel more and more pressure to merge with or acquire storage capabilities to lock down its position in the data center but the lack of access to offshore cash may hinder a short term transaction.

Figure 20: Acquisitions

| Company | Date | Acquirer |
|---|---|---|
| Nicira | July 2012 | VMWare |
| Xsigo | July 2012 | Oracle |
| vCider | October 2012 | Cisco |
| Cariden | November 2012 | Cisco |
| Vyatta | November 2012 | Brocade |
| Contrail | December 2012 | Juniper |
| LineRate Systems | February 2013 | F5 Networks |
| Insieme | November 2013 | Cisco |
| Corente | January 2014 | Oracle |

Source: J.P. Morgan

In the Figure 20 above we have listed key acquisitions in the SDN space over the last couple of years. 2013 and early 2014 have clearly seen a much reduced deal volume when compared to 2012. However, we expect real competition to heat up again in 2014 though we don't expect deal volume to rival 2012 until late 2014 or 2015. Of all the acquisitions made by incumbents, so far VMware and Oracle have been able to acquire the most interesting startups in our opinion though at generally high prices. We believe that Oracle, VMware and Cisco will continue to remain active with acquisitions as all continue to see data center networking as key to their future strategies.

## Opensource Networking Projects

Opensource networking projects continue to drive innovation and commoditization in networking. Many of these projects are outshoots of development efforts led by webscale companies (Google, Amazon, etc) to advance their own data center operations. Note that Open vSwitch, the base for Nicira's NSX, is an open source project as is Big Switch's Floodlight. Cumulus' OS is based on Linux OS and the Quagga open source routing project.

In addition to providing a summary of the open source landscape we believe that the variety and quality of these projects foreshadows the future of networking value add. We believe that much of what Cisco has been selling over time to customers will end up in commoditized open source and the value will migrate up stack toward new networking applications like security and traffic analysis where innovation speed must increase.

**Open vSwitch**

Open vSwitch is a production quality, multilayer virtual switch licensed under the open source Apache 2.0 license. It is designed to enable network automation through programmatic extension, while still supporting standard management interfaces and protocols (e.g. NetFlow, sFlow, SPAN, RSPAN, CLI, LACP, 802.1ag). In addition, OVS is designed to support distribution across multiple physical servers similar to VMware's vNetwork distributed vswitch or Cisco's Nexus 1000V. Open vSwitch also provides visibility into inter-VM communication via NetFlow, sFlow, IPFIX, SPAN, RSPAN, and GRE-tunneled mirrors. It also supports multiple tunneling protocols (GRE, VXLAN, IPsec, GRE and VXLAN over IPsec) and remote configuration protocol with C and Python bindings.

**Open Compute Networking Project**

The Open Compute Networking Project is aimed at creating a set of technologies that are disaggregated and fully open, allowing for rapid innovation in networking. The project aims to facilitate the development of network hardware and software – together with trusted project validation and testing – in a truly open and collaborative community environment. Its initial goal is to develop a top-of-rack (leaf) switch, while future plans target spine switches and other hardware and software solutions in the space. Broadcom already published specifications for its Open Switch Platform that can be used as a 10GbE Leaf and 40GbE Spine Switch. Intel has submitted a design guide for OCP Open Rack adopters that provides an overview for implementing an intra-rack optical interconnect scheme that utilizes a New Photonic Connector (NPC) and embedded optical modules to deliver next generation data rate scaling and system architectural benefits. Cumulus Networks submitted specifications for the Open Network Install Environment (ONIE). The ONIE is an open source initiative that defines an open OS "install environment" for bare metal network switches, such as the OCP Network Switch design. ONIE provides what is effectively a standardized BIOS boot methodology which, in turn, enables a bare metal switch to be easily loaded with a switch OS of the user's choosing. Traditionally, Ethernet switches are procured with preinstalled, captive operating systems, effectively creating networking appliances that lock end users into a vertical supply chain.

**OpenStack Neutron**

Neutron is an OpenStack project to provide "networking as a service" between interface devices (e.g., vNICs) managed by other Openstack services (e.g., nova). A number of controller vendors and open source communities have developed plugins that would let their solutions interoperate with Neutron. The set of plugins included in the main Neutron distribution and supported by the Neutron community include: Open vSwitch, Cisco UCS/Nexus, Linux Bridge, Modular Layer 2, Nicira Network Virtualization Platform (NVP), Ryu OpenFlow Controller, Big Switch Controller, Cloudbase Hyper-V, MidoNet, Brocade Neutron, PLUMgrid and Mellanox. Additional plugins available from other sources (not included in the main Neutron distribution) are OpenContrail, Extreme Networks and Ruijie Networks.

**Open DayLight**

The OpenDaylight (ODL) Project is an open source framework that aims to accelerate adoption, foster new innovation and create a more open and transparent approach to SDN with the goal of a common, open and vendor neutral SDN platform for developers to utilize, contribute to and build commercial products and technologies upon. ODL's initial goal was to launch its code in Q3'13, but that has now been pushed in to Q1'14 (most likely coming out in February). We believe that Cisco effectively dominates the OpenDayLight project via control of the majority of the initial code and ongoing commits. As such, we doubt Open DayLight is likely to be widely accepted by end users as an open source initiative independent of Cisco.

**Floodlight**

The Floodlight Open SDN Controller is an enterprise-class, Apache-licensed, Java-based OpenFlow Controller. It is supported by a community of developers including a number of engineers from Big Switch Networks. OpenFlow is an open standard managed by the Open Networking Foundation. OpenFlow specifies a protocol through which a remote controller can modify the behavior of networking devices through a well-defined "forwarding instruction set". Floodlight is designed to work

with a growing number of switches, routers, virtual switches, and access points that support the OpenFlow standard.

**Quagga**

Quagga is a routing software package that provides TCP/IP based routing services with routing protocols support such as RIPv1, RIPv2, RIPng, OSPFv2, OSPFv3, IS-IS, BGP-4, and BGP-4+. Quagga also supports special BGP Route Reflector and Route Server behavior. In addition to traditional IPv4 routing protocols, Quagga also supports IPv6 routing protocols. A system with Quagga installed acts as a dedicated router. With Quagga, your machine exchanges routing information with other routers using routing protocols. Quagga uses this information to update the kernel routing table so that the right data goes to the right place. Cumulus Networks is a major participant in the Quagga project and makes heavy use of Quagga code in their own products.

**BIRD**

The BIRD project aims to develop a fully functional dynamic IP routing daemon primarily targeted on (but not limited to) Linux, FreeBSD and other UNIX-like systems and distributed under the GNU General Public License. BIRD currently supports both IPv4 and IPv6, Multiple routing tables, BGP, RIP, OSPF, BFD, Static routes, IPv6 Router Advertisements, Inter-table protocol and a number of other features

**XORP**

XORP is an extensible open source routing platform. XORP provides a fully featured platform that implements IPv4 and IPv6 routing protocols and a unified platform to configure them. It is the only open source platform to offer integrated multicast capability. XORP's modular architecture allows rapid introduction of new protocols, features and functionality, including support for custom hardware and software forwarding.

**Net-SNMP**

Net-SNMP is a suite of applications used to implement SNMP v1, SNMP v2c and SNMP v3 using both IPv4 and IPv6. The suite includes Command-line applications to retrieve information or manipulate configuration of an SNMP-capable device, a graphical MIB browser using Tk/perl, a daemon application for receiving SNMP notifications, an extensible agent for responding to SNMP queries for management information and a library for developing new SNMP applications, with both C and perl APIs.

**Ryu**

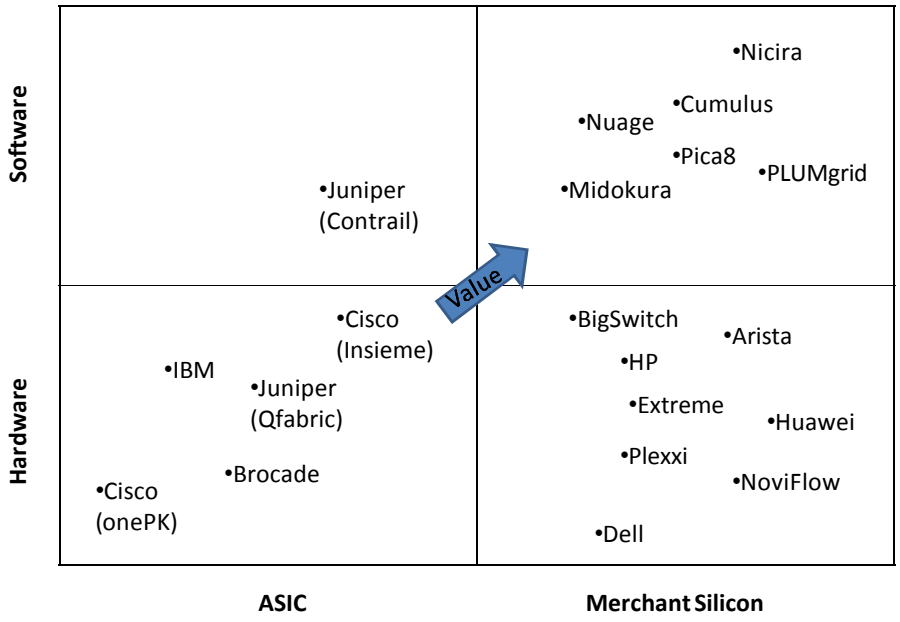
Ryu is a component-based software defined networking framework. Ryu provides software components with well defined API that make it easy for developers to create new network management and control applications. Ryu supports various protocols for managing network devices, such as OpenFlow, Netconf, OF-config, etc. About OpenFlow, Ryu supports fully 1.0, 1.2, 1.3 and Nicira Extensions. All of the code is freely available under the Apache 2.0 license.

## SDN Value Matrix

We believe that SDN oriented companies can be classified along two main axes. The first is whether the company is focused on leveraging its own ASICs or off the shelf silicon from the likes of Broadcom. In Figure 21 below we illustrate where we think each company stands. Though Cisco has made progress with Insieme we continue to see the company relying on custom ASICs to add value. However, we believe this

misses the movement of value creation away from ASICs and toward the companies who leverage powerful commodity silicon to innovate. We believe Cisco will have a tough time moving completely into the new world because so much of its historical success was driven by the very ASICs that current trends are making obsolete.

**Figure 21: Vendor Value Matrix**




Source: J.P. Morgan

We categorize vendors like Juniper, IBM, HP and Brocade as vendors investing in ASICs, although they all use a combination of internal ASICs and merchant silicon in their switching solutions. We have attempted to draw the line between vendors who are continuing to invest in ASICs and those who are not with our chart.

Intel announced its SeaCliff Trail in April 2013. SeaCliff is a reference design SDN capable switch built on Intel's Ethernet Switch (Fulcrum) FM6764 for packet forwarding and a control plane module based on the Intel Xeon processor E5-26xx series and Intel Communications Chipset 89xx Series. Intel also modified Wind River Linux OS and developed Open Network Software (ONS) that runs on these switches. We believe the Linux OS may not be very well developed so would expect Intel to potentially partner with other switch OS vendors like Cumulus.

We believe Intel has plans to integrate high speed networking (possibly 100GbE) straight into its x86 platforms. This would effectively enable the construction of server racks without top of rack switches. We suspect this is still a couple of years away in the best case, but the possibility illustrates just how quickly things could change in the data center as a result of SDN. Texas Instruments has also announced plans to develop a networking chip optimized for OpenFlow control.

We expect incumbent vendors to continue to attempt to leverage ASICs to compete, but believe that this dated strategy is likely to fail as merchant silicon increases in capability. Broadcom's latest StrataXGS Trident II Series can support 100+ 10GbE ports with flexibility to support up to 32 40GbE ports, delivers NVGRE and VXLAN

L2oL3 transit and gateway switch technologies and supports equal cost multipathing-based fat-tree networking scale on a single chip.

EZChips's NP-5 is a 240-Gigabit network processor with integrated traffic management for building ultra-dense 10GbE, 40GbE and 100GbE port line cards in switches and routers. It can support 64x1GbE, 48x10GbE, 12x40GbE and 4x100GbE ports.

Note that most of the chips that market leader Broadcom supplies are based on older nodes (65nm and above). As Broadcom migrates to newer (smaller) nodes, we would expect price/performance to improve and power requirements to come down. We also note that Broadcom's learning curve for features needed in their Trident line should continue to be steep as the chipset is used in and with more and more products.

**Table 2: Generalized Vendor Silicon Strategy**

| Vendor | Silicon | Vendor | Silicon |
|---|---|---|---|
| Midokura | Merchant | Dell | ASIC/Merchant |
| Plexxi | Broadcom | Brocade | ASIC/Merchant |
| NoviFlow | EZChip NP-4 | IBM | ASIC/Merchant |
| Arista | Broadcom | Cisco | ASIC/Merchant |
| Pica8 | Broadcom | Juniper | ASIC/Merchant |
| HP | ASIC/Merchant | | |

Source: Industry websites and J.P. Morgan

In Table 2 above, we summarize the silicon strategies of the main data center networking competitors. We have not included software-only companies like Big Switch and VMware/Nicira given these companies are predominantly focused on providing software and, in our opinion, do not have or need a specific hardware strategy.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com



# Service Provider SDN Focus Growing

Increasing numbers of service providers are looking at hosted cloud services as an alternate revenue generating engine as their core services revenue lines continue to come under pressure. With the growth of SP Cloud services we believe there will be two interesting market phenomena developing: one is the growth of in-house networking solutions or open source based solutions, and the other is increasing competition for compute/SaaS wallet share in medium sized enterprises.

We believe that SPs building their own public clouds will gravitate towards either building their own in-house networking solutions or using open source based solutions running on economical switching infrastructure and away from the traditional way of building infrastructure by procuring all hardware and software as recommended/supplied by incumbents. This is true in the case of Verizon where we believe the carrier built its own in-house switch OS for ToR and uses aggregation switches from Arista. Also, we believe AT&T is increasingly looking at different networking suppliers and solutions other than Cisco in building its own SDN data center solutions. While not the focus of this section we do believe that Cisco is well positioned in the actual carrier transport networks to help with SDN and network automation but we equally believe that this development will take more time than SDN deployment in the data center.

We also expect to see increasing competition for mid tier business compute services. Service Providers generally have well established sales relationships with small sized businesses due to their existing enterprise offerings. These small businesses will be, in our opinion, early adopters of hosted public cloud solutions because of the cost benefits associated with them. Given the depth and breadth of SP relationships, we believe that SPs are well positioned to benefit from this hosted cloud migration while suppliers like Amazon may struggle to maintain share. We believe that heavy competition from SP Cloud will in turn force large cloud providers such as AWS, GCE and Azure to increasingly target medium sized businesses where Cisco currently has a strong position. Should the market continue to transition in this direction, Cisco is likely to face significant market share pressure in switching and associated services. In Table 3 below, we highlight some of the key cloud initiatives under way at Service Providers.

**Table 3: Service Providers with Hosted Cloud Offerings**

| Service Provider | Service Provider |
|---|---|
| AT&T | Pacnet |
| CenturyLink-SAVVIS | Reliance Globalcom |
| Verizon | SingTel |
| Level 3 | T-Systems |
| BT Global Services | Tata Communciations |
| NTT Communications | Telstra |
| Orange Business Services | Vodafone Global Enterprise |

Source: Company reports.

## Verizon

On October 3, 2013, Verizon announced Verizon Cloud, its new cloud Infrastructure as a Service (IaaS) platform and cloud-based object storage service. The public beta for Verizon Cloud launched in Q4'13. Verizon Cloud has two main components:

Verizon Cloud Compute and Verizon Cloud Storage. Verizon Cloud Compute is the IaaS platform. Verizon Cloud Storage is an object-based storage service.

We believe that Verizon has built its new cloud infrastructure platform in conjunction with AMD's SeaMicro division. The new platform is based on SeaMicro's SM15000, a high-density 10U appliance that integrates compute, SSD storage and SDN-based networking onto a 1.28Tbps fabric. Verizon and AMD have designed it to allow fine-grained VM configuration (CPU, RAM, storage throughput and network bandwidth) and rapid provisioning (new VMs spin up in 18 seconds).

Verizon's chief technology officer for cloud, John Considin, reportedly explained to Barron's blog that much of the Verizon Cloud follows the emerging trend of data centers being built from computing bricks rather than traditional name-brand gear, tied together with a lot of innovative software. For rack switching, Verizon developed its own in-house switch software that runs on the SeaMicro boxes. It also developed its own storage software that coordinates the operation of solid-state drives installed inside each server. Compute and storage can both be made accessible to any node in the network and all nodes are tied together with an aggregation switch from Arista Networks.

The service currently supports Xen and VMware and from 2014 will reportedly support KVM and Hyper-V and provides Linux, BSD and Windows Server OSs, with customers also able to upload their own OS images. The roadmap also includes support for API compatibility with OpenStack, CloudStack and AWS. The service is available in the U.S. currently (from Verizon's Culpeper, Virginia datacenter) and will be available from other U.S. data centers as well as in Brazil and Europe (London and Amsterdam) from mid-2014.

## AT&T

We believe that AT&T is also increasingly looking at non-traditional ways of implementing future data center networking. AT&T is also one of the earliest customers of Nicira's overlay controller solution. The company, working with Nicira, is reportedly delivering enterprise-grade, secure and scalable network virtualization within its internal OpenStack deployment. In addition, AT&T's new Domain 2.0 program is aimed at disrupting the traditional way of building its networking infrastructure.

The Domain 2.0 program announced on Sep 23, 2013, is designed to make a rapid and broad move to a modern, cloud-based architecture that is expected to significantly reduce the time required to switch architectures while simultaneously accelerating time-to-market with technologically advanced products and services. We believe AT&T is increasingly looking at alternate solution providers who can help the carrier reduce time-to-market on new services and do that at low cost. We believe that AT&T excluded Cisco from an SDN related RFP floated in December, speaking to the carriers' willingness to embrace newer technologies from new innovative companies.

## SDN in Carrier Networks Still a Way Off

No discussion of SDN and service providers would be complete without addressing the potential use of automation technologies in carrier networks. We believe this is inevitable but equally see deployments taking a few more years even though we suspect major carriers would like things to move more quickly. The main attraction

of automation for carriers globally is the reduction of opex. This is important as rapidly growing data usage has put more and more upward pressure and capex with the trend getting worse over the next several years. Carriers know that network efficiency will keep increasing but we believe many accept that technology gains alone won't be enough to offset pressure on ROIC.

We believe that this need to automate networks should eventually result in a large revenue and profit opportunity for multiple vendors including Cisco, Juniper, Ciena, Alcatel-Lucent, Nokia, Infinera and several others. However, we have enough time in the saddle dealing with carriers to know that, no matter how badly they want to change, they tend to be extremely slow moving. As a result we intend to continue to monitor activity in this area led by companies like Cisco (David Ward) and Ciena (OPn architecture) but doubt that revenue benefits will begin accruing to our companies in 2014.

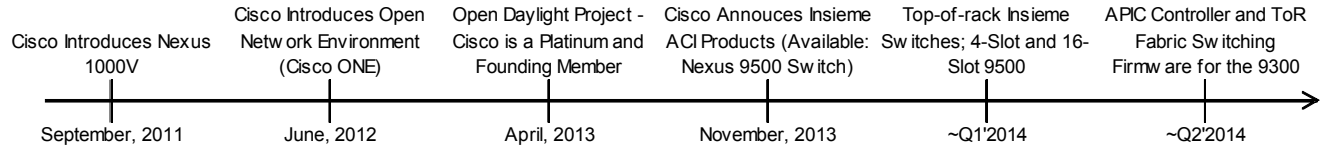
# Company SDN Roadmaps for 2014

## Cisco

As the leading networking vendor, Cisco has the most at stake with SDN, in our view, and is most exposed to downside if SDN triggers networking commoditization. The company has deliberately taken a broad approach to SDN thus far, which makes sense to us given that SDN has yet to hit the mainstream enterprise market. Though SDN presents longer term risks to Cisco, we believe the company should do well in early-stage SDN deployment with the recent Insieme launch. With the announcement coming late in 2013 and the complete solution available in the second half of 2014, we believe the data center switching market might briefly pause in early 2014.

We do not believe that SDN will immediately impact Cisco's earnings but we are increasingly convinced that SDN is likely to lower pricing for most of the data center switching market dramatically. In terms of timing, our central case is that material pricing impacts are likely to begin by mid 2014 and increase through H2. However, we believe that large enterprise customers are already starting to circumnavigate the integrated stack vendors with white-box switches – we expect this phenomenon to continue to roll to smaller enterprises over the next few years as implementation and management become easier. In Table 4, we display recent and expected SDN announcements from Cisco.

**Table 4: Cisco's SDN Announcement Timeline**

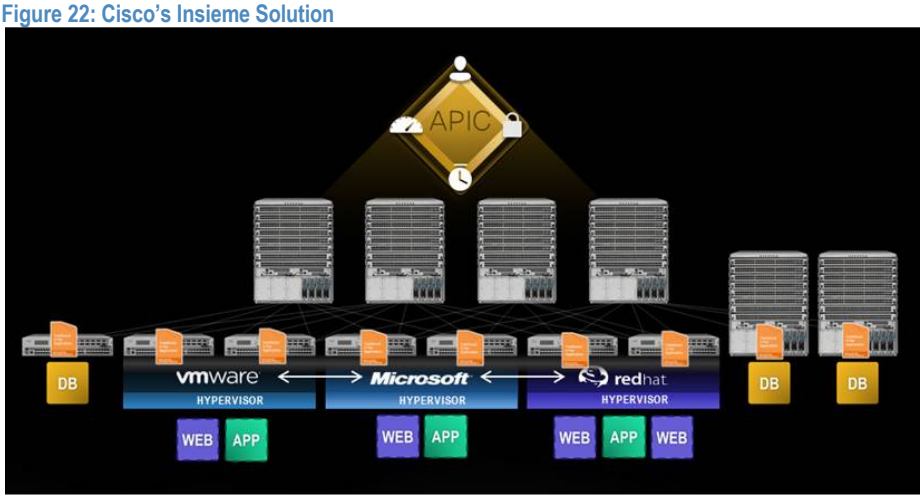



Source: Company reports.

**Announcements**

On November 5, 2013, Cisco announced the highly anticipated Insieme SDN solution. Soni Jiandani, Insieme's SVP of Marketing, talked about three main building blocks in its current SDN strategy, which include the Nexus hardware, Insieme's APIC controller, and then an application ecosystem built around the controller. The architecture is displayed in Table 5 below. A customer has the ability to define their 3-tier application policy in a central location. Once policy is defined, the APIC controller pushes it across the underlying switching fabric. With this, the network can support a multi-vendor environment (multiple hypervisor solutions including VMware, Microsoft, and Red Hat). Based on the APIC solution, Cisco claims its solution is also able to support underlying bare-metal networking hardware. We are somewhat skeptical of this last claim since it would seem to fly in the face of Cisco's overarching strategy with regards to SDN.

Figure 22: Cisco's Insieme Solution



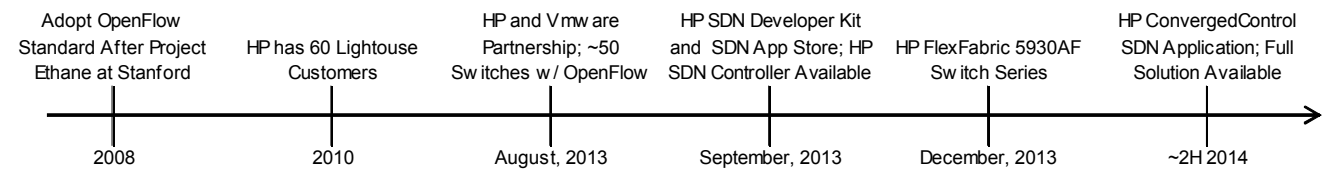

Source: Company reports.

The company has only released a partial solution to date. Currently, the Nexus 9500 aggregation switch is available in a 4-slot option with the 16-slot option arriving in H1 2014. We believe the top-of-rack Insieme switches will be available in April (Cisco noted Q2'14). Cisco also gave some idea around pricing – a 288 port deployment of the Insieme solution for $75k, which equates to $260/port but this was incomplete. We believe this is a fully loaded price including all layers of switching as well as the APIC controller but it wasn't clear whether typical add ons like L3 licenses and Smartnet were included. However, we believe this low pricing/port level relative to Cisco's current averages is a signal that the company intends to self-cannibalize to maintain its footprint share in the data center. We see this as consistent with our early 2013 analysis which implied large reductions in the size of the switching market in both revenue and profit terms. We have updated this analysis in this report as more specific pricing data has become available.

## HP (covered by Mark Moskowitz)

At our SDN conference on September 25, 2013, we spoke with HP's Bethany Mayer, SVP of Networking, about the company's SDN strategy and outlook. Mayer noted that HP's switch operating system is programmable, and that the company is not ruling out the possibility of decoupling HP's OS from the hardware. Like Cisco, HP continues to believe custom silicon is the best path forward. In addition, Mayer implied HP's future support of overlay control, as seen by HP's willingness to collaborate with others. We believe that another major vendor like Dell is likely to move to provide own-branded bare metal ToR switches in early 2014. Assuming we are correct in this we would expect HP to consider pivoting to a similar strategy or some sort of bare metal/proprietary hybrid approach.

Table 5: HP's SDN Announcement Timeline

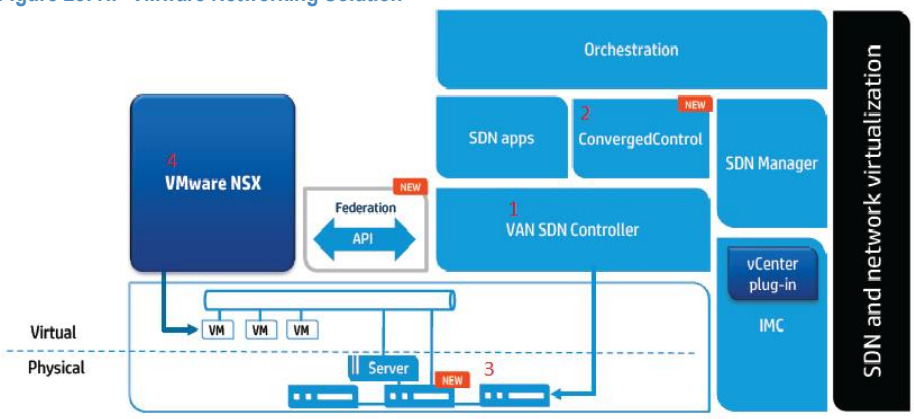



Source: Company reports.

**Announcements**

On August 26, 2013, HP and VMware announced the integration of HP's SDN controller with VMware's NSX virtualization platform. The federation between HP's controller and VMware's platform is aimed at unifying virtual and physical networking through APIs. The new offering's architecture can be seen in Figure 23. The key components of the new offering include HP's VAN SDN controller (1), ConvergedControl Application (2), FlexFabric 5930 Top-of-Rack Switch (3), and VMware's NSN virtualized platform (4). Like similar architectures, the goal is to increase automation and visibility in the data center. This is achieved by the NSX sharing virtual information with HP's controller. The complete solution won't be available until the second half of 2014. The SDN Controller and FlexFabric top-of-rack switch are currently available on a standalone basis. The ConvergedControl application will be sold in the back-half of the year; this is not surprising as the piecemeal rollout matches Cisco's Insieme launch.

Figure 23: HP-VMware Networking Solution




Source: Company reports.

On September 30, 2013, the company unveiled HP SDN Developer Kit (SDK) and the HP SDN App Store. The developer kit is focused on enabling developers to create, test and validate applications. Monetizing applications has always been a fragmented process; we believe a central store will not only attract developers, but also add critical mass to the platform over the medium-term.

While we believe the strategy is somewhat forward thinking, it is clear the company is hesitant about fully committing to a particular SDN strategy. We believe HP will continue to pursue ASIC based switches for the foreseeable future as it believes there are a number of applications (such as DPI, network security, etc) that will continue to justify investing in internal silicon development. Based on recent announcements and their current product suite, we believe HP is slightly ahead of Cisco on adapting to the software-defined future. To be fair to Cisco, HP also has less to lose in this transition in our opinion.

## Juniper

At a conference in December 2013, Kathleen Nemeth, VP of Investor Relations, said the company continues to see opportunity in SDN and NFV as the company currently does not have a large data center footprint. Nemeth pointed to the potential in data center deployments for Contrail or OpenContrail to be implemented. This would, according to Juniper, potentially pull through an opportunity for the MX portfolio and security products. At a different conference in December, Robyn Denholm, CFO,

implied that the company's minuscule switching share (2% in overall switching) provides potential upside from their SDN products without the downside of commoditization or increased competition. That being said, the company has not shed incremental light on any plans or changes to their existing SDN strategy articulated at the Mobile World Congress in February of 2013.

**Table 6: Juniper's SDN Announcement Timeline**


Source: Company reports.

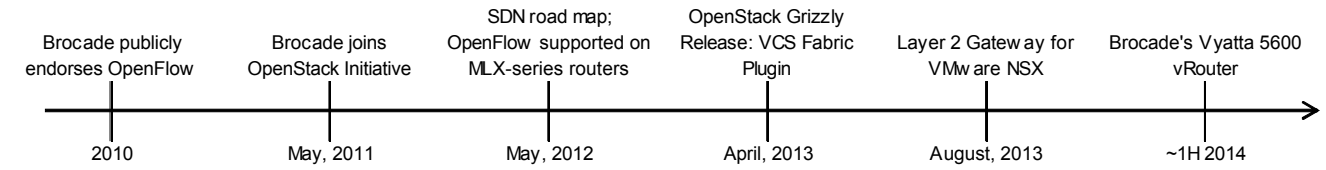
**Announcements**

In Table 6, we lay out Juniper's SDN history. In late 2012, the company solidified their SDN strategy when they agreed to acquire Contrail Systems. The Contrail SDN controller became available in September of 2013 after an originally planned launch in 2014 (Robyn Denholm noted at a conference in December that Contrail was in 40 betas globally). JunosV became available in Q1'13. The App Engine de-links network and security services from hardware by creating virtual machines. Juniper does not believe that a fully open source controller can provide full functionality but said that some components of their controller will be open source (OpenContrail was introduced in September 2013). In August 2013, Juniper announced its partnership with VMware to extend VMware's NSX Gateway and VXLAN routing capabilities across access, aggregation, core and edge tiers of the data center network.

## Brocade (covered by Mark Moskowitz)

At our SDN conference on September 25, 2013, JP Morgan's Mark Moskowitz spoke with Ken Cheng, CTO and Vice President of Corporate Development, about the company's focus points and views on SDN. Cheng noted that Brocade is against vertical integration, which is reflected by the company's Openstack allegiance. He also noted that within a certain selection of products in the data center, Brocade is looking to start adding merchant silicon. Cheng said that he has recently hired SDN talent away from Juniper. On January 14, 2014, Brocade announced that it hired Benson Schliesser, a Juniper and Cisco alum with expertise in network virtualization.

**Table 7: Brocade's SDN Announcement Timeline**




Source: Company reports.

**Announcements**

In Table 7, we lay out Brocade's SDN announcements. On April 30, 2013, Brocade introduced various virtual networking products for the data center. The company highlighted two components: the Vyatta vRouter and the Virtual ADX Application Delivery Switch. The virtual router is Brocade's layer 3 solution which was designed with the mission of being platform- and hypervisor-agnostic (supports all major

hypervisors, including VMware, Microsoft, Citrix, and Red Hat). The Virtual ADX is targeted at adding a virtual option to the physical portfolio; Brocade held 2.1% of the physical ADC market in Q3'13. Like HP, we believe Brocade is being very cautious when it comes to selecting a specific SDN strategy.

# EM SPs Outlook Still Shaky

Cisco reported its first product order decline of 4% Y/Y in FQ1'14 (to Oct) since the Great Financial Crisis. The last time we saw an order decline from the company was the -8% contraction posted in FQ1'10. Cisco flagged weak demand from Emerging Markets (EMs) Service Providers (SPs) as the main driver for this as slowing revenue growth, depreciating EM currencies and generally declining GDP growth estimates capped results. In this section we analyze current trends in key EMs and conclude that things are likely to remain tough in H1'14 with the potential for recovery later in 2014 if developed market economies remain on track.

**Table 8: Cisco: EM Product Order Trend in FQ1'14**

| | FQ1'14A |
|---|---|
| Emerging Markets | -12% |
| Brazil | -25% |
| Russia | -30% |
| Mexico | -18% |
| China | -18% |
| India | -18% |

Source: Company reports.

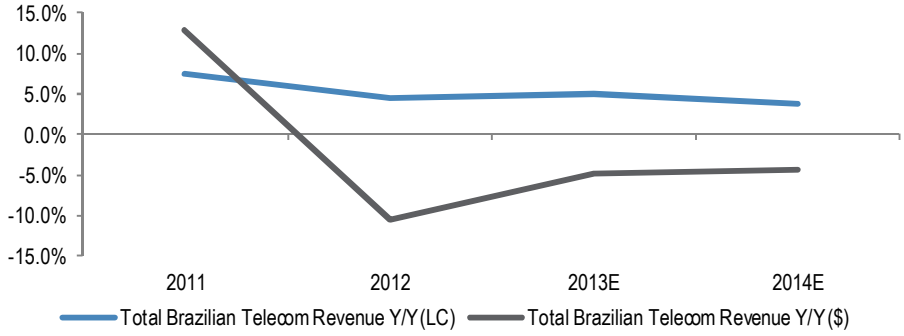
## Brazil

We believe Brazil will continue to remain challenging for Cisco due to a depreciating BRL and slowing operator revenue growth. Telecom revenue for key operators in Brazil is expected to grow by only 3.8% Y/Y to BRL98.8bn (~$42.2bn) in 2014 down from 4.9% Y/Y in 2013. Importantly, the USD strengthened by a significant 12.8% Y/Y and 10.6% Q/Q in Q3'13 vs the Brazilian Real, making it very difficult for orders to grow on a USD denominated basis. In addition, our economists' forecast for Brazilian GDP growth has declined to an anemic 2.1% Y/Y from the 4.0% projected at the beginning of 2013.

### Operators and Cisco

Service Providers' revenue growth in local currency in Brazil improved a bit in 2013 to 4.9% growth from 4.4% Y/Y. For 2014, however, consensus growth is expected to slow to 3.8% Y/Y. Also, revenues for MTR in Brazil are expected to decline by 25% Y/Y in 2014 vs. 10% in 2013. We believe that total order volume for Cisco will return to strong growth when operators get more comfortable with their own revenue prospects but this looks like it will take until at least the second half of 2014 to us.

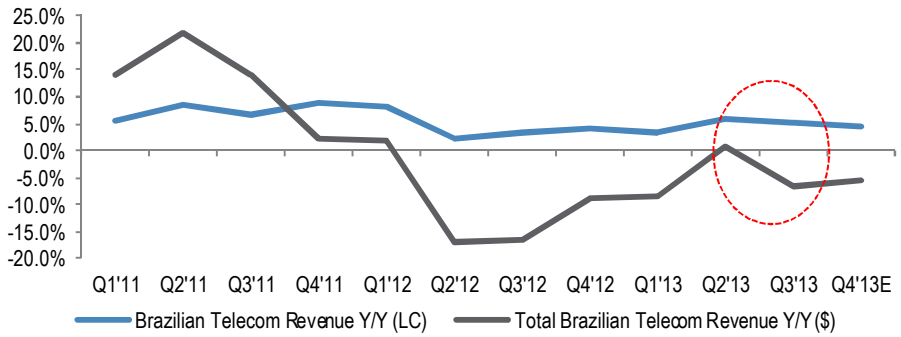
**Figure 24: Brazilian Operators* Revenue (LC) Growth Is Expected to Decline**




Source: Company reports and J.P. Morgan estimates. * - Operators considered are TIM Brasil, Oi, Telefonica Vivo and America Movil Brazil.

In Figure 25 below, we show Y/Y revenue trends for Brazilian carriers both in local currency and USD. Cisco's product orders in FQ1'14 (to Oct) declined by 25% Y/Y. For Q4'13, however, operators revenue denominated in USD looks stable on the weak level seen in Q3.

Figure 25: Brazilian Telecom Revenue (LC) Y/Y Has Been Declining




Source: Company reports and J.P. Morgan estimates.

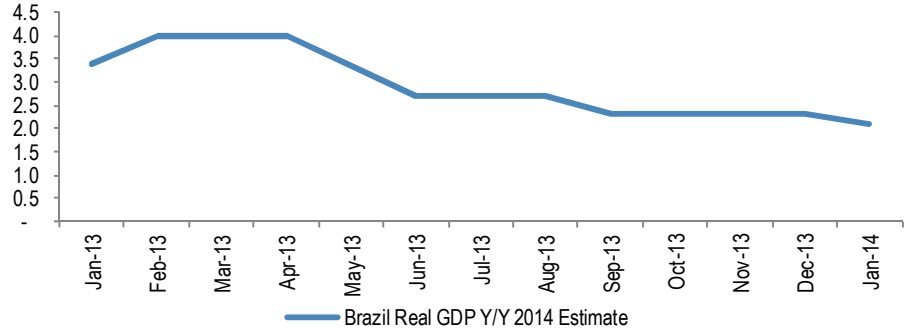
**FX Swings**

USD strengthened by 12.8% Y/Y and 10.6% Q/Q in Q3'13 vs. the BRL to 2.29. Our FX strategy analysts are forecasting that the USD should continue to strengthen to 2.50 BRL/USD by the end of 2014. We believe that Y/Y comps will get even tougher for Cisco assuming our strategists are correct in their view of ongoing BRL depreciation.

**Uncertain Macro in an Election Year**

Our economists' forecast for 2014 real GDP growth in Brazil has declined steadily since Feb 2013. Brazil, which in Feb 2013 was forecasted to grow by 4.0% Y/Y in 2014, is now expected to grow by only 2.1% Y/Y (2013E Growth: 2.3%). GDP forecasts declined throughout Q2'13 and again at the end of Q3'13. Our regional economist reduced his Brazil GDP Y/Y growth expectation to 2.1% from 2.3% in Jan 2014 due to potential impact from worsening private sentiment driven by challenges related to Fed tapering in the US, China growth moderation, and increasing concerns over fiscal and quasi-fiscal policy amid Brazilian presidential elections in October.

Figure 26: Brazil: 2014 Real GDP Y/Y Growth Projections Over Time



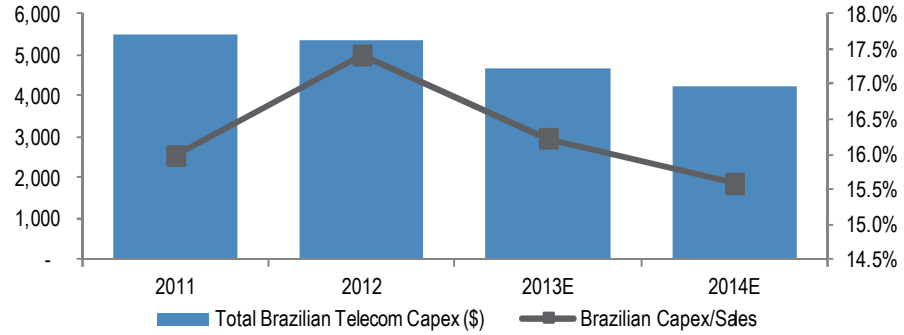

Source: J.P. Morgan.

### Capex

Total Capex/sales in Brazil is expected to decline from 2012 levels in 2013 and 2014. Based on our local analysts' forecasts, Capex/sales in Brazil is expected to decline to 15.6% in 2014 from 16.2% in 2013 and 17.4% in 2012. This also doesn't bode well for Cisco and other companies supplying equipment to Brazilian carriers in our opinion.

**Figure 27: Brazil*: Capex/Sales Declining**

$ in millions




Source: Company reports and J.P. Morgan estimates. * - Operators considered here are TIM Brasil, Oi and Telefonica Vivo.

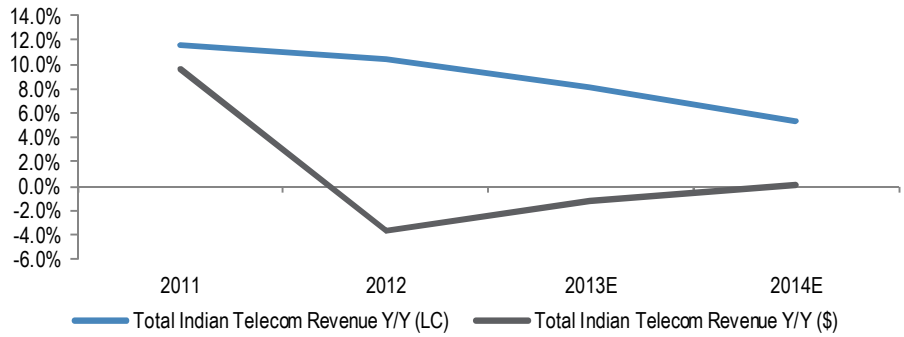
## India

Telecom regulatory issues, slowing GDP growth, depreciating currency and declining SP revenue all hurt the telecom equipment market in India for most of 2012 and 2013. For 2014, however, a stabilizing telecom regulatory environment and improving GDP outlook should provide some respite in our opinion. However, we expect slowing carrier revenue growth to remain a drag even as some other headwinds diminish.

### Operators and Cisco

Indian Service Providers' revenue growth in local currency in 2013 declined to 8.2% from 10.4% Y/Y in 2012. For 2014, the growth rate is expected to further slow to 5.3% Y/Y. We believe that this slowing operator revenue trend will remain a headwind for equipment vendors in 2014.

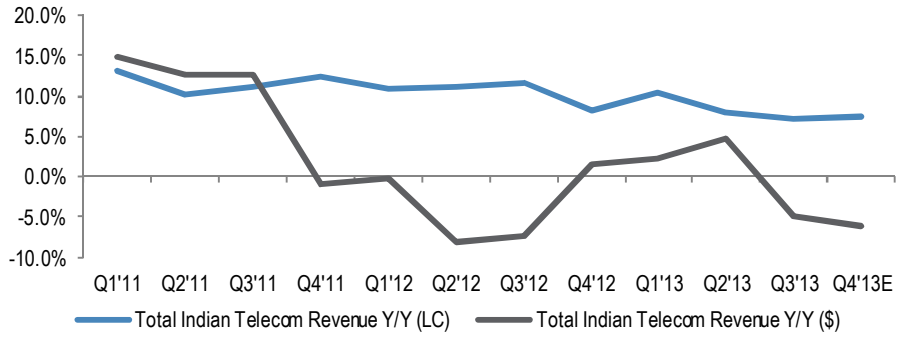
**Figure 28: Indian Operators* Revenue (LC) Growth Is Expected to Decline**




Source: Company reports and J.P. Morgan estimates. * - Operators considered are Bharti Airtel India and South Asia, Reliance Communciations and Idea Cellular. Estimates for Bharti Airtel are from consensus.

In Figure 29, we show Y/Y revenue trends for Indian carriers both in local currency and USD. Note that the sharp Q3'13 decline in Y/Y revenue growth in USD was due primarily to the depreciation of INR as opposed to fundamentally slower demand in local currency terms.

Figure 29: Indian Telecom Revenue (LC) Y/Y Has Been Declining




Source: Company reports and J.P. Morgan estimates.

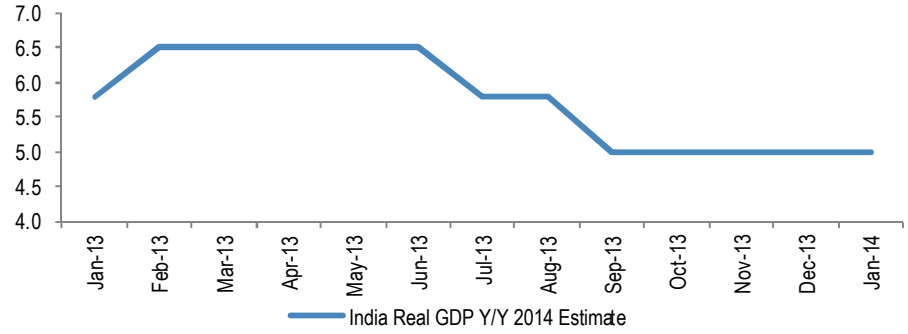
**FX Swings**

The USD strengthened by 12.7% Y/Y and 11.2% Q/Q in Q3'13 vs. the INR to 62.1. Our FX strategy analysts are forecasting that the USD should remain stable at 62.0 through the end of 2014. However, recent depreciation of the INR is likely to make H1'14 equipment comps tough in our opinion.

**GDP Forecasts Have Stabilized**

Our economists' forecasts for 2014 real GDP growth in India have declined since Feb 2013. J.P. Morgan's 2014 GDP growth forecast is now 5.0%, down from 6.5% in Feb 2013. However, GDP growth estimates have been stable since the last reduction made in September.

Figure 30: India: 2014 Real GDP Y/Y Growth Projections Over Time

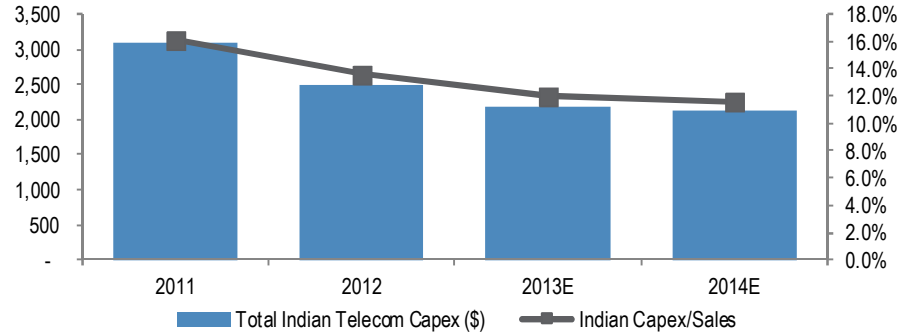



Source: J.P. Morgan.

**Stable Capex/Sales for 2014**

Based on our local analysts' forecasts, Capex/sales in India is expected to remain almost stable at 11.6% in 2014 vs. 12.0% in 2013, but down materially from 13.5% in 2012.

Figure 31: India: Capex/Sales declining
$ in millions




Source: Company reports and J.P. Morgan estimates.

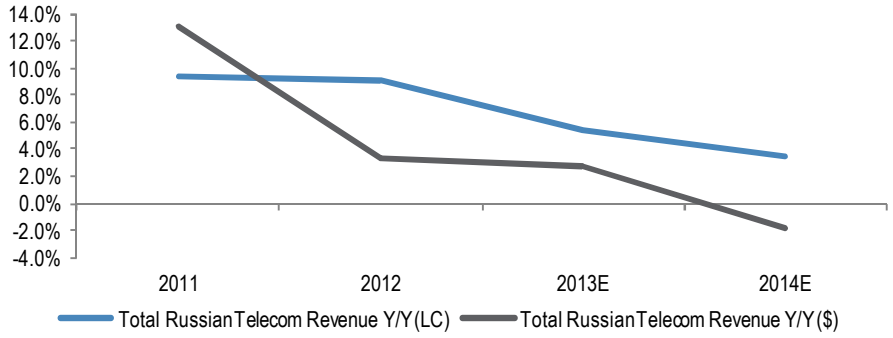
## Russia

We suspect that Russia also played a part in Cisco's weaker FQ1 order volumes. Russian telecom revenue is expected to improve slightly in Q4'13 to 5.4% Y/Y from 4.5% Y/Y in Q3'13 according to an aggregate of J.P. Morgan analysts' estimates. Russian Capex in 2014 is also expected to grow by a slight 1.8% Y/Y to $5.4bn and capex intensity (capex/sales) is forecast to improve to 18.6% from 17.9%. However, J.P. Morgan's 2014 GDP forecasts for Russia have declined to just 1.8% in Jan 2014 from 2.2% in September. The downward bias to GDP forecasts causes us to approach 2014 with caution for equipment vendors like Cisco selling into the country.

### Operators and Cisco

Russian Service Providers' revenue in local currency in 2013 grew by 5.3%, down from 9.1% in 2012. In 2014, the growth rate is expected to be down to 3.4%.

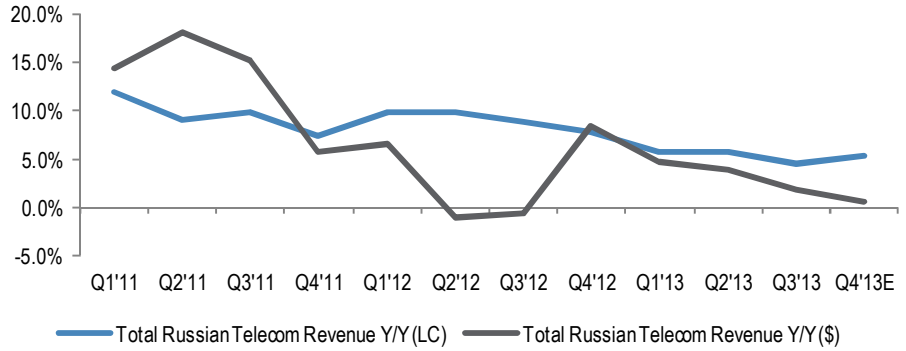
Figure 32: Russian Operators* Revenue (LC) Growth Is Expected to Decline




Source: Company reports and J.P. Morgan estimates. * - Operators considered are Vimpelcom, MTS and MegaFon.

In Figure 33 below, we show Y/Y revenue trends for Russian carriers both in local currency and USD. Unlike Brazil and India, revenue in USD declined on a more predictable trendline in late 2014.

Figure 33: Russian Telecom Revenue (LC) Y/Y Has Been Declining




Source: Company reports and J.P. Morgan estimates.

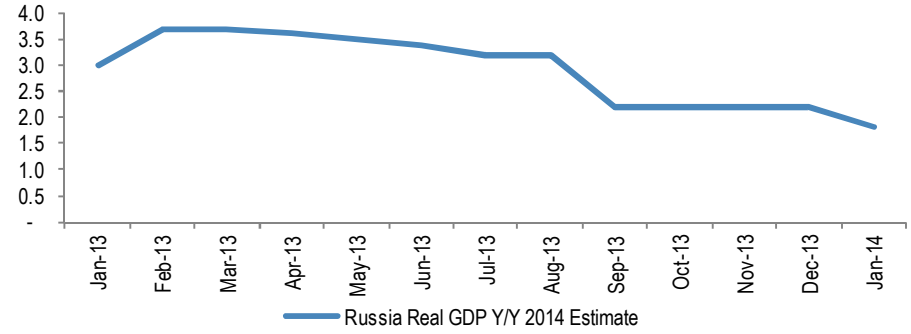
**FX Swings**

We don't believe that RUB/USD FX swings were significant enough for operators to get concerned about placing additional orders with Cisco. USD strengthened by only 2.6% Y/Y and 3.6% Q/Q in Q3'13 vs. the RUB to 32.8 on our calculations.

**Macro Forecasts Stable**

J.P. Morgan's 2014 GDP growth forecast for Russia is now 1.8%, down from 3.7% in Feb 2013 and 2.2% in Sep 2013.

Figure 34: Russia: 2014 Real GDP Y/Y Growth Projections Over Time

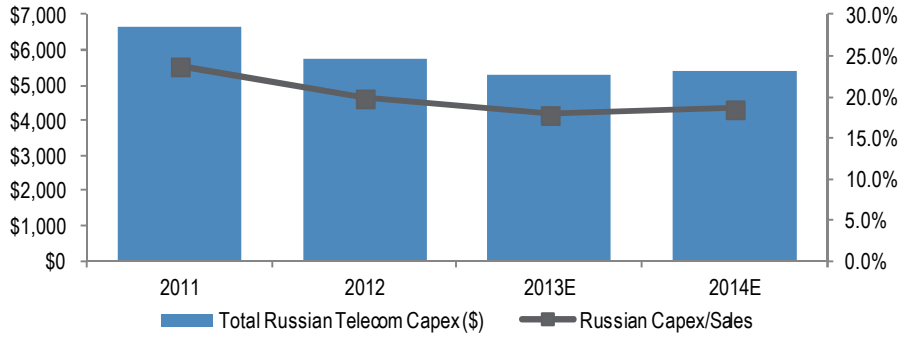



Source: J.P. Morgan.

**Improving Capex/Sales for 2014**

Based on our local analysts' forecasts, Capex/sales in Russia is expected to improve to 18.6% in 2014 from 17.9% in 2013.

Figure 35: Russia: Capex/Sales Forecast to Improve
$ in millions

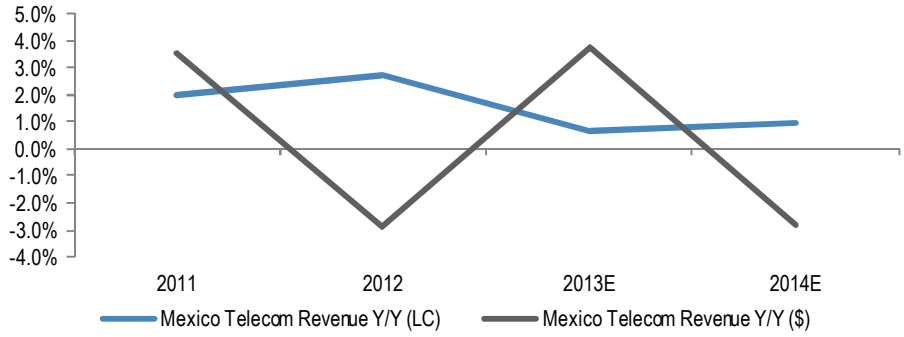



Source: Company reports and J.P. Morgan estimates.

## Mexico

Mexican telecom revenue growth in MXN is expected to improve slightly in 2014 to 1.0% Y/Y from 0.7% Y/Y in 2013based again on aggregate J.P. Morgan telco forecasts. We believe weak product orders for Cisco could be linked to the significant decline in 2014 GDP estimates for the country in October. J.P. Morgan's 2014 GDP growth estimates in October were revised down to 3.4% from 4.0% in September.

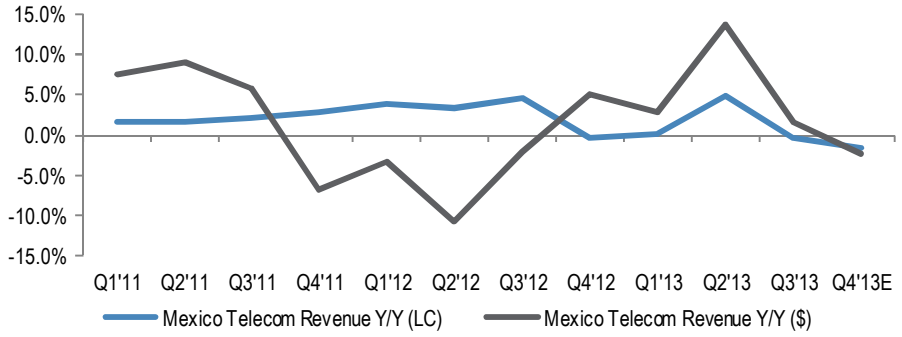
Figure 36: Mexico Operators* Revenue Growth Is Expected to Decline




Source: Company reports and J.P. Morgan estimates. * - Operator considered is America Movil Mexico.

In Figure 37 below, we show Y/Y revenue trends for Mexican carriers both in local currency and USD.

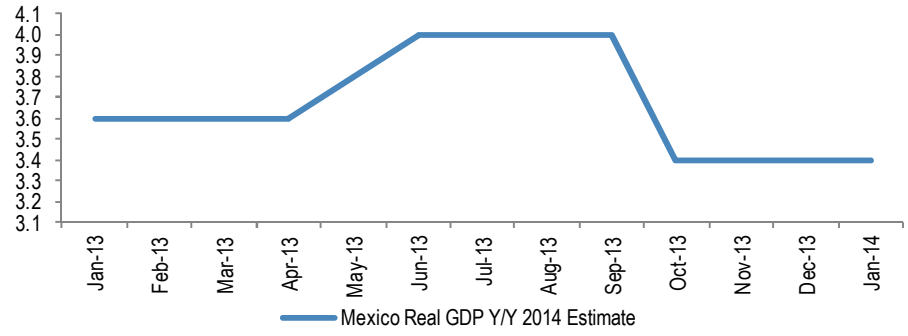
Figure 37: Mexico Telecom Revenue Y/Y




Source: Company reports and J.P. Morgan estimates.

The USD strengthened by only 3.4% Q/Q but deteriorated by 2.0% Y/Y in Q3'13 vs. the MXN to 12.9. J.P. Morgan's 2014 GDP growth forecast for Russia is now 3.4%, down from 4.0% in Sep 2013.

Figure 38: Mexico: 2014 Real GDP Y/Y Growth Projections Over Time

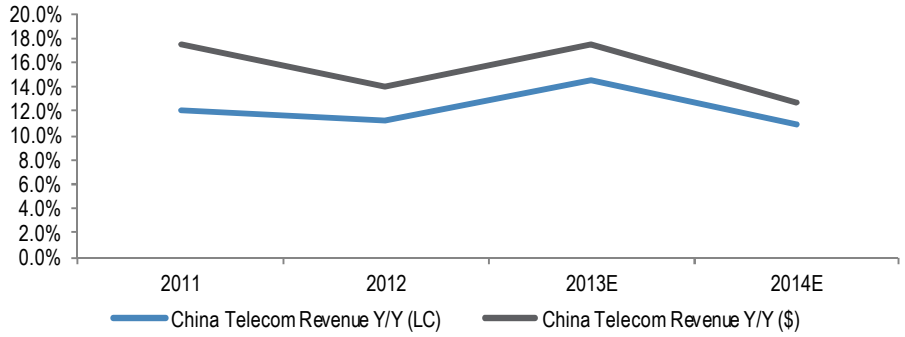



Source: J.P. Morgan.

## China

Cisco's product order decline in China is due primarily to political trade issues that have persisted for a number of quarters in our opinion. Excluding this we see no reason that Chinese orders shouldn't grow materially in 2014. J.P. Morgan's local analyst models taken in aggregate forecast that Chinese telecom revenue in CNY is likely to grow by a strong 10.9% Y/Y this year following 14.6% Y/Y growth in 2013.

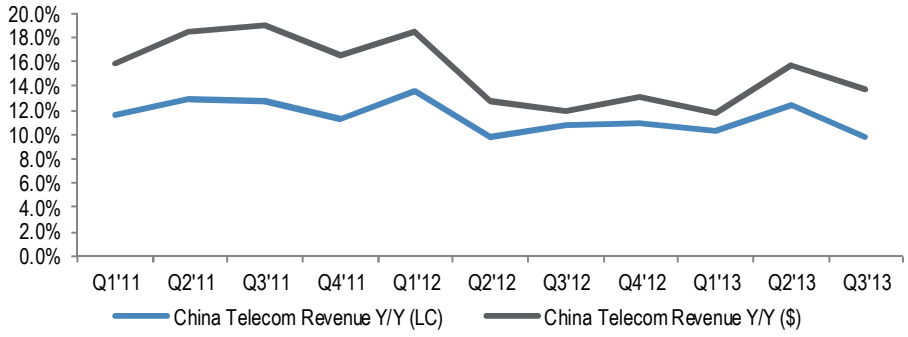
Figure 39: Chinese Operators* Revenue Growth Is Expected to Decline




Source: Company reports and J.P. Morgan estimates.. * - Operators considered are China Mobile, China Telecom and China Unicom.

In Figure 40 below, we show Y/Y revenue trends for Chinese carriers both in local currency and USD.

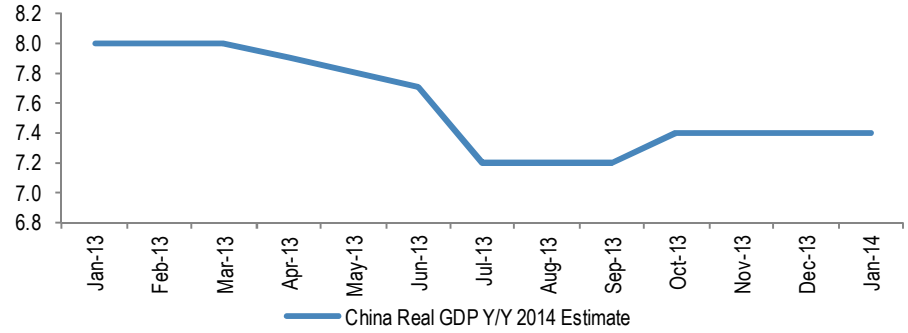
Figure 40: Chinese Telecom Revenue Y/Y




Source: Company reports and J.P. Morgan estimates.

Unlike other EMs, J.P. Morgan's 2014 GDP growth forecast for China moved up slightly to 7.4% in Jan 2014 from 7.2% in Sep 2013.

Figure 41: China: 2014 Real GDP Y/Y Growth Projections Over Time




Source: J.P. Morgan.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





# Carrier CapEx Looking Up in 2014

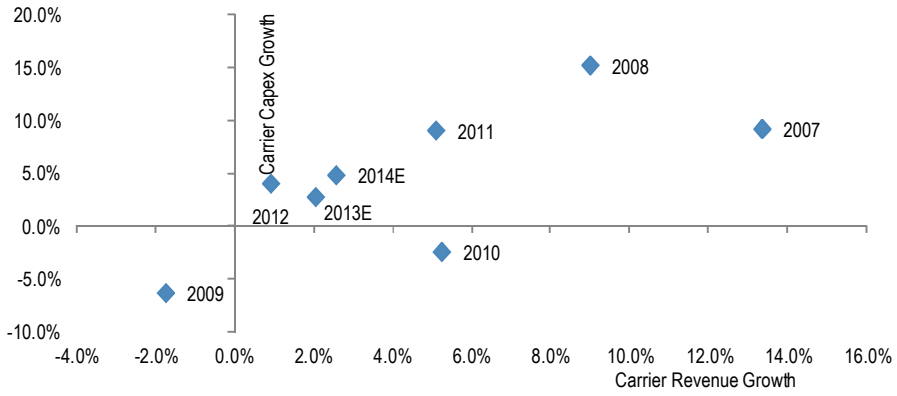
Based on our bottom-up telecom CapEx model including 34 major carriers across different regions, we estimate that carrier CapEx will be up 4.0% Y/Y in 2013. This is slightly above our previous estimate of 3.6%, driven primarily by aggressive spending in the US and APAC. We also introduce our estimates for 2014, during which we expect telco CapEx to grow by 4.8% Y/Y, supported by strong growth in Western Europe and APAC telecom companies.

In our opinion, a service provider's revenue outlook is a key measure influencing near-term capital spending decisions. Our model predicts aggregate revenue growth of 2.5% Y/Y in 2014, vs 0.9% Y/Y growth in 2013.This revenue growth is a bullish sign for global carrier CapEx in our opinion.

## CapEx/Sales trends

We believe that although carriers can almost always afford to spend on equipment, they are typically more inclined to do so when their own revenues are not under pressure. In Figure 42 below, we illustrate this with our aggregate global carrier model data, though similar patterns can be seen on regional or local levels over time.

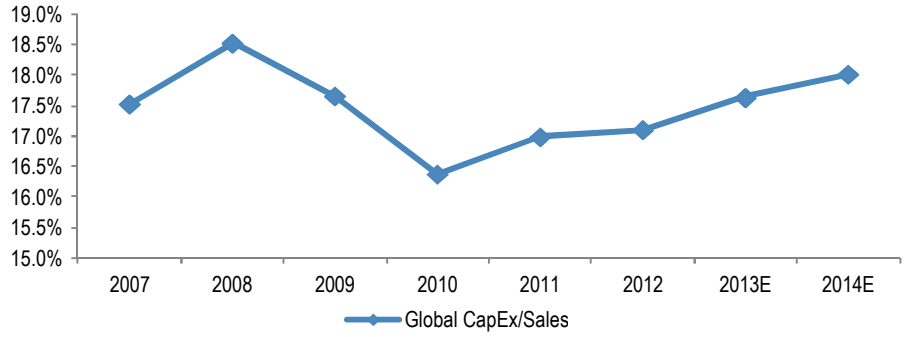
**Figure 42: Carrier Revenue Growth Has Historically Resulted in Carrier CapEx Growth**




Source: Company reports and J.P. Morgan estimates.

Carrier CapEx was rapidly pared back in 2009 as carriers, who tend to utilize large amounts of short term debt financing, were scrambling for short term working capital. CapEx/Sales declined from 18.5% in 2008 to 17.7% in 2009 and then again to 16.4% in 2010. We suspect that the 2010 decline was also partially due to shoring up cash balances, particularly in Europe. CapEx/sales finally began recovering in 2011 but not by as much as people had hoped. Carrier networking stocks underperformed as a result. We expect the momentum of the last 3 years to continue heading into 2014, as carriers around the world accelerate LTE rollout offset only slightly by slower US LTE spending.

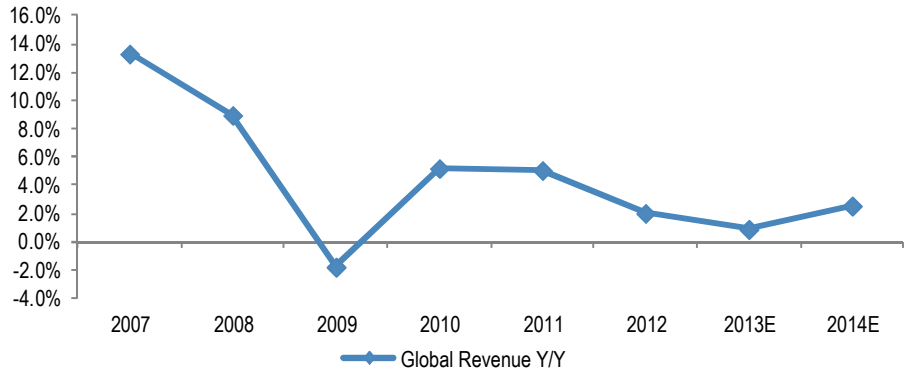
Figure 43: Global CapEx/Sales




Source: Company reports and J.P. Morgan estimates.

Our model indicates that carrier revenue is expected to grow by 2.5% Y/Y in 2014, following 0.9% growth in 2013 and 2.0% growth in 2012. While we admit that macro risks remain, particularly in emerging markets, we believe that even in a more negative scenario, revenues look like they should be flat to slightly up in 2014.

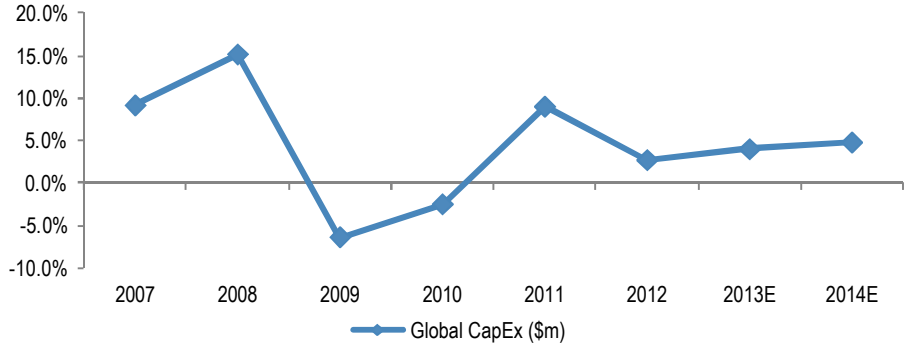
Figure 44: Global Revenue Y/Y Trend




Source: Company reports and J.P. Morgan estimates.

Against this backdrop of robust revenue growth in 2014, we expect CapEx growth to accelerate in 2014. We again refer to Figure 42 where we show the positive correlation between CapEx growth and revenue growth. We forecast CapEx to grow by 4.8% in 2014, versus growth of 4.0% in 2013 and 2.7% in 2012 as the slow recovery toward pre-GFC levels continues.

Figure 45: Global CapEx Y/Y Trend




Source: Company reports and J.P. Morgan estimates.

## Forecast Changes

Our top 34 global carrier aggregate model shows that analysts expect 4.8% Y/Y growth in CapEx to $222.44B in 2014. In Table 9 below, we highlight either consensus or J.P. Morgan analysts' (where available) 2013 and 2014 CapEx estimates by carrier to illustrate where expectations have been changing the most. We have added MegaFon to the list of carriers we track in this update.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com



J.P.Morgan

### Table 9: Capex Forecast Changes

$ million, year-end 31 December

| | Current 2013E | Previous 2013E | % Change | Current 2014E | Y/Y |
|---|---|---|---|---|---|
| America Movil | 9,999 | 9,928 | 0.7% | 9,478 | -5.2% |
| AT&T | 21,154 | 20,959 | 0.9% | 20,993 | -0.8% |
| Bharti Airtel* | 2,047 | 2,276 | -10.1% | 1,828 | -10.7% |
| China Mobile | 30,136 | 30,715 | -1.9% | 32,808 | 8.9% |
| China Unicom | 12,809 | 12,854 | -0.3% | 13,477 | 5.2% |
| China Telecom | 13,099 | 12,051 | 8.7% | 16,275 | 24.2% |
| DTAC | 377 | 324 | 16.4% | 418 | 10.9% |
| Etisalat | 1,474 | 998 | 47.8% | 1,307 | -11.4% |
| France Telecom | 7,518 | 7,653 | -1.8% | 7,792 | 3.6% |
| Idea Cellular | 563 | 605 | -7.0% | 568 | 0.9% |
| Kddi | 5,810 | 4,845 | 19.9% | 5,465 | -5.9% |
| KPN | 2,231 | 3,006 | -25.8% | 2,131 | -4.4% |
| MTN Group | 2,677 | 3,144 | -14.9% | 2,382 | -11.0% |
| MTS | 2,621 | 2,636 | -0.6% | 2,516 | -4.0% |
| NTT DoCoMo | 7,664 | 8,101 | -5.4% | 7,244 | -5.5% |
| Portugal Telecom (ex. Brazil) | 807 | 1,502 | -46.3% | 764 | -5.3% |
| Portugal Telecom Brazil | 718 | 713 | 0.8% | 696 | -3.1% |
| PT Telekomunikasi | 1,789 | 1,869 | -4.3% | 1,868 | 4.4% |
| Reliance Communications | 238 | 361 | -33.9% | 311 | 30.4% |
| Saudi Telecom | 1,557 | 2,518 | -38.2% | 1,501 | -3.6% |
| SingTel | 1,549 | 1,957 | -20.8% | 1,402 | -9.5% |
| SK Telecom | 2,522 | 1,928 | 30.8% | 2,602 | 3.2% |
| SoftBank | 7,432 | 5,578 | 33.2% | 6,709 | -9.7% |
| Sprint | 7,998 | 7,662 | 4.4% | 7,986 | -0.1% |
| Tele2 | 809 | 898 | -9.9% | 569 | -29.7% |
| Telekom Austria | 895 | 899 | -0.4% | 881 | -1.5% |
| Telecom Italia (ex. Argentina, Brazil) | 4,078 | 4,207 | -3.1% | 4,156 | 1.9% |
| Telecom Italia Brazil | 1,673 | 1,925 | -13.1% | 1,516 | -9.4% |
| Telecom Italia Argentina | 796 | 913 | -12.8% | 843 | 5.9% |
| Telefonica S.A. (ex. LatAm) | 4,124 | 4,607 | -10.5% | 4,213 | 2.1% |
| Telefonica LatAm | 5,482 | 6,013 | -8.8% | 5,090 | -7.2% |
| Telenor (ex. DTAC, Uninor) | 1,951 | 2,060 | -5.3% | 1,963 | 0.6% |
| Teliasonera | 2,255 | 2,281 | -1.2% | 2,145 | -4.9% |
| T-Mobile (ex. T-Mob US) | 7,759 | 7,940 | -2.3% | 8,739 | 12.6% |
| T-Mobile USA | 4,245 | 3,398 | 24.9% | 4,264 | 0.4% |
| Turkcell | 881 | 950 | -7.3% | 859 | -2.5% |
| Uninor | 30 | 324 | -90.7% | 45 | 47.8% |
| Verizon | 16,604 | 16,102 | 3.1% | 16,971 | 2.2% |
| Vimpelcom | 4,795 | 4,144 | 15.7% | 4,726 | -1.5% |
| Vodafone | 9,637 | 9,236 | 4.3% | 15,566 | 61.5% |
| **Total, ex Megafon** | **210,805** | **210,080** | **0.3%** | **221,064** | **4.9%** |
| Megafon | 1,446 | NA | NM | 1,373 | -5.1% |
| **Total** | **212,251** | | | **222,437** | **4.8%** |

Source: J.P. Morgan estimates. *Consensus estimates.

The 0.3% beat in 2013 was driven mainly by greater than expected CapEx in the US, as carriers aggressively rolled out LTE. APAC CapEx was also higher than expected, driven by China Telecom and Japanese carriers. This was offset partially by slower than expected growth in Europe, LatAm and MEA. In 2014, CapEx is expected to grow in Europe and APAC, and decline in LatAm and MEA, while the US is expected to remain flattish.

**Table 10: CapEx Forecast Changes by Region**

$ million

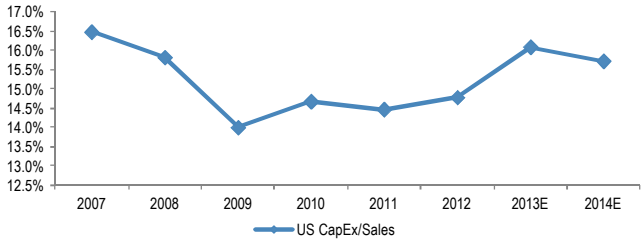
| | Current 2013E | Previous 2013E | % Change | Current 2014E | Y/Y |
|---|---|---|---|---|---|
| US | $50,001 | $48,121 | 3.9% | $50,214 | 0.4% |
| Europe | $51,807 | $53,465 | -3.1% | 58,392 | 12.7% |
| APAC | $86,067 | $83,788 | 3.8% | $91,018 | 5.8% |
| LatAm | $18,669 | $19,491 | -4.2% | $17,624 | -5.6% |
| Middle East and Africa | $5,707 | $6,660 | -14.3% | $5,189 | -9.1% |
| **Total** | **$212,251** | **$211,526** | **0.3%** | **$222,437** | **4.8%** |

Source: J.P. Morgan estimates. Previous forecast for Europe includes Megafon for comparability.

## Regional CapEx Highlights

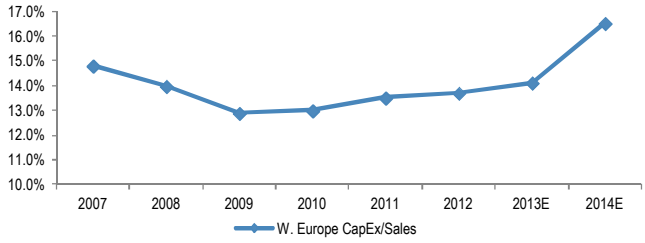
In this section, we take a closer look at regional CapEx trends. CapEx is expected to grow by 16.3% in Western Europe, as carriers accelerate LTE rollout. In the US, CapEx is expected to grow by a modest 0.4%, which isn't surprising as carriers are reaching coverage completion. APAC CapEx is expected to grow 5.8% as Chinese carriers grow their 4G rollout. In contrast, capital spending is expected to decline in Eastern Europe and LatAm and MEA. We expect Global CapeEx/Sales to increase from 17.6% in 2013 to 18.0% in 2014, driven by Western Europe.

### Figure 46: US: CapEx/Sales



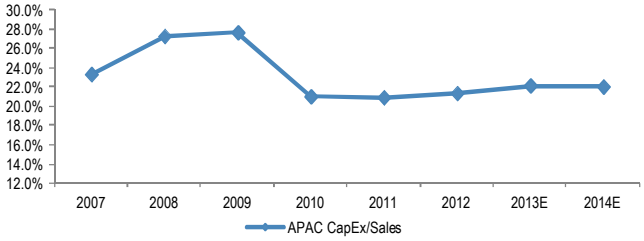

Source: Company reports and J.P. Morgan estimates.

### Figure 47: W. Europe: CapEx/Sales



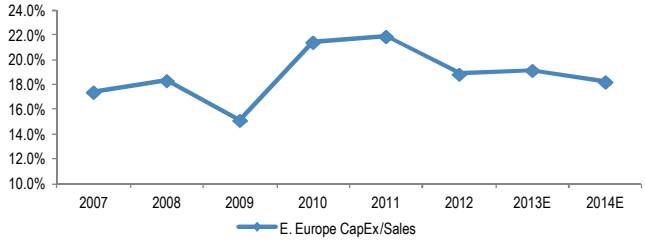

Source: Company reports and J.P. Morgan estimates.

### Figure 48: APAC: CapEx/Sales



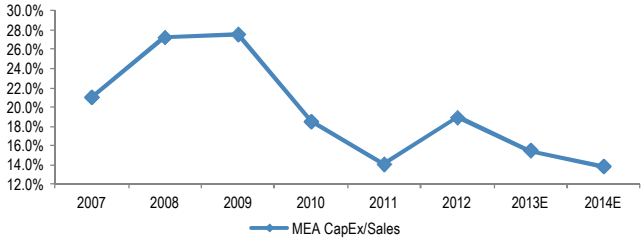

Source: Company reports and J.P. Morgan estimates.

### Figure 49: E.Europe: CapEx/Sales



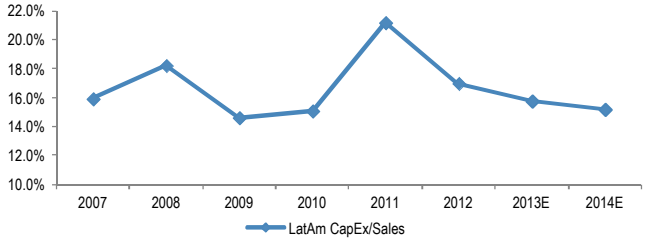

Source: Company reports and J.P. Morgan estimates.

### Figure 50: MEA: CapEx/Sales




Source: Company reports and J.P. Morgan estimates.

### Figure 51: LatAm: CapEx/Sales

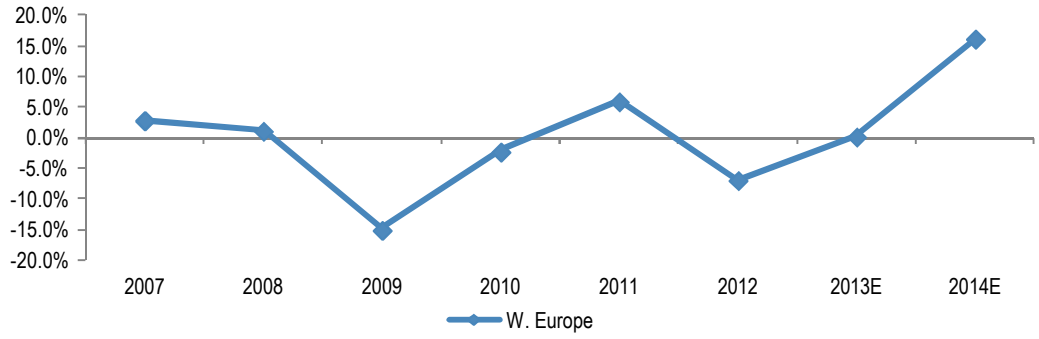



Source: Company reports and J.P. Morgan estimates.

## Western Europe

After a tough 2012 and flat 2013, we expect CapEx to ramp up in Western Europe 2014, spurred by aggressive LTE rollouts. We calculate that Western European CapEx/Sales has been growing in the post-GFC period, though revenues have generally been under pressure. Should revenues decline more slowly in 2013 or stabilize it is possible that capex paces slightly ahead of our already positive outlook.

Figure 52: Western Europe: CapEx

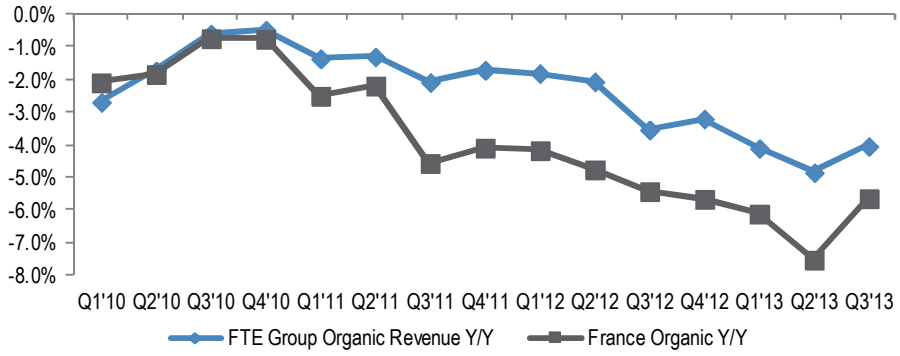



Source: Company reports and J.P. Morgan estimates.

**France Telecom** *(JPM Analyst: Hannes Wittig)*

- Q3 performance – EBITDA beat and in-line Sales: France Telecom reported a slight miss in sales, with revenue of €10,162m missing JPMe by 0.5% and consensus by 0.4%, but beat on EBITDA of €3,366m, topping JPMe by 1.7% and consensus by 0.8%. CapEx of €1,293m was 7.7% above JPMe of €1,200, but 0.9% below consensus of €1,305m.
- Organic revenue still deteriorating: FTE's group organic revenue declined by 4.0% Y/Y in Q3'13, following a 4.8% decline in Q2'13 and 4.1% decline in Q1'13.

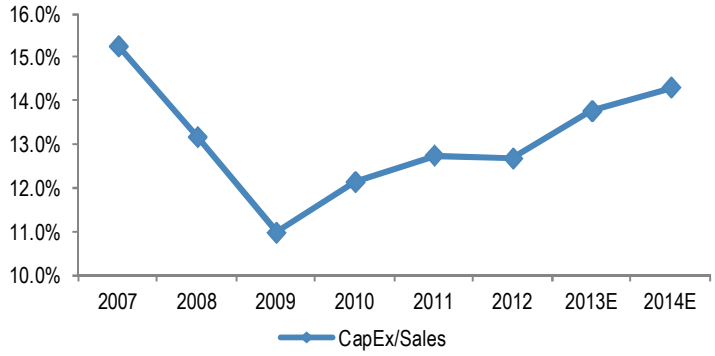
Figure 53: FTE Organic Revenue Trend




Source: Company reports and J.P. Morgan estimates.

- 2013 guidance reiterated: France Telecom has confirmed its 2013 guidance of at least €7bn operating cash flow. The company said that CapEx of 4G and FTTH VDSL have amounted to €400 million over the first nine months of 2013, which is two times what was spent a year ago, and warned that CapEx would be more front-end loaded this year, as compared to the usual seasonality of more CapEx in Q4. Note that our estimate implies a 6.2% Y/Y drop in Q4 CapEx. The company said that it had 4G LTE coverage of 32% of the French population, and targets more than 40% coverage by the year-end.
- CapEx/Sales improving in 2014: France Telecom's CapEx/Sales bottomed in 2009, and has been increasing ever since. We are forecasting it to continue to grow from 13.8% in 2013 to 14.3% in 2014.

Figure 54: FTE: CapEx/Sales

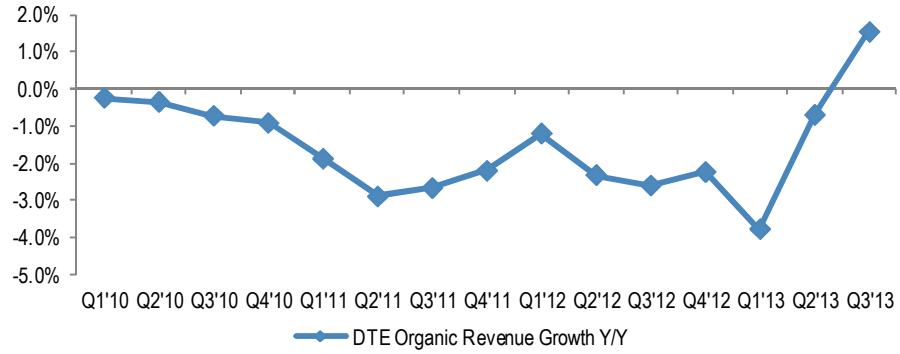



Source: Company reports and J.P. Morgan estimates.

**Deutsche Telekom** *(JPM Analyst: Hannes Wittig)*

- Q3 performance: Deutsche Telekom reported a beat in Q3, with revenue of €15,525m beating JPMe by 1.5% and consensus by 1.9%. EBITDA of €4,659m beat JPMe by 0.6% and consensus by 1.9%, while CapEx of €2,260m beat JPMe by 8.9% and was in-line with consensus.
- Organic revenue trend improving: We estimate that organic revenue increased by 1.5% in Q3, following a decline of 0.7% in Q2 and 3.8% in Q1.

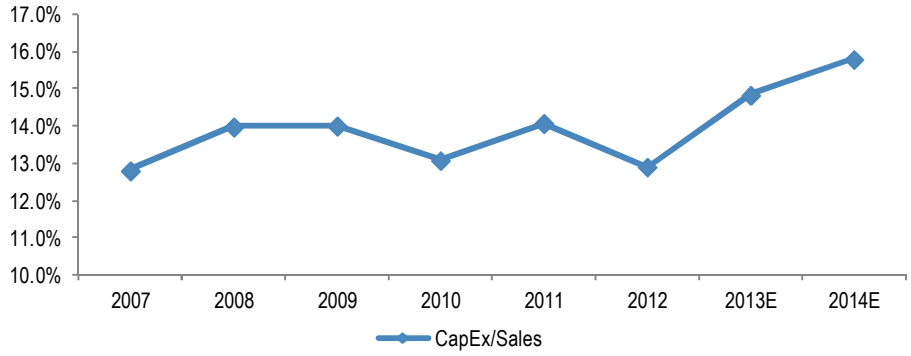
Figure 55: DTE: Estimated Organic Revenue Trend




Source: Company reports and J.P. Morgan estimates.

- CapEx/Sales trends improving in 2014: Deutsche Telekom's CapEx/Sales is expected to grow from 14.8% in 2013 to 15.8% in 2014. We believe that DTE will continue to invest in FTTC/H projects to fend off increasing competition from cable MSOs in Germany.

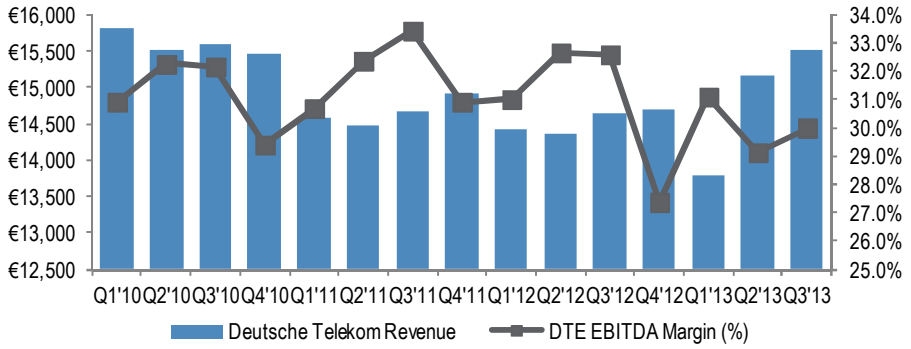
Figure 56: DTE: CapEx/Sales




Source: Company reports and J.P. Morgan estimates.

- T-Mobile forecasts: We estimate T-Mobile (ex. US) CapEx to grow by 12.9% Y/Y in 2014 and T-Mobile US CapEx to grow by 0.7% Y/Y in 2014.
- Steady EBITDA margins: EBITDA margin in Q3'13 improved to 30.0%, compared to 29.1%. We note that DTE's full-year guidance of €17.5bn EBITDA implies a 2.7% EBITDA growth in Q4'13.

Figure 57: Deutsche Telekom: Revenue and EBITDA Margin Trend
€ million, year-end 31 December



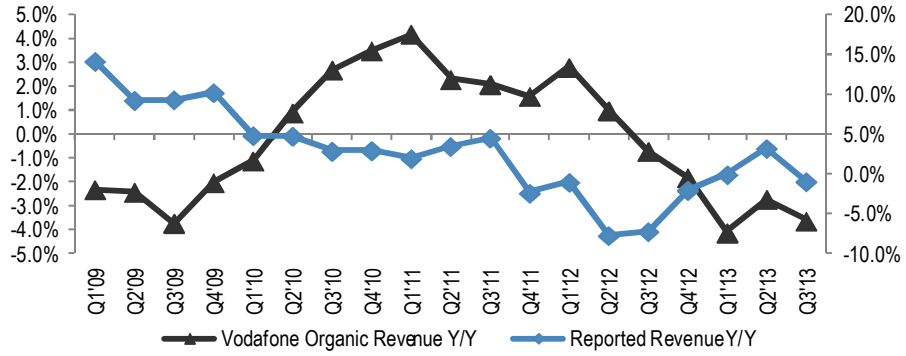

Source: Company reports and J.P. Morgan estimates.

- T-Mobile US merger discussion: J.P.Morgan's analyst Hannes Wittig notes that there has been talk about a possible acquisition of T-Mobile US by Sprint, for upwards of $20bn. While the regulatory risk of any such deal is significant, our analyst believes that DTE has little to lose in a potential transaction if a sufficiently large break-up fee can be negotiated. Further, if the sale does go through, we believe it will provide potentially surplus cash to be invested in CapEx programs, much like Vodafone's Project Spring program.

**Vodafone** *(JPM Analyst: Akhil Dattani)*

- HI'14 performance: Vodafone announced H1'14 (to September) revenues of €22,034m, 1% ahead of consensus. EBIDA of €6,609m beat consensus by 3.4%.
- Declining organic revenue: Vodafone's organic revenue declined by 3.6% in CQ3'13, compared with a fall of 2.7% in CQ2'13 and 4.1% in CQ1'13.

Figure 58: Vodafone: Organic Revenue




Source: Company reports and J.P. Morgan estimates.

- Project Spring: Alongside the VZW disposal, Vodafone announced a €6bn 3 year investment plan in addition to its usual CapEx. Vodafone subsequently raised the budget to €7bn, and accelerated this program to complete by March 2016. We do not expect meaningful impact from this project until the second half of 2014.

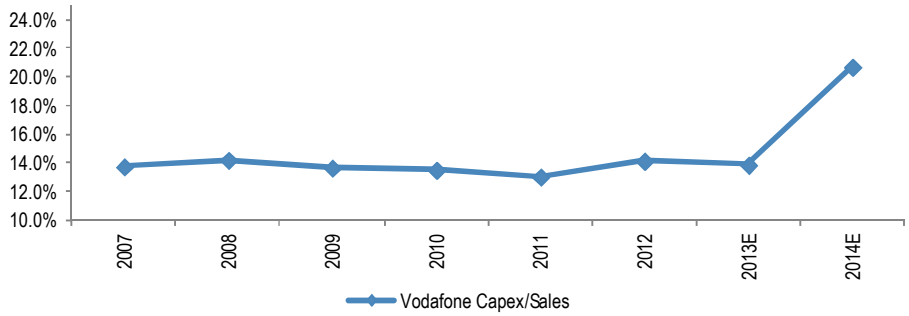
Table 11: Project Spring – Areas of Planned Investment

| Focus | Budget | Commentary |
|---|---|---|
| Europe | £3.0bn | Deeper 3G coverage. Accelerate 4G, supported by single RAN and high capacity backhaul. Use small cells and Wi-Fi to differentiate |
| AMAP | £1.5bn | Extend 3G coverage. Provide wider voice coverage and better data experience |
| Convergence | £1.0bn | Increase DSL and fibre footprint in Europe. In AMAP establish a fibre footprint to enable converged services |
| Enterprise | £0.5bn | Expand coverage, M2M and Vodafone One Net. Accelerate IP-VPN in 9 markets. Increase hosting and traffic routing capabilities |
| Experience | £1.0bn | Greater retail presence, upgrade existing stores and improve online platforms. Drive faster deployment of mobile payment services |

Source: Company reports.

- CapEx/Sales increasing in 2014: Helped largely by Project Spring, Vodafone's CapEx/Sales is expected to grow from 13.9% in 2013 to 20.7% in 2014.

Figure 59: Vodafone: CapEx/Sales




Source: Company reports and J.P. Morgan estimates.

- Civils and Maintenance in CapEx: In 2008, we estimated Vodafone's civils CapEx to make up 3% of overall revenue or ~15% of its CapEx and its maintenance CapEx to make up 3.6% of overall revenue or ~18% of its CapEx.
- Outlook reaffirmed: Vodafone reaffirmed its FY'14 outlook of €2.1bn free cash flow, and said that CapEx will remain broadly stable excluding Project Spring.

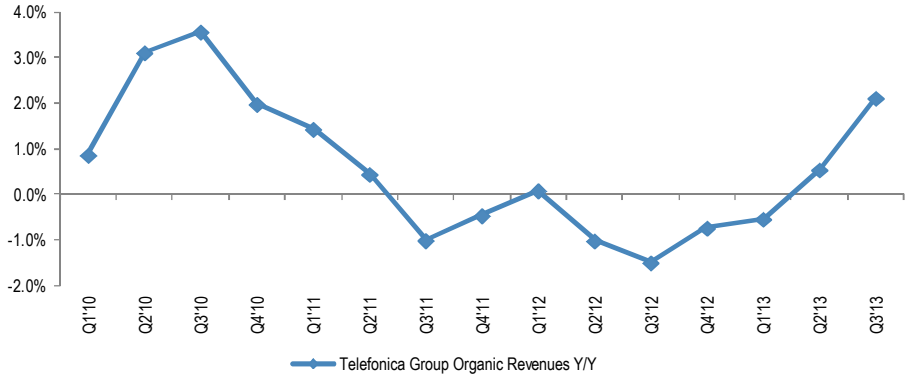
**Telefonica** *(JPM Analyst: Torsten Achtmann)*

- Q3 Performance: Telefonica reported broadly in-line results for Q3'13. Revenue of €14,063m was 0.2% below JPMe but 0.6% above consensus, largely

attributable to Venezuela. Net income of €1,089m was in-line with JPMe but 15% above consensus.

- Organic growth rate improving: The group's organic revenue increased by 2.1% Y/Y in Q3, compared to a growth of 0.5% in Q2 and a decline of 0.5% in Q1.

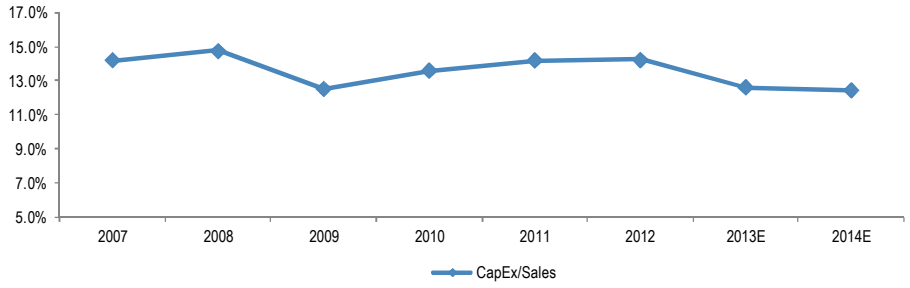
**Figure 60: Telefonica: Organic Revenue Trend Improving**




Source: Company reports and J.P. Morgan estimates.

- CapEx/Sales expected to remain stable: We expect Telefonica's CapEx/Sales to be 12.4% in 2014, compared to 12.6% in 2013.

**Figure 61: Telefonica: CapEx/Sales**




Source: Company reports and J.P. Morgan estimates.

**Telecom Italia** *(JPM analyst: Torsten Achtmann)*

- Q3 performance: Telecom Italia's Q3 performance slightly disappointing, with revenues of €6,629m missing JPMe by 0.8% and consensus by 0.2%. EBITDA of €2,697m missed JPMe by 1.9% and consensus by 0.6%, while CapEx of €1,260m was 7.7% above JPMe and 8.5% above consensus.

- Strategic update: Telecom Italia presented a strategic update plan, including accelerated high speed infrastructure investment, greater focus on value-added services, and increased efficiency. New 2013-2016 guidance acknowledges continued 'single digit' domestic EBITDA declines.

- Telecom Italia targets: TI aims to achieve €1bn of cumulative domestic opex efficiencies by 2016. Main cornerstones are outsourcing, more efficient marketing, energy saving projects, better space management, more aggressive site sharing. As a result of these initiatives, TI management hopes to achieve the following targets, which at the group level are stated excluding Argentina.

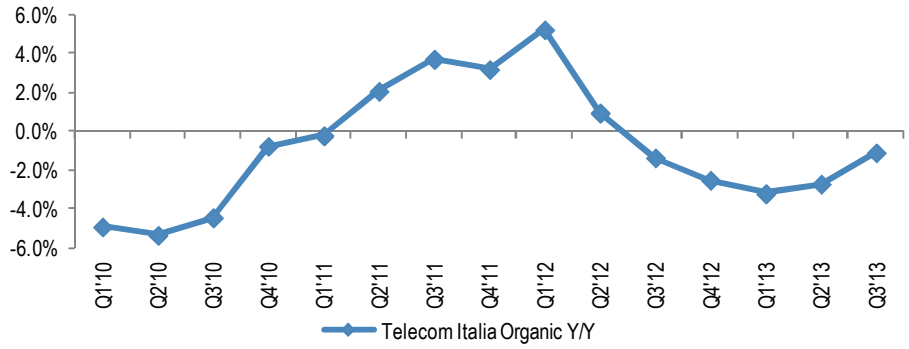
**Table 12: Telecom Italia Targets**

| | Group | Domestic | Brazil |
|---|---|---|---|
| Revenues | Stable | Low single digit decline | Mid single digit growth |
| EBITDA | Stable | Low single digit decline | Mid single digit growth |
| Capex | <14bn | ~18% capex/sales | ~17% capex/sales |

Source: Company reports.

- Organic Revenue decline continues: The company's organic revenue declined by 1.1% Y/Y in Q3, after falling 2.7% in Q2 and 3.2% in Q1.

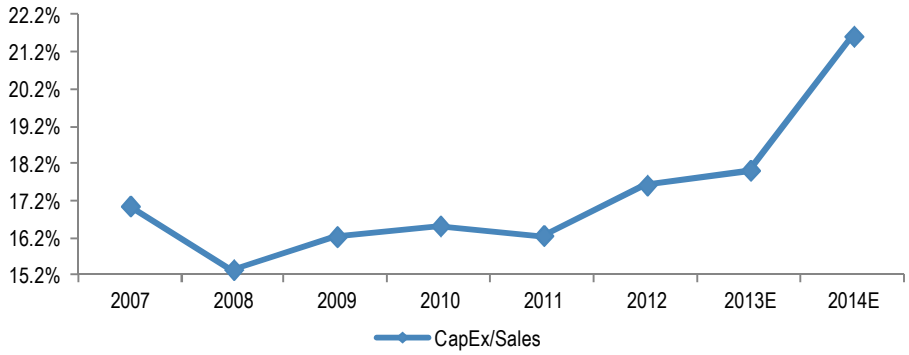
**Figure 62: Telecom Italia: Organic Revenue Trend**




Source: Company reports.

- CapEx/Sales expected to increase: Telecom Italia's CapEx/Sales has been on the rise since 2008. J.P.Morgan's analyst forecasts CapEx/Sales to increase from 18.0% in 2013 to 21.6% in 2014, a decrease of 0.5% from his previous estimate.

**Figure 63: Telecom Italia: CapEx/Sales**

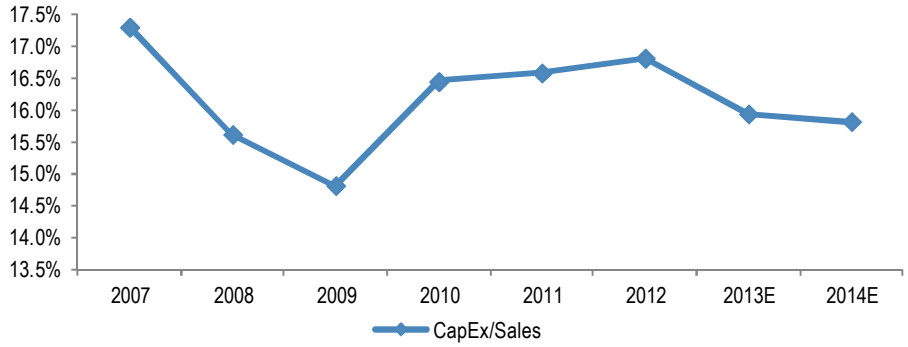



Source: Company reports and J.P. Morgan estimates.

**Telekom Austria** *(JPM analyst: Hannes Wittig)*

- Q3 performance: Telekom Austria results were slightly below expectations. Q3 sales were €1036m, 2.5% below JPMe and 1.2% below consensus. EBITDA was €358m, 1.9% below JPMe and in-line with consensus. CapEx was €168m, 1.6% over JPMe and 2.8% over consensus.
- Outlook reiterated: The company reiterated its guidance for 2013, with sales of ~€4.1bn and CapEx of €650m - €700m.
- CapEx/Sales expected to remain stable: We expect CapEx/Sales to be 15.8% in 2014, compared to 15.9% in 2013 and down from 16.8% in 2012.

Figure 64: Telekom Austria: CapEx/Sales

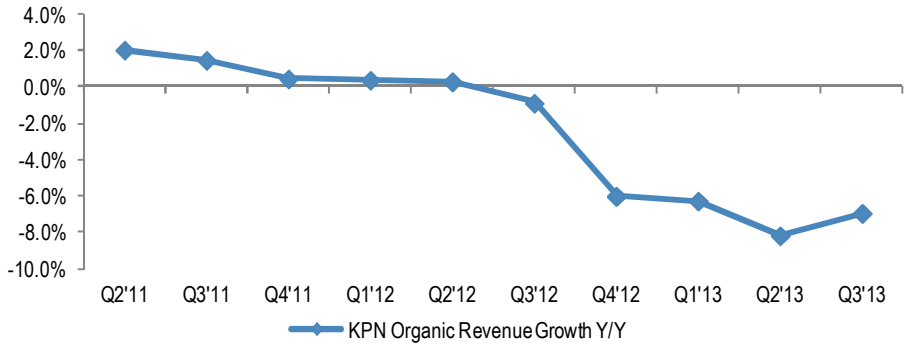



Source: Company reports and J.P. Morgan estimates.

**KPN** *(JPM analyst: Akhil Dattani)*

- Q3 performance: KPN reported revenues of €2,853m, 1.4% below consensus of €2,894m. However, EBITDA at €989m was 2% ahead of consensus. CapEx at €483m was 8.2% below consensus.
- CapEx guidance in-line: Post the E-Plus sale, KPM guided for 2013 CapEx of <€1.7bn (JPMe €1.6bn) and 2013-2015 CapEx of <€4.7bn (JPMe €4.7bn)
- Declining organic revenue: Organic revenue continued to decline, going down by 7.0% in Q3'13 compared to 8.2% in Q2'13 and 6.3% in Q1'13.

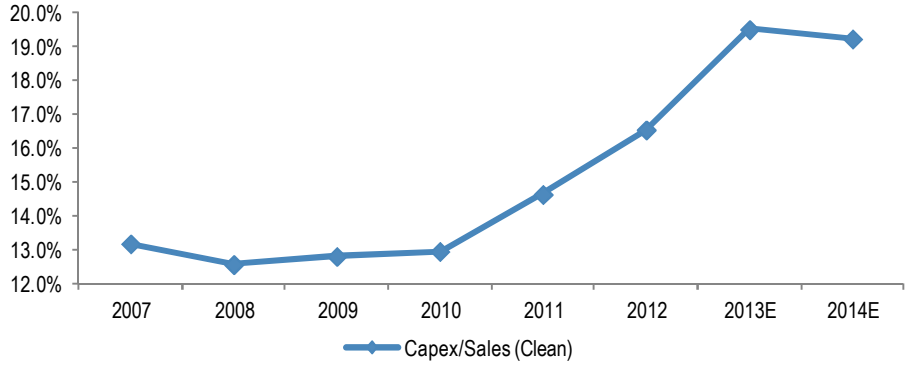
Figure 65: KPN Organic Revenue Growth Trend




Source: Company reports and J.P. Morgan estimates.

- CapEx/Sales expected to be stable: We expect 2014 CapEx/Sales to be 19.2%, versus 19.5% in 2013 and 16.6% in 2012.

Figure 66: KPN: CapEx/Sales

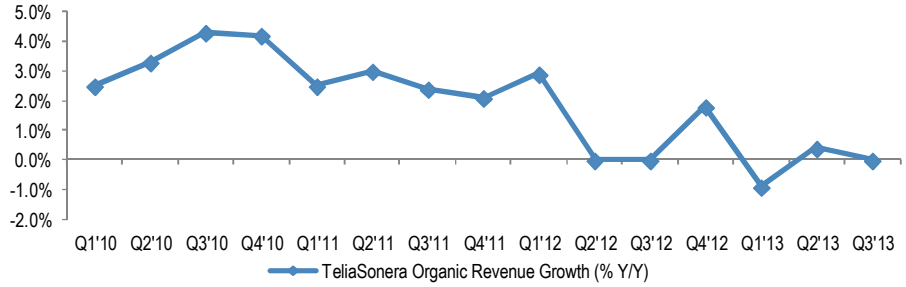



Source: Company reports and J.P. Morgan estimates.

**TeliaSonera** *(JPM analyst: Akhil Dattani)*

- Q3 performance: TeliaSonera reported a beat in Q3'13, with revenues of SEK25,381m 1.3% above consensus. Recurring EBIDTA was SEK9,419m, beating consensus by 3.8%, while CapEx of SEK4,027m beat consensus by 14.9%.
- Organic revenue stable: Organic revenue was stable in Q3'13, compared to a growth of 0.4% in Q2'13 and a decline of 0.9% in Q1'13.

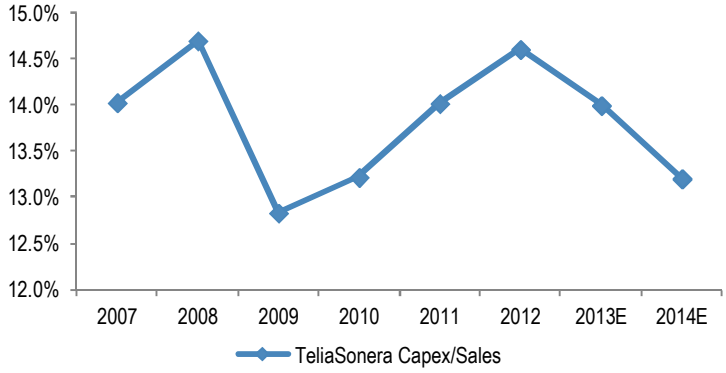
Figure 67: TeliaSonera: Organic Revenue Growth




Source: Company reports and J.P. Morgan estimates.

- Declining CapEx/Sales: TeliaSonera's CapEx/Sales has been on a downward trajectory since 2012 and we are forecasting that trend to continue into 2014. We expect 2014 CapEx/Sales to be 13.2%, vs14.0% in 2013.

Figure 68: TeliaSonera: CapEx/Sales

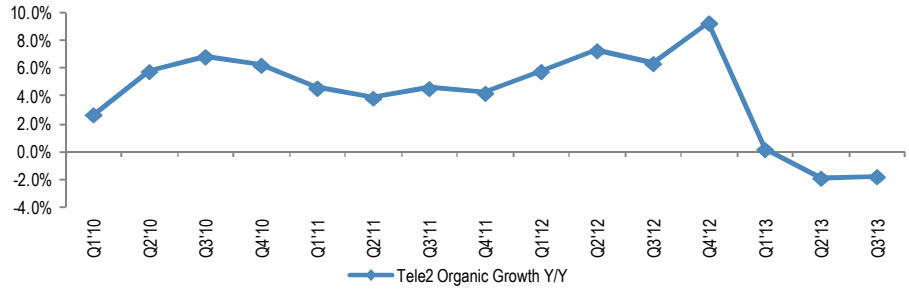



Source: Company reports and J.P. Morgan estimates.

**Tele2** *(JPM analyst: Akhil Dattani)*

- Q3 performance: Tele2 reported largely disappointing Q3'13 results. Revenues of SEK7,529m were 0.4% below consensus, while EBITDA of SEK1,523m was 5% below consensus. CapEx of SEK954m was 18.3% below consensus of SEK1,168m.
- Organic revenue declining: Organic revenue declined by 1.7% in Q3, compared to a fall of 1.9% in Q2 and a rise of 0.2% in Q1.

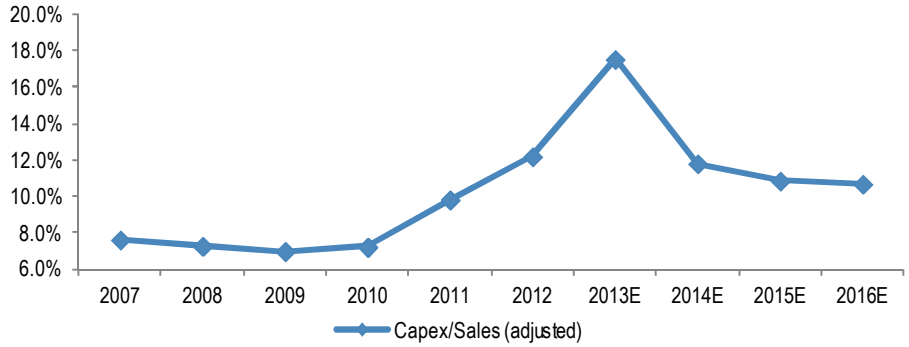
Figure 69: Tele2: Organic Revenue Trend




Source: Company reports and J.P. Morgan estimates.

- Outlook update: Tele2 reiterated its 2013 CapEx guidance of SEK6,000m. The company also decreased its 2015 net sales estimates to SEK32.5m – SEK33.5m (previously at least SEK35.6m), and EBITDA estimates to SEK6.7m – SEK7.3m (previously at least SEK8.3m). The company cited a quicker than anticipated shift from voice to data, move from "pay as you go" to bucket pricing and faster deterioration of fixed line services for the decrease.
- CapEx/Sales expected to stay flat: We expect CapEx/Sales of 10.7% in 2014, compared to 10.9% in 2013.

Figure 70: Tele2: CapEx/Sales

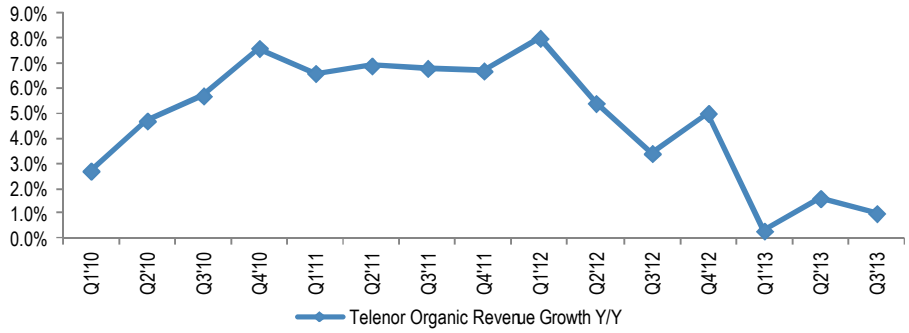



Source: Company reports and J.P. Morgan estimates.

**Telenor** *(JPM analyst: Akhil Dattani)*

- Q3 performance: Telenor reported in-line results, with revenues of NOK25,953m missing consensus by 0.6%. EBUTDA of NOK9,465m beat consensus by 0.3%, while CapEx of NOK5,589m beat consensus by 23.9%.
- Stable organic revenues: Organic revenue grew by 1.0% in Q3'13, compared to 1.% in Q2'13 and 0.3$ in Q1'13.

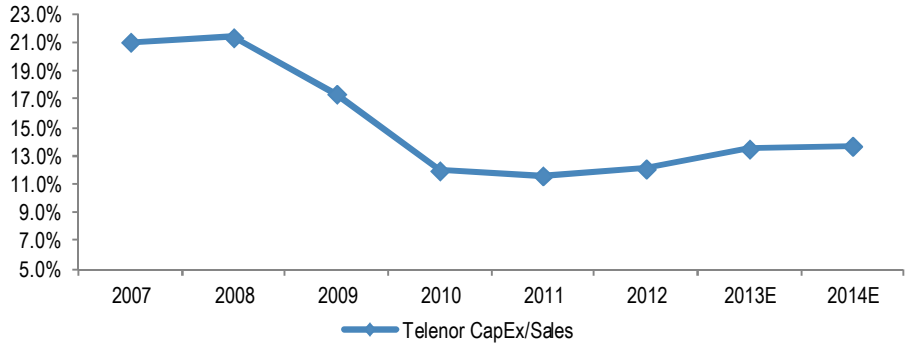
Figure 71: Telenor: Organic Revenue Growth Trend




Source: Company reports and J.P. Morgan estimates.

- CapEx/Sales improving: Telenor's CapEx/Sales had been on a downward trend since 2008 declining from 21.4% in 2008 to 12.1% in 2012, which reached an inflection in 2013. We forecast 2014 CapEx/Sales to be 13.7%, compared to 13.5% in 2013.

Figure 72: Telenor: CapEx/Sales Trend



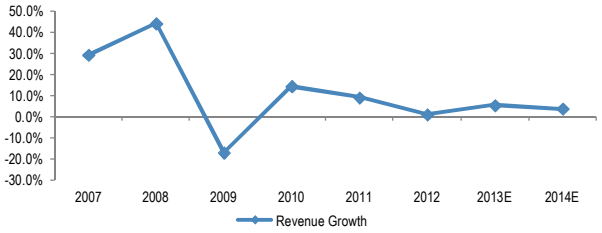

Source: Company reports and J.P. Morgan estimates.

## Eastern Europe

**MTS** *(JPM analyst: Alexei Gogolev)*

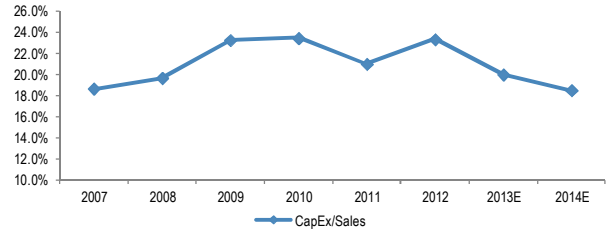
- Q3 performance: MTS reported in-line results, with Q3'13 revenue of RUB103,388m missing consensus by 0.6% and JPMe by 0.9%. EBITDA of RUB46,290m beat consensus by 0.8% and JPMe by 0.4%, while CapEx of RUB17,819m, beat consensus by 2.1%.
- Outlook reconfirmed: Management reconfirmed its 2013 guidance of over 43% EBITDA margin and 20% CapEx/Sales, and said that it expects revenue to grow at least 5% Y/Y. The company also said that it 2014 and 2015 CapEx/Sales to be in the 18% - 19% range.
- We are forecasting 2014 CapEx of $2,516m at a Y/Y decline of 4.0% and CapEx/Sales of 18.5%.

Figure 73: MTS: Revenue Growth Y/Y




Source: Company reports and J.P. Morgan estimates.

Figure 74: MTS: CapEx/Sales

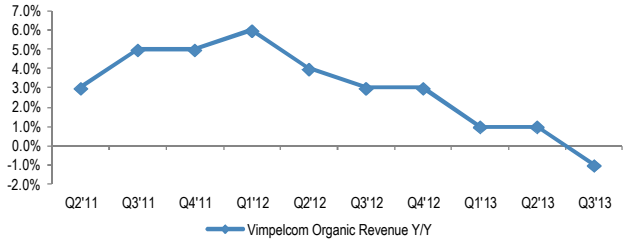



Source: Company reports and J.P. Morgan estimates.

**Vimpelcom** *(JPM analyst: Torsten Achtmann)*

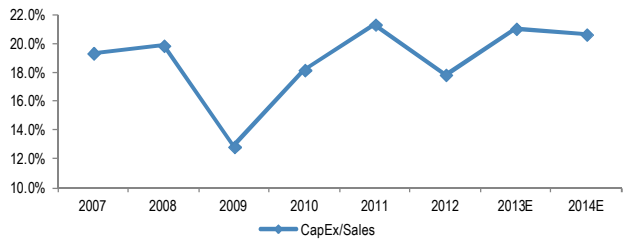
- Q3 performance: Vimpelcom reported solid Q3'13 results. Revenues of $5.69bn were in line with JPMe expectations of $5.68bn, and 1% below consensus estimates of $5.74bn. EBITDA of $2.47bn was in line with JPMe expectations but 0.7% below consensus. CapEx was $1,040m, representing CapEx/Sales of 18.3%.
- We are forecasting 2014 CapEx of $4,726m, down 1.5% Y/Y. CapEx/Sales for 2014 is expected to be 20.7%, versus 21.1% in 2013.

Figure 75: Vimpelcom: Organic Revenue Growth Trend




Source: Company reports and J.P. Morgan estimates.

Figure 76: Vimpelcom: CapEx/Sales Trends

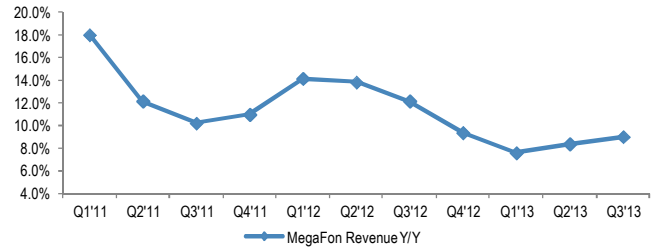



Source: Company reports and J.P. Morgan estimates.

**MegaFon** *(JPM analyst: Alexei Gogolev)*

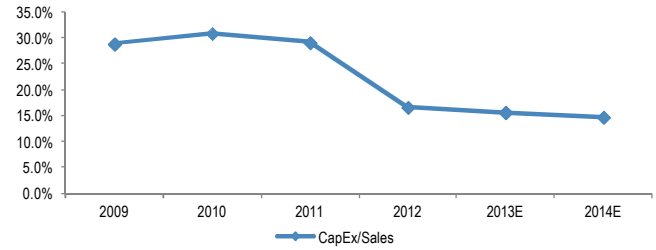
- Q3 performance: MegaFon reported a solid set of Q3'13 results, with revenue of RUB77,543m beating JPMe and consensus by 1%. EBITDA of RUB35,387m was 2% ahead of JPMe and consensus, while net income beat JPMe by 1% and consensus by 3%. CapEx of RUB10,862m grew by 51% Y/Y and by 30% sequentially.
- We are forecasting 2014 CapEx of RUB46,092m, up 0.1% Y/Y. CapEx/Sales is expected to shrink to 14.7% in 2014, versus 15.6% in 2013.

Figure 77: MegaFon: Revenue Growth Trend




Source: Company reports and J.P. Morgan estimates.

Figure 78: MegaFon: CapEx/Sales Trend




Source: Company reports and J.P. Morgan estimates.

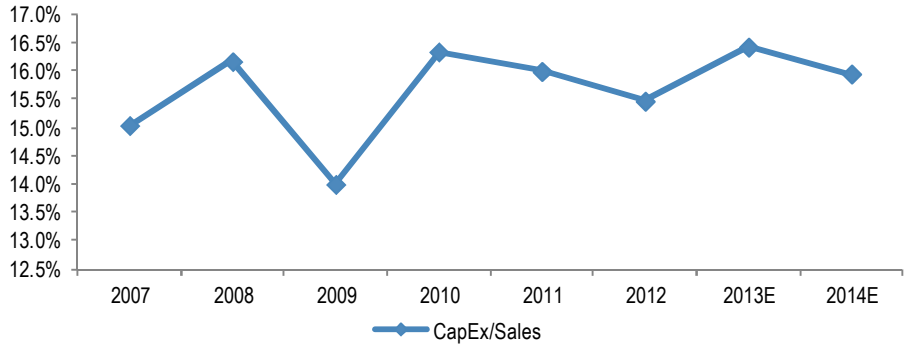
## US

**AT&T** *(JPM analyst: Philip Cusick)*

- Q4 CapEx to be down Q/Q due to strong Q3: AT&T reiterated its CapEx guidance of ~$21bn for 2013. At $21.0bn for 2013 AT&T's implied CapEx for Q4 is roughly $5.2bn (- 12% Y/Y) – a significant 13% Q/Q decline. Q3 CapEx, however, was significantly above expectations, possibly indicating that AT&T pulled forward some of its Q4 investments.
- Q3 CapEx beat due to wireline: Q3 CapEx at $6.0bn was a 12% above JPMe of $5.3bn and 11% above consensus of $5.4bn. Wireline CapEx at $2,913m came in 31% above JPMe of $2,218m. We don't believe that AT&T's long-term investment plans have changed materially. Q3 CapEx/Sales was 19% in Q3'13 vs. 16% in Q3'12.
- Wireless CapEx miss: Wireless CapEx in Q3 was ~$3,060m (+13% Y/Y, +2% Q/Q), missing JPMe of $3,106m by 1.5%. Wireless CapEx/Sales was 17.5% in Q3, better than the 17.4% seen in Q2'13 and 16.3% in Q3'12.
- LTE deployment progressing ahead of plans: AT&T's LTE covered 250m pops at the end of Q3'13, up from 225m at the end of Q2'13 and 174m at the end of 2012. The company's LTE network is expected to cover nearly 300m POPs by year-end 2014.

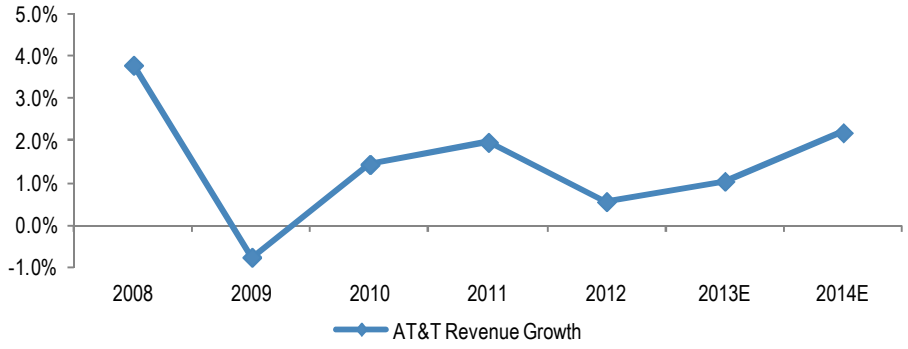
- CapEx/Sales expected to decline: CapEx/Sales is expected to decline to 16.0% in 2014 from 16.4% in 2013, as LTE rollouts near completion.

**Figure 79: AT&T: CapEx/Sales**




Source: Company reports and J.P. Morgan estimates.

**Figure 80: AT&T: Revenue Growth**



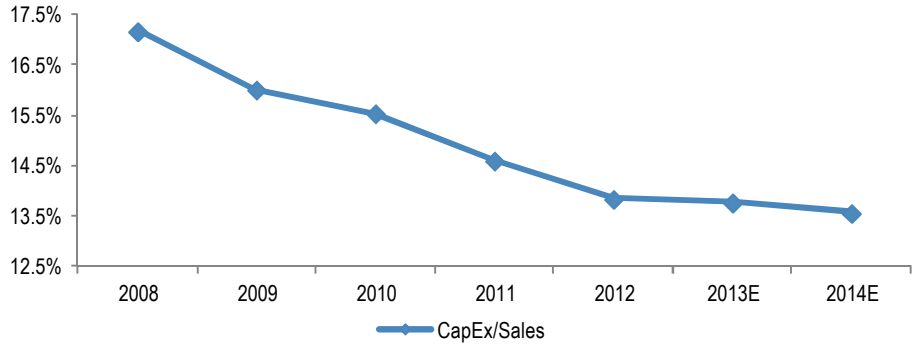

Source: Company reports and J.P. Morgan estimates.

**Verizon** *(JPM analyst: Philip Cusick)*

- 2013 CapEx in line: Verizon's 2013 CapEx of $16,604m was in line with guidance of $16.6bn, but a slight 0.1% below JPMe of $16,623m and 0.9% above consensus of $16,463m.
- 2014 CapEx guide above the Street: Verizon guided for full-year 2014 capex of $16.5bn - $17.0bn, contradicting negative market expectations. At the mid point of the range, 2014 capex guidance was 1.9% higher than consensus of $16,442m but was 1.3% lower than JPMe of $16,973m. Verizon said that 69% of its data traffic is flowing through its LTE network (Q3'13: 64%) but is driven by 44% of its customer base (Q3'13: 38%). Management indicated that it will continue to deploy capital to increase capacity and density to its network to support this load.
- LTE update: Verizon has substantially completed deployment of its 4G LTE network, covering more than 99% of its current 3G network footprint. The Verizon 4G LTE network is now available to 97% of the US population in more than 500 markets covering nearly 305m people
- Wireless capex miss: Q4 wireless capex declined 3.1% Y/Y and increased 10.4% Q/Q to $2,705m, but missed JPMe of $2,878m by 6.0%.

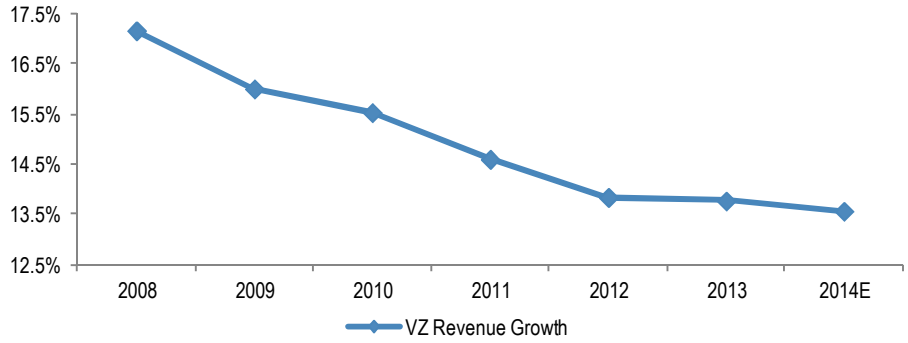
- Wireline capex beat: Q4 wireline capex increased 10.8% Y.Y and 16.1% Q/Q to $1,762m and beat JPMe of $1,638m by 7.6%.
- EBITDA slight miss: Q4 EBITDA came in at $10,251m, 0.9% below JPMe of $10,346m. EBITDA margin of 33.0% was also lower than JPMe of 33.3%.
- CapEx/Sales Expected to decline: Verizon's CapEx/Sales has been decreasing since 2006. We expect CapEx/Sales to decline to 13.6% in 2014 from 13.8% in 2013, as LTE rollouts near completion.

**Figure 81: Verizon: CapEx/Sales**




Source: Company reports and J.P. Morgan estimates.

**Figure 82: Verizon: Revenue Growth**




Source: Company reports and J.P. Morgan estimates.

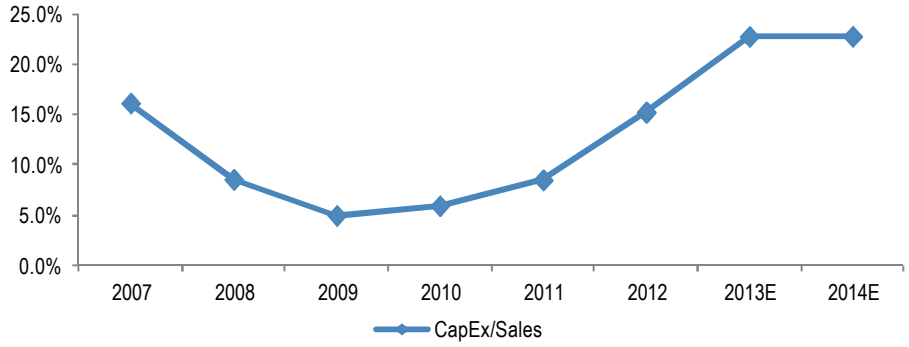
**Sprint** *(JPM analyst: Philip Cusick)*

- Q3 performance: Sprint reported a soft quarter, with revenue of $8,681m missing JPMe by 2.4% and consensus by 1.6%. EBITDA of $1,343m missed JPMe by 5.7% but beat consensus by 5.2%, while CapEx of 1,841m missed JPMe by 11.7% and consensus by 15.5%.
- Outlook reiterated: Sprint's CapEx guidance remained at $8bn for 2013, implying a CapEx of $2.5bn in Q4'13.
- LTE update: Sprint said that it has launched 4G LTE across 730 markets and targets 200m LTE PoPs by the end of 2013. Sprint sees macro cell deployment remaining relatively flat for the next few years with the potential to add small cells – the company is aggressively deploying LTE on the 1.9 spectrum.
- Higher CapEx to drag onto 2015: Sprint has 230 cities launched with LTE to date with more than 26k cell sites upgraded. It continues to aim for 200m LTE pops

by YE13 and expects to complete the 1.9GHz (PCS band) upgrade to LTE by mid-2014, with 100m LTE pops on 2.5GHz by YE14. J.P. Morgan's analyst estimates CapEx to remain at $8bn for 2013 and 2014, but increased 2015 CapEx forecasts to $6.5b from $6b for the continued rollout of 2.5GHz.

- CapEx/Sales Expected to Hold Steady: We estimate CapEx/Sales for 2014 to be 22.7%, same as in 2013.

**Figure 83: Sprint: CapEx/Sales**




Source: Company reports and J.P. Morgan estimates.

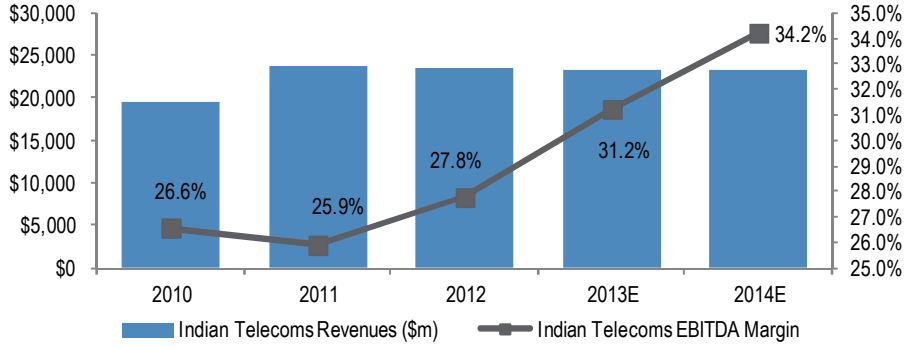
## APAC

### India

Based on J.P. Morgan and consensus estimates, the combined revenues of Indian carriers (Bharti Airtel, Reliance Communications, Idea Cellular and Uninor) are expected to decline by 1% Y/Y in 2014 to $23bn, following a 1% decline in 2013. EBITDA margins have been steadily increasing, and this increase is also expected to continue in 2014.

**Figure 84: India: Revenue and EBITDA Margins**

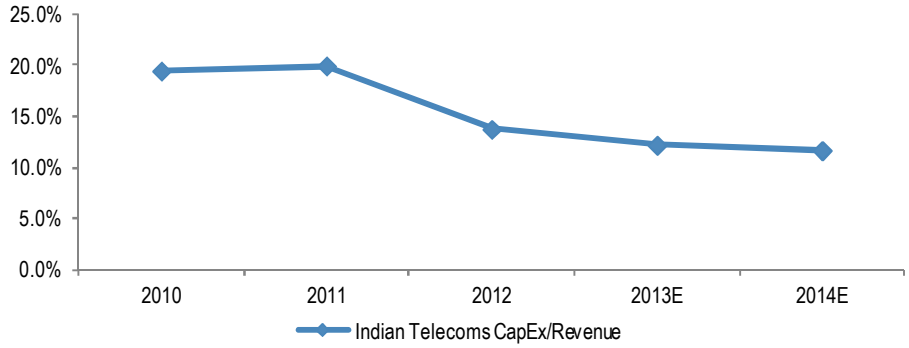
$ million, year-end 31 December




Source: Company reports and J.P. Morgan estimates. Operators considered are Bharti Airtel India and South Asia, Reliance Communciations and Idea Cellular. Estimates for Bharti Airtel are from consensus.

CapEx/Sales has been declining steadily since 2010 and we believe this carries over to 2014 but absolute capex is not expected to decline in constant currency terms. We expect CapEx/Sales of 11.7% in 2014, versus 12.2% in 2013.

Figure 85: Indian Telecoms CapEx/Sales




Source: Company reports and J.P. Morgan estimates.

Table 13: Indian Telecoms CapEx Guidance

| Company | FY End | FY'14E | FY'13A | Y/Y | FY 14 Guidance |
|---|---|---|---|---|---|
| Bharti Airtel | Mar | US$2.1bn* | US$2.5bn | -19% | Reiterated guidance of $2 billion to $2.2 billion |
| Reliance Communications | Mar | INR15,000m | INR 15,498m | -3% | Reiterated Full FY CapEx of INR15,000m |
| Idea Cellular | Mar | INR35,000m | INR 33,640m | 4% | Reiterated Full FY CapEx of INR35,000m |

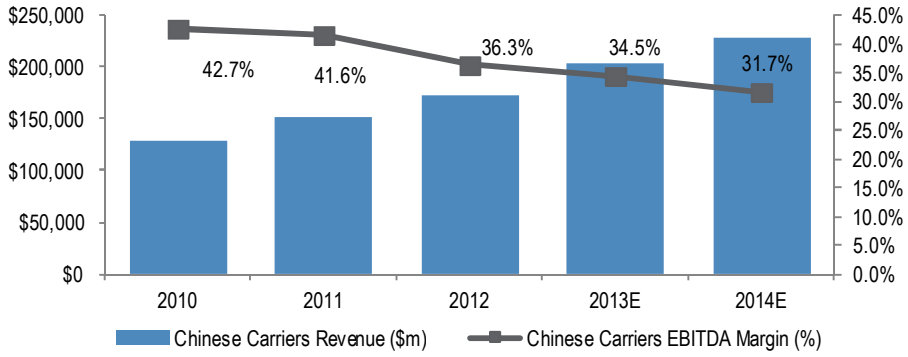
Source: Company reports and J.P. Morgan estimates. *Consensus estimate.

**China** *(JPM analyst: Lucy Liu)*

The combined revenue of Chinese carriers is expected to grow by a strong 12.7% Y/Y in 2014, led by China Mobile. EBITDA margins, however, are expected to fall from 34.5% in 2013 to 31.7% in 2014. Both of these are influenced largely by China Mobile's iPhone deal, which is expected to add revenue but impact margins in the near term.

Figure 86: Chinese Carriers: Revenue and EBITDA Margins

$ million, year-end 31 December




Source: Company reports and J.P. Morgan estimates.

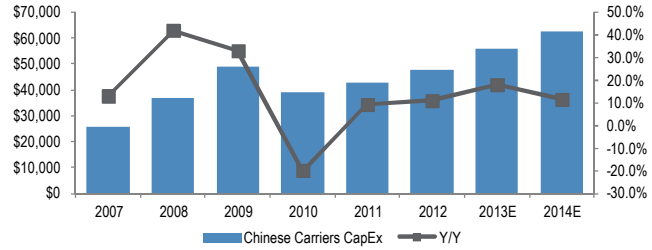
Table 14: iPhone economics to China Mobile

| | 2014E | 2015E | 2016E |
|---|---|---|---|
| CM iPhone subs adds (mn) | 10 | 12 | 14.4 |
| ARPU (Rmb) | 200 | 240 | 288 |
| current average ARPU (Rmb) | 70 | 67 | 63 |
| **Incremental revenue (Rmb mn)** | **7,800** | **22,902** | **35,612** |
| | | | |
| Average subsidy per device (Rmb) | 2,000 | 2,000 | 2,000 |
| **Subsidy increase (Rmb mn)** | **20,000** | **24,000** | **28,800** |
| | | | |
| Net profit impact (Rmb mn) | -9,150 | -824 | 5,109 |
| current forecast of CM net profits (rmb mn) | 115,315 | 111,681 | 113,433 |
| % of CM's current net profit | -8% | -1% | 5% |

Source: J.P. Morgan estimates.

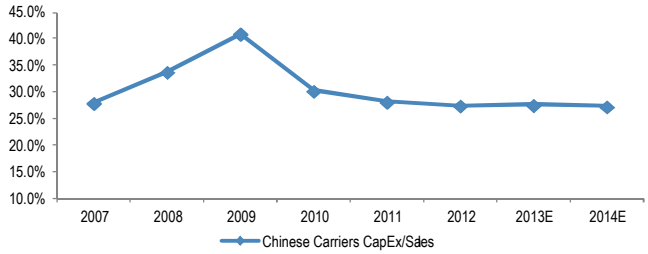
CapEx is expected to grow 11.6% Y/Y in 2014, after a growth of 18.0% Y/Y in 2013. CapEx/Sales is expected to hold steady at 27.3%, compared to 27.5% in 2013.

Figure 87: Chinese CapEx
$ million, year-end 31 December




Source: Company reports and J.P. Morgan estimates.

Figure 88: Chinese CapEx/Sales




Source: Company reports and J.P. Morgan estimates.

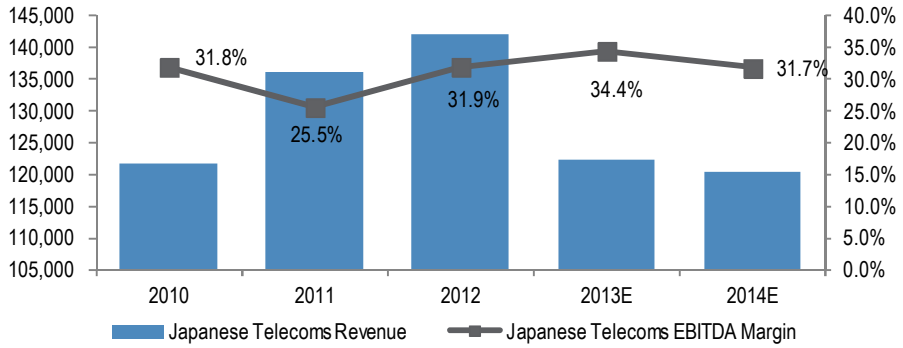
- China Mobile CapEx Hike in 2014 expected: J.P.Morgan's Analyst Lucy Liu believes that CM is delaying the 2013 target of finishing 200K 4G to mid-2014, but plans to then accelerate the plan to complete another 300K BTSs by 2015 to finish by the end of 2014. 2013 CapEx is expected to come lower than guidance (Rmb192bn) but 2014 is expected to grow rapidly – particularly in H2 if our analyst is correct. We forecast 2014 CapEx to be around Rmb 200bn.
- China Telecom CapEx expected to stay high in 2014/2015: J.P.Morgan's analyst Lucy Liu expects CT to deploy 350K-400K 4G BTS nationwide, below CM's 500K, but still higher than its 3G BTS of 280K, due to higher spectrum. We forecast CapEx of close to Rmb100bn in 2014. 2014 is expected to be the peak of the CapEx cycle, but 2015 CapEx is forecast to remain relatively high at more than Rmb90bn.

**Japan**

Japanese carrier revenue is expected to decrease by 1.7% in 2014, following a decline of 13.8% in 2013. EBITDA margins are expected to drop from 34.4% in 2013 to 31.7% in 2014.

**Figure 89: Japanese Carriers: Top line and EBITDA Margin**

$ million, year-end 31 December

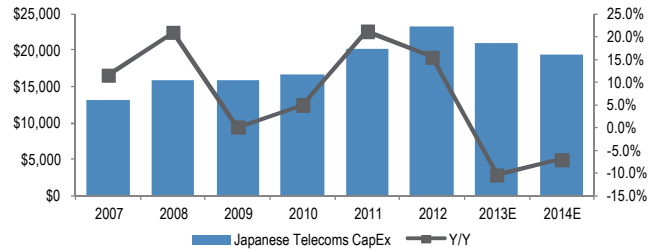



Source: Company reports and J.P. Morgan estimates.

Carrier CapEx is expected to decline by 7.1% Y/Y to $19.4bn in 2014, while CapEx/Sales is expected to drop to 16.1% in 2014 compared to 17.1% in 2013.

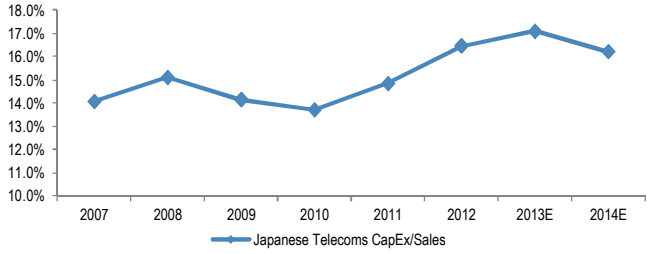
**Figure 90: Japanese CapEx**

$ million, year-end 31 December




Source: Company reports and J.P. Morgan estimates.

**Figure 91: Japanese CapEx/Sales**




Source: Company reports and J.P. Morgan estimates.

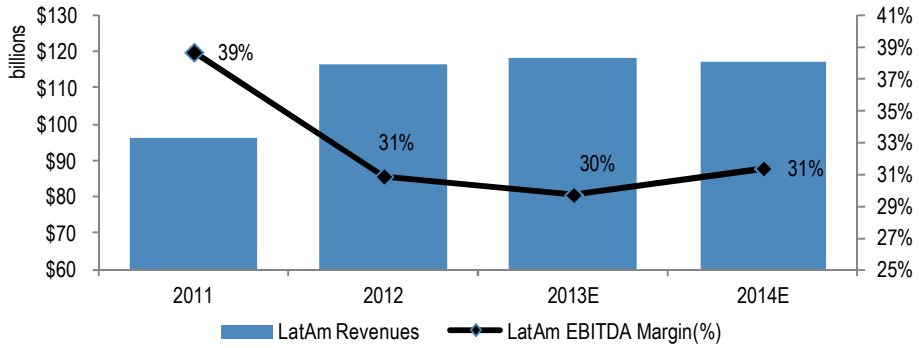
- NTT Docomo: NTT Docomo's FQ2 (to September) revenue declined 3.8% Y.Y to ¥1,085bn, missing consensus by 3.3%. CapEx declined 14.8% Y/Y to ¥156bn. The company reiterated its guidance of ¥700bn CapEx for FY'14 (ending March 2014)
- KDDI: KDDI's FQ2 (to September) revenue grew 19.6% Y/Y to ¥,1051bn, beating consensus by 4.7%. CapEx increased 14.0% Y/Y to ¥132bn. The company reiterated its guidance of ¥580bn CapEx for FY'14.
- Softbank: Excluding Sprint, Softbank's FQ2 (to September) revenue grew by ~13% Y/Y. Excluding Sprint, Softbank plans to invest ¥780bn in CapEx in FY 2014, ¥580bn in FY 2015 and ¥450bn in FY 2016.

## LatAm

Latin American carrier revenues are expected to decline 2% in 2014, following an increase of 1% in 2013. EBITDA margins are expected to increase to 31% in 2014, compared to 30% in 2013.

**Figure 92: LatAm Carriers: Revenue**

$ million, year-end 31 December

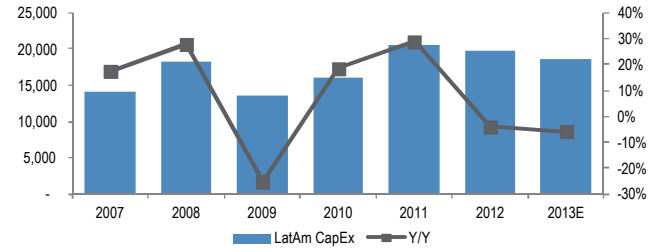



Source: Company reports and J.P. Morgan estimates.

CapEx at LatAm carriers is expected to decline by 5.6% in 2014, following a decline of 5.8% in 2013. CapEx/Sales is expected to continue its steady decline, going down from 15.8% in 2013 to 15.2% in 2014.

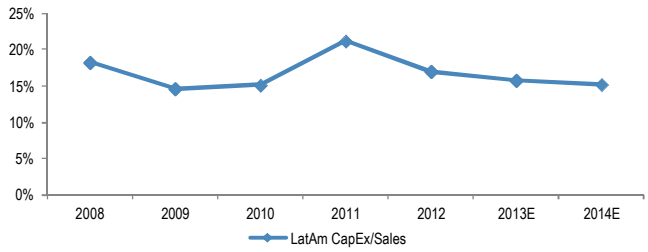
**Figure 93: LatAm CapEx**

$ million, year-end 31 December




Source: Company reports and J.P. Morgan estimates.

**Figure 94: LatAm CapEx/Sales**




Source: Company reports and J.P. Morgan estimates.

- America Movil (covered by Andre Baggio): America Movil's Q3 revenue at MXN194,221m was 3% below JPMe and in line with consensus. CapEx at MXN29,600m was 2% above JPMe but 9.5% below consensus. The company guided for $10bn CapEx for 2013.
- Telefonica Brasil (covered by Andre Baggio): Telefonica Brasil's Q3 revenue declined by 10.8% Y/Y to €1.6bn, but CapEx increased by 29.9% Y/Y to 395m.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





# The “Snowden Effect”

We believe that 2014 will see a large increase in security spending by enterprises driven by revelations of NSA information collection released by Edward Snowden beginning in June 2013. While information is still sketchy, Snowden revealed large meta-data collection systems built by US intelligence services to mass collect data generated by civilians using modern networks and online services. In addition to this, documents released by Snowden suggest the direct tapping of major fiber links to mass collect data which is, in turn, fed to the NSA's analysis engines. While meta data seems innocuous it is anything but in our opinion. From a corporate security point of view it seems undesireable to have any outside agency able to analyze, in detail, the communications patterns of senior executives and those in sensitive positions. With the benefit of additional data that agency could determine anything from when and where major M&A is likely to what the company's position is on sensitive regulatory issues. In addition to meta-data Reuters ran a story on December 20, 2013 saying that the NSA paid RSA $10m to use a specific pseudo random number generator in its encryption products called DUAL_EC_DRBG. The article goes on to assert that this deal was done to provide the NSA with the ability to decrypt traffic thought to be secure by using a backdoor. In our opinion, this will further raise enterprise demand for the ability to communicate securely. Another key story on this front relates directly to Cisco. Der Spiegel reported on December 30, 2013, that the NSA had compromised security on several specific Cisco security appliances. This story has yet to completely play out though we believe it has the potential to hurt Cisco's security appliance business as well as its enterprise networking business.

**Possible Implications**

We see three implications from the NSA story that could affect our companies in 2014.

1. We expect companies to increase the use of secure encryption for communications traversing public networks.

2. We believe that enterprise IT shops will take steps to reduce the meta data footprint of employees in sensitive positions and for all employees using corporate systems.

3. We expect next generation network security systems adoption to be accelerated.

**Companies Impacted**

We will address here how we see company impacts generally playing out this year for security. However, we believe there is a lot more to come on this story and intend to do more work as further details emerge.

On our first point, we believe that companies like Riverbed could benefit from an increased focus on secure encryption deployment. Cisco is also well positioned here but Der Spiegel’s allegations could make it tough to capitalize on this as we mentioned above. F5 also has significant SSL encryption capabilities which could benefit from this trend should it develop as we expect.

Meta data control is a tougher technological problem since much of this information is created on BYOD devices being used on public networks. We suspect that next generation MDM technology will address this though we have yet to hear existing MDM players talk about the capability. Here we look for new companies to emerge with solutions.

Lastly, we believe that large enterprises in particular are likely to accelerate deployment of sophisticated next generation security systems. We believe that this was already underway in 2013 but see the ongoing press related to the NSA as a constant reminder that very sophisticated hacking attempts are likely for large corporate networks. In prior research we have indicated that we believe F5 is well positioned for the evolution of security systems. We expect these systems to consist of multiple intelligent security agents running on centralized compute infrastructure and communicating with "enforcement" elements located at critical choke-points in the network. Given the fact that all network traffic has to flow through an ADC before it hits a server we believe that F5 and other ADC vendors are in the right place in the data center network. We also see the fact that ADCs have long been “controllable” via remote scripts and APIs as an advantage when considering them for this “enforcement” role.

**Company Commentary on Security**

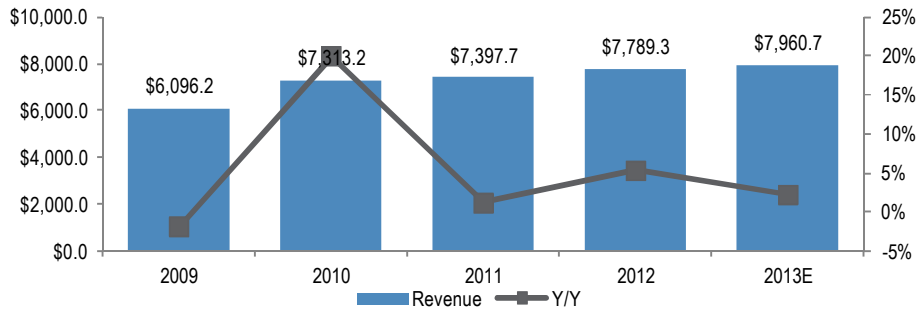
Several of our companies have commented on increased demand for security related products. F5 Networks noted on the Q1’14 earnings conference call that its security solutions sold well and was driver of the overall business. The company reconfirmed its commitment to further security by building two security operations centers in Seattle and Tel Aviv to support their security service. Juniper Networks commented in its Q4’13 earnings call that customer feedback is positive, and the commitment and focus around security is a priority. These are merely two examples of the current sentiment – enterprise and service provider customers are focused on bolstering their overall security capabilities.

**Security Appliance Market Overview**

In Figure 95 below, we lay out the historical performance of the overall network security appliance market. After declining to +1% Y/Y growth in 2011, the market recovered with 5% Y/Y growth to $7,789m in 2012 and is expected to grow by ~2% in 2013.

**Figure 95: Network Security Appliance Market**

$ in millions




Source: J.P. Morgan estimates, Dell'Oro Group

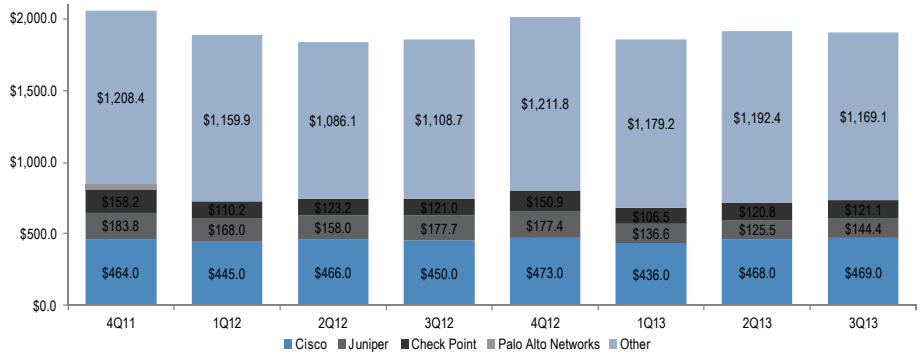
Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





We show the network security market composition in Figure 96 below. Cisco is the largest security vendor with 24% of the market in Q3'13 – this is not surprising as its switching and routing base naturally pulls through security products. Check Point also sticks out with 6% even though it doesn't have the product bundling capabilities that Cisco and Juniper have. "Other vendors" still represented 59% of the market in Q3'13. We believe this illustrates just how fragmented the market continues to be and how many new companies are constantly emerging as threats change. While consolidation seems likely we doubt it reduces fragmentation given the rapidly evolving nature of the overall security market.

**Figure 96: Network Security Appliance Market**
$ in millions




Source: Dell'Oro Group

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





# Networking and IT Spending Outlook

We have a cautious view on the enterprise networking market heading into 2014, driven by Cisco's product transition and macro weakness in emerging markets. On the positive side, we are cautiously optimistic about the US economy though enterprise datapoints so far in Q1 have been negative in our opinion. For Service Provider Networking we believe overall growth is positive but somewhat lackluster driven by weak emerging markets economic growth.

We forecast the total fixed networking market to grow by 4.4% Y/Y to $68.7B in 2013, and by 4.1% Y/Y to $71.5B in 2014. This is lower than our earlier estimates of 4.9% growth to $69.0B for 2013 and 5.6% growth to $72.8B for 2014. We expect the enterprise networking market to grow by 5.7% to $38.3B in 2013, and by 4.7% to 40.1B in 2014, led by WLAN growth. We forecast the service provider networking market to grow by 2.9% to $30.3B in 2013 and by 3.3% to $31.4B in 2014, as growth is hampered by EM macro weakness.

We expect a slowdown in the switching market due to a possible pause in developed market spending before the full availability of Cisco's Insieme switching solution (along with the APIC controller) and ongoing macro-driven weakness in emerging markets. Accordingly, we reduce our total switching estimate by 5.0% to $10.5B, implying a -0.1% Y/Y decline in H1'14 (vs. +1.7% Y/Y in H1'13 and +11.1% in H1'12). We expect the switching market to recover and grow by 3.0% Y/Y in H2'14.

We are increasing our 2014 total enterprise routing forecast by $144m to $3,826m. This is driven by a $132m increase in Access routing to $2,957m and a slight $11m increase in high-end routing to $869m. We believe that DMs drive the improvement in access routing revenues. We also increase our 2014 total service provider routing forecast by 1.7% to $10,361m, as we believe that carriers are exhausting their routing capacity and continue to need to augment, particularly in the core.

While we keep our total ADC forecast for 2014 unchanged at $1,793m, we reduce our ADC Physical forecast by 2.3% to $1,493m and increase our Virtual ADC forecast by 13% to $300m as demand continues to shift toward virtual solutions. In the WLAN market, we lower our WLAN SOHO forecast by 1.2% to $4,809m, but increase our WLAN Enterprise forecast by a slight 0.3% to $4,706m driven mainly by BYOD in large enterprises.

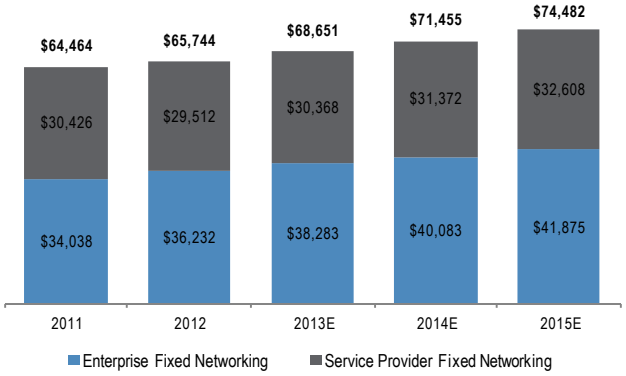
We lower our optical market revenue estimate by 4.0% in 2013 to $13,006m and by 4.6% in 2014 to $13,629m due to the recent weakness in China. We believe that the Chinese optical market grew by only 1.3% Y/Y to $770m in Q3, down from 28% Y/Y in Q2. Note that this change has only minor impact on Western vendors since we believe that most optical gear being provided to China is being sold by Chinese brands.

Though we reduced our 2014 outlook, we highlight Metro and Long Haul DWDM as attractive markets within optical and forecast 14.1% and 9.2% Y/Y growth respectively for those segments. We are also positive on enterprise WLAN (+14.8% Y/Y) and service provider core routing (+8.9% Y/Y).

As part of this update, we are also introducing 2015 networking forecasts. We expect the networking market to grow by 4.2% to $74.5B. This is based on 4.5% growth in

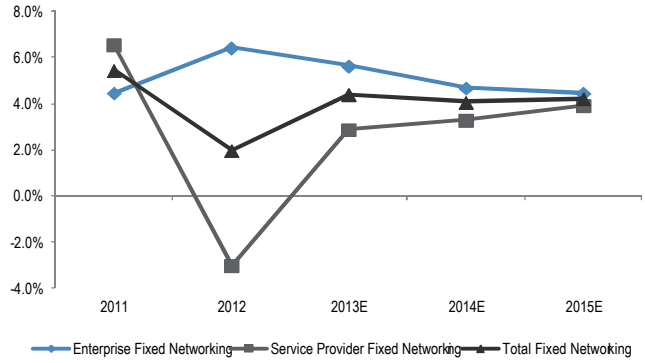
the enterprise networking market to $41.9B, and 3.9% growth in the service provider networking market to $32.6B.

**Figure 97: Current Total Equipment Market Forecast**
$ million




Source: J.P Morgan estimates, Dell'Oro Group

**Figure 98: Y/Y Growth Rates**
$ million




Source: J.P Morgan estimates, Dell'Oro Group

Supporting our cautious enterprise spending view, our most recent J.P. Morgan CIO Survey published in October 2013 indicated deteriorating IT spending trends, which is consistent with our downward revisions. According to our CIO Survey respondents, IT spending is now projected to increase 2.9% Y/Y in 2013, down from an estimated 3.3% Y/Y growth in our April survey. The respondents' early look at 2014 suggests IT spending improvements with 3.9% Y/Y growth.

Our CIO Survey also indicates a rise in pessimism toward communications spending with a combined 21% of our respondents anticipating spending will decline Y/Y in 2013. This compares unfavorably to 16% of respondents expecting to reduce communications spending in our prior CIO Survey this past April.

Overall, a possible Osborne effect caused by Cisco's product transition and a weaker macro environment in the EMs drive our cautious view of the networking market in 2014, offset partially by improving US macro indicators.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





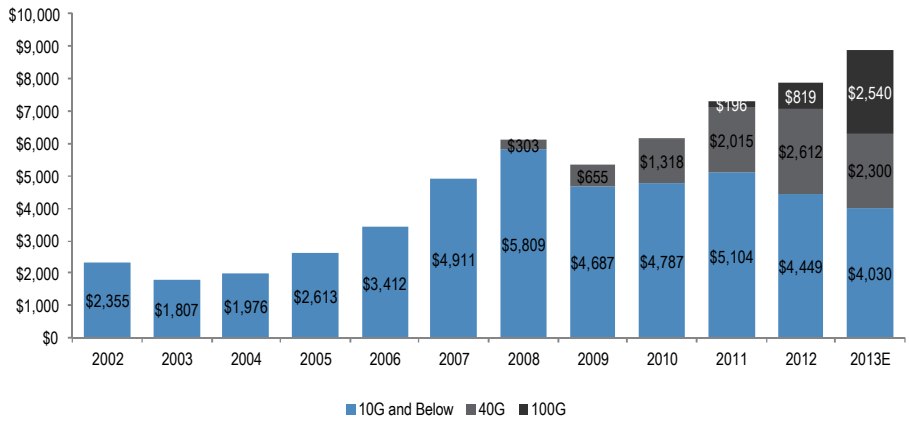
# Optical Momentum Set to Continue

We continue to believe that there is more value to extract from the 100G optical refresh in the US, Europe, and in Asia. In this section we conclude that 100G will continue to drive optical market revenue growth in 2014. We also look at the dynamics between each speed with regard to units and ASPs. In addition, we briefly look at gross margin implications for Ciena and Infinera, as well as review our optical forecast for 2014. In our 2013 report we concluded that there was more to go for on optical and this worked well last year. We see recent pullbacks in relevant stocks combined with continuing solid fundamentals as supportive of optical as a sound investment for 2014 as well. In this report we reaffirm our conviction with regards to Ciena and Infinera as names that will benefit from the global upgrade.

### 2013 Revenue Breakdown

Although the final 2013 numbers are not in, we expect 100G to finish up 210% Y/Y having increased ~$1.7b from the previous year. The long haul market drove the top line increasing ~$1.2 or 226%, while the metro market expanded by ~$461m or 177%. 10G and 40G slightly contracted by 9% and 12% in 2013, respectively. Overall, the optical market is expected to have grown to ~$8.9bn, up13% or $990m. An important point we make here is that total optical WDM revenue has surpassed peak levels seen in 2008 and shows little sign of a slowdown. We believe that this is due to lower priced 10G ports being replaced by higher ASP 100G in many cases. We expect this trend to continue for multiple years.

Figure 99: Historical Annual WDM Revenues by Speed
$ in millions



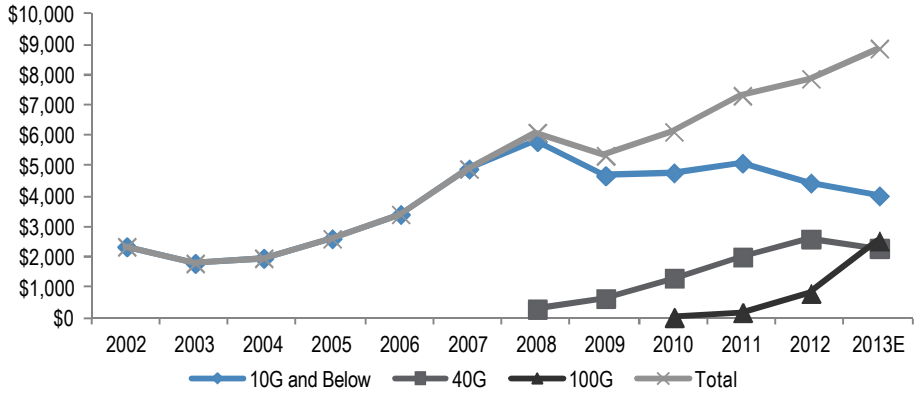

Source: Dell'Oro Group.

### 100G Is Expected to Drive the Market in 2014

As we mentioned above we see the fear of 100G cannibalizing the 40 G- and 10 G-nodes as slightly overblown. If there is any significant revenue neutral cannibalization effect we believe it will be from 40G to 100G which is somewhat expected based on slowing 40G growth. We see migration to 100G from 10G as the main revenue growth driver as carriers continue to deal with fiber exhaust on major routes in both the US and Europe. In Figure 100 below, we illustrate solid optical market growth despite quarterly shifts in the speed mix. Also, based on commentary from the optical vendors, there is significant opportunity in FY2014 for greenfield projects to complement existing customers. Infinera's CEO Tom Fallon said that in

Q3 the company added 5 new DTN-X customers, 40% of which were new customers to the company. We believe European operators in particular are set to invest more in countries like Germany and the UK as long and medium haul routes there are congested.

**Figure 100: Historical Annual WDM Revenues by Speed**
$ in millions

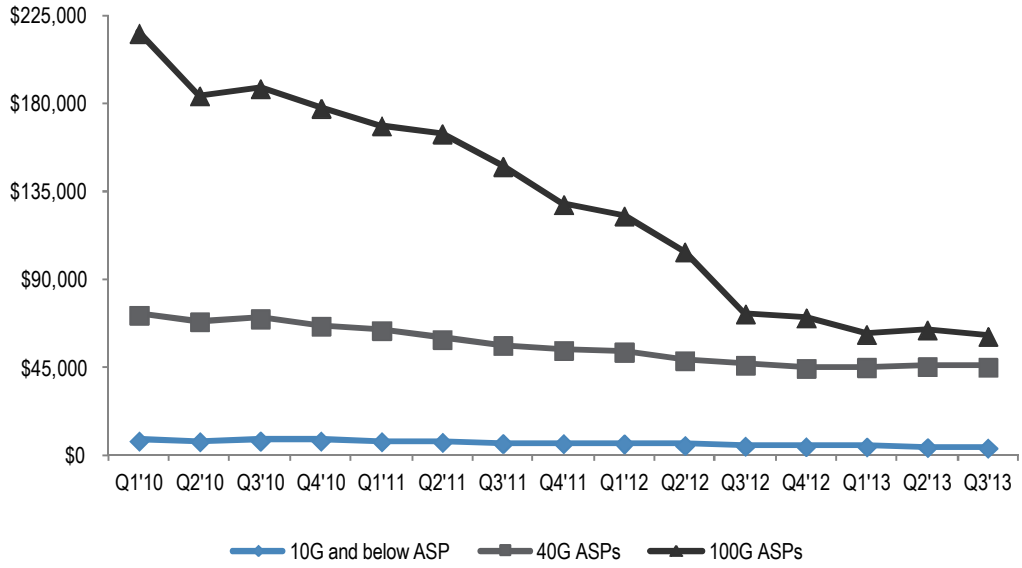



Source: Dell'Oro Group

**ASPs Expected to Stabilize**

When we examined ASPs last year, 100G prices had continued to decline. In Q3'12, a 100G wavelength was selling at ~$72,929 while 40G was sold at ~$46,791. Since then 100G and 40G prices have fallen 16% and 2%, respectively. While the Y/Y decrease points towards more pricing pressure, the 100G price level has now been stable since late 2012 based on Dell'Oro data. Precipitous declines were a result of ongoing bidding wars to land Tier-1 and other 100G deals which we see as a normal phenomenon early in a typical cycle. While we expect continued technology driven pricing declines going forward we believe these should be much more moderate as 100G becomes more mainstream.

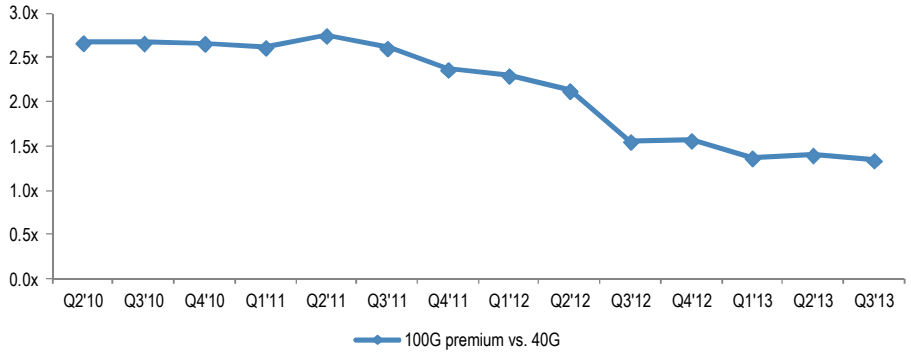
Figure 101: 100G ASP Declines Are Bottoming Out




Source: Dell' Oro Group

We have seen a significant shift in the pricing complex of various optical speeds since 2012. The premiums in the market appear to be relatively stable. Currently, 100G is selling at 1.3 times 40G prices – this is down 0.1x from Q2'13 and 0.3 from Q3'12. Figure 102 below shows that, over the past year, the 100G premium has flattened out after a rapid decline at the end of 2013. We believe that 100G has found a foothold at ~$60,000 and should continue to sell at roughly ~1.3x 40G and ~13.9x 10G throughout 2014, in our opinion.

Figure 102: 100G ASP as a Multiple of 40G ASP Stabilizing at ~1.3x



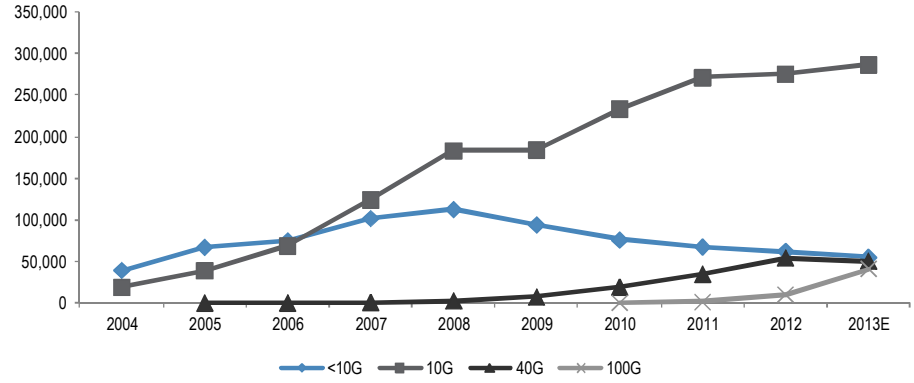

Source: Dell'Oro Group

**100G Wavelength Growth Continues to Accelerate**

Figure 103 details annual WDM wavelengths/port shipments by speed. Unsurprisingly, 10G continues to dominate overall wavelengths/port shipments with 275,490 in 2012 (+1.6% Y/Y). 40G wavelengths/port shipments jumped 56.4% Y/Y in 2012 to 54,289. However, this is modest compared to100G, which soared 651.2% Y/Y, though off a much smaller base, to 10,209. We look for strong 100G growth to continue. While not all speed demand will transition to 100G, we expect the 100/10

ratio to continue to increase in as more 100G builds solidify in 2014 – currently, 6 10G units ship for each 100G sold.

Figure 103: Historical Annual WDM Wavelengths/Port Shipments by Speed




Source: Dell'Oro Group

**Optical Gross Margin Drivers**

Gross margin in the optical space is notoriously exposed to lumpy deal flow and build characteristics inherent in this part of the network. In regards to deals, companies, including Ciena and Infinera, experience the fluctuations that have always been associated with the routing space; the recognition of large carrier deals will drastically sway the top line and overall corporate gross margins depending on reconvene recognition. The current status of carrier builds will also directly impact the gross margin picture of any particular quarter. Laying down the initial footprint of a 100G deployment will drive lower margins that are associated with the chassis implementation. Once this phase is complete, companies will move to fill the hollow network with linecards which will tends to drive better gross margin for the equipment vendors.

**Ciena Gross Margin Outlook**

Ciena saw gross margin of 42.8% in FY2013, up 1.9% from the previous year. However, this slid to 40.8% in FYQ4, down 2.2% Y/Y. For 2014, we are estimating a slight increase to 42.3%, down 0.5pp Y/Y but better sequentially. In the last earnings call James Moylan, CFO, said the company does have a large backlog, and that they feel positive about underlying demand dynamics looking forward. Adding to the company's confidence, Ciena also gave a FY14 EBIT margin target of 7% to 10% (our previous estimate was 7.1%). Considering this is the first time management has guided to full year profitably we believe the company has an almost unprecedented level of confidence in its current demand pipeline. A headwind to FY14 gross margin could be the company's pursuit of European deals –we expect the company to sacrifice some margin as they pursue larger deals in Europe through discounting. However, we don't expect this to drive the kind of ASP declines seen in late 2011 and early 2012 as 100G was just getting off the ground.

**Infinera Gross Margin outlook**

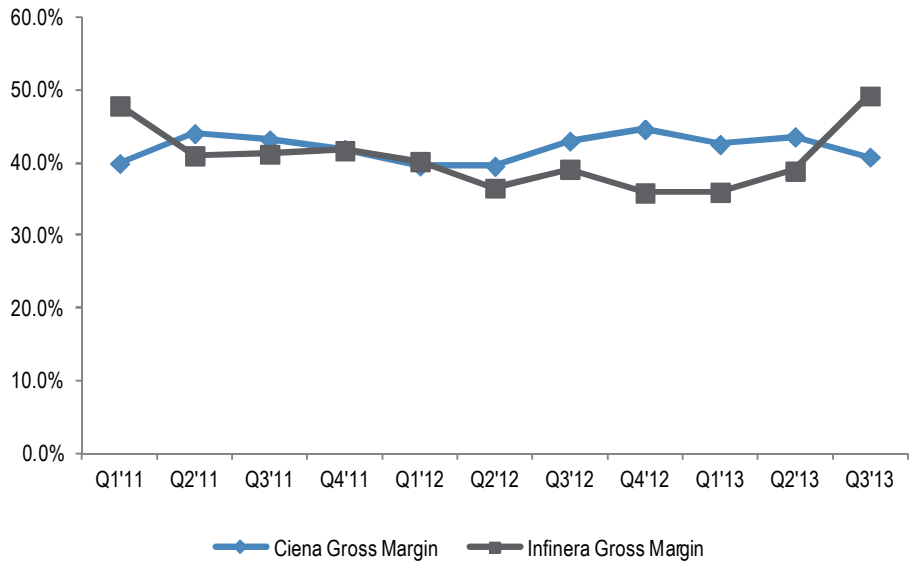
Based on management's Q4 margin guidance of 40%, implied FY13 gross margin is 41.2%, up 3.3% from the previous year. The company reported gross margin of 49.2% in Q3, which exceed INFN's mid-range target of 45%. Ita Brennan, CFO,

noted that some of the DTN-X networks did not require shipment of lower-margin amplifiers. The company noted that at this stage of DTN-X they expect ~40% gross margin for FY2014 which reflects the low-margin nature of footprints, along with competing for new and existing accounts. Ita Brennan did note that the company does have room for yield improvement and cost reductions which should bode well with ASP stabilization. We believe Infinera is being relatively conservative, and there is significant upside from the ramp of DTN-X deployments that are entering the fill-stage. Downside risk remains in the rate at which the new deployments move to fill chassis with higher margin line cards– the company noted that the fill rate was exceptional in Q3 so we believe the current margin guidance incorporates a more normalized fill rate considering the early stage of many deployments.

**ASPs and Units Expected to Drive Gross Margin in 2014**

As illustrated in Figure 104, we expect 100G ASPs to continue to stabilize throughout the course of 2014. 100G also currently ships around 1/6 the volume seen in 10G. Based on pricing stability and continued unit growth, we believe optical vendors will continue to see solid top line growth as well as eventual margin expansion on better revenue scale.

Figure 104: Ciena and Infinera Gross Margin Trends




Source: Company reports.

**100G Deployment Announcements**

In Table 15, we provide a current list of 100G deployment announcements. At this point, most of these represent first supplier wins. Given industry practice is to use at least two main suppliers for any major component of the network, we would expect second suppliers to be named in the next 12-18 months, if not sooner.

In 2013, Verizon (covered by Phil Cusick) completed the end of their long-haul build which slightly impacted the 100G run-rate in Q3. However, after completing their long-haul revamp, we expect them to shift focus to the metro area, and anticipate that they will award vendors with contracts in the 2H of 2014.

AT&T (covered by Phil Cusick) is slightly behind Verizon from a 100G strategy standpoint, and based on the fierce competition in the domestic market, we anticipate AT&T making a structural 100G decision in 2014. In early 2010 AT&T announced Ciena as a multi-year supplier for optical transport network and metro/core transport. Based on Verizon's long haul refresh, we expect AT&T to move similarly with Ciena having a good chance of winning the primary supplier position in our opinion.

We believe that the US market is at the forefront of 100G deployment due to greater OTT video demand. However, we believe that European and Asian operators will look to follow suit given similar increasing capacity pressure on their own networks. In Europe, RASCOM elected to use Ciena's 6500 Packet-Optical Platform for the 100G upgrade and network route expansion from Russia to Western Europe. In Asia, Ciena inked a deal with Reliance Globalcom to upgrade their trans-Atlantic submarine network with Ciena's 100G GeoMesh Solution after having completed a 100G upgrade for Tata Communications.

In terms of overall 100G wins, we believe Ciena is well established with design win momentum, particularly with Tier 1 service providers in North America and Europe. We also believe the company is now a more important strategic partner for many carriers post the integration of Nortel's optical business.Ciena announced in the FQ4'13 earnings conference call that 50% to 75% of revenue in 2013 came from 40G and 100G applications – up significantly from 2013. They noted that Ciena continues to see the trend to 100G. After announcing 5 new commitments on its Q3'13 earnings call, Infinera's DTN-X purchase commitments increased to 39 customers (up from 20 last year).

Table 15: Sampling of 100G Deployment Announcements

| Carrier | Vendor | Announced | Completed |
|---|---|---|---|
| Inexio | ADVA | | 12/4/2013 |
| MegaFon | Huawei | | 11/18/2013 |
| JSC Fortex | ADVA | | 10/1/2013 |
| Vodafone | Ciena | | 9/19/2013 |
| Fibertech | Ciena | | 9/17/2013 |
| Shenandoah Telecom | Cisco | | 8/16/2013 |
| Southern Cross | Ciena | | 7/31/2013 |
| PLDT | Ciena | 7/11/2013 | |
| GTS | Ciena | | 7/9/2013 |
| Epsilon | Alcatel-Lucent | 6/25/2013 | |
| KPN | Huawei | | 6/20/2013 |
| Avelacom | Alcatel-Lucent | 6/13/2013 | |
| British Telecom | Ciena | 5/23/2013 | |
| ARSAT | Alcatel-Lucent | 5/23/2013 | |
| RASCOM | Ciena | 5/21/2013 | |
| Hetzner Online | ADVA | | 5/7/2013 |
| Interoute | Infinera | | 4/16/2013 |
| Viatel Group | Huawei | | 4/16/2013 |
| Integra | Ciena | 4/10/2013 | |
| iFiber | Ciena | 4/10/2013 | |
| Kabel Deutschland | ADVA | 4/9/2013 | |
| Swisscom | Huawei | | 3/27/2013 |
| CenturyLink | Ciena | | 3/18/2013 |
| Reliance Globalcom | Ciena | 3/14/2013 | |
| Akado Telecom | Infinera | | 3/12/2013 |
| Telecom Italia | Infinera | | 2/28/2013 |
| Telefonica Vivo | Ciena | | 2/21/2013 |
| France Telecom | Alcatel-Lucent | | 2/6/2013 |
| KDDI | Infinera | 2/4/2013 | |
| Tata Communications | Ciena | | 1/24/20123 |
| Comcast | Ciena | 1/17/2013 | |
| SK Telecom | NSN | | 1/7/2013 |

Source: Company websites.

## Optical Market Forecast

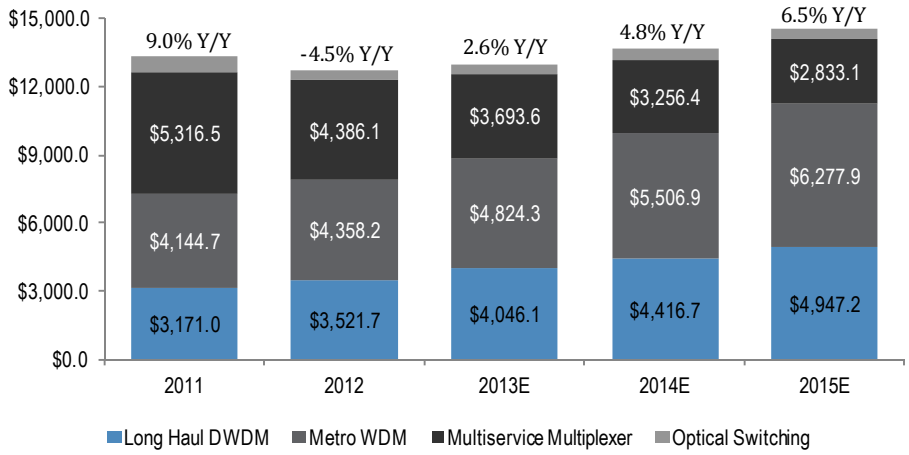
We are forecasting the overall optical to expand by 5% Y/Y as Optical Switching and Multiservice Multiplexer market declines offset the upside we see in the WDM market. We continued to expect growth to be driven by 100G as global carriers look to upgrade core capacity, which is reflected in our positive outlook for both Long Haul DWDM and Metro WDM markets growing 9.2% and 14.1% Y/Y in 2014, respectively. Our forecast may prove to be conservative if we see upside from announced metro network builds. Figure 105 below shows our forecast of the long haul and metro market as well as recent historical numbers.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





Figure 105: Long Haul and Metro Market Forecast




Source: J.P. Morgan estimates, Dell'Oro Group

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com



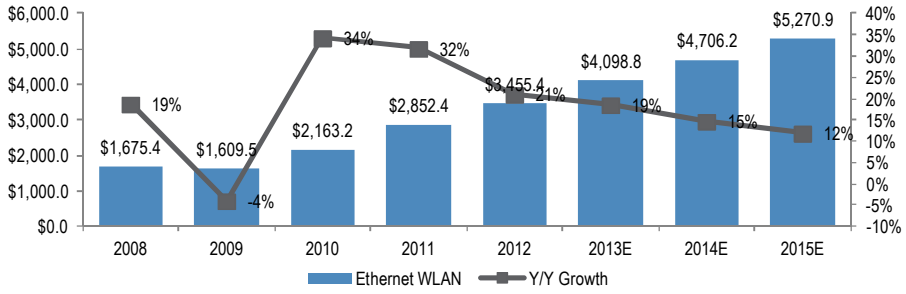


# Enterprise WLAN

While macro pressures and uncertainly continue to weigh on enterprise spending levels, we see strong underlying fundamentals driving enterprise WLAN market growth. The general vendor sentiment is that BYOD and Wi-Fi mobile device growth still provides upside as the enterprise campus environment migrates from the wired world toward totally wireless connectivity for employees. We expect continued WLAN growth to serve as a cannibalization threat for wired access as desktop ports become increasingly unnecessary. The acceleration in cloud based WLAN took shape in 2013 and we expect networking companies to jockey for share in this part of the market in 2014 along with continuing intense competition in the overall market.

We forecast overall enterprise WLAN market growth of 18.6% Y/Y in 2013 to $4.10B, before slightly decelerating to 14.8% Y/Y in 2014 to $4.71B as spending remains pressured from macroeconomic uncertainty. We are currently modeling 12.0% Y/Y growth in 2015 bringing the total enterprise WLAN market to $5.27B for that year. The rationale for decelerating growth is based on our belief that prices will continue to drop based on competition in all parts of the market (see following section for more detail).

**Figure 106: Enterprise WLAN Market Forecast**
$ in millions




Source: J.P. Morgan estimates, Dell'Oro Group

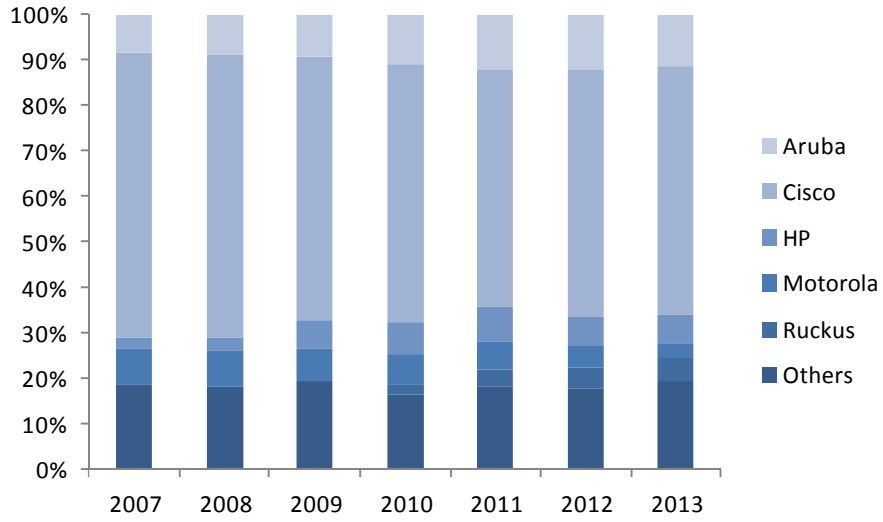
Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com



## Cisco Continues to Lead in Enterprise WLAN

The Enterprise WLAN market has been in a steady-state for the past couple years with the major vendors maintaining their historic range of market share. Cisco has dominated the market with mid-50s% market share since 2008 with the high being 66.5% in Q3'06. Since then, other players have entered the market and carved out small niches of share for themselves. As seen in Figure 107 below, the smaller vendors account for just 19% of the total market; this is unique to WLAN as other networking products are more concentrated. The lower-end of the market is made up of companies that have ~1% to ~3% of the market, including Alcatel-Lucent, Juniper Networks, and Xirrus.

Figure 107: Enterprise WLAN Revenue Market Share




Source: Dell'Oro Group

Revenue market share has remained relatively consistent since our last report. As competition has increased in the lower-end the smaller vendors have managed to extract 3.6% market share from the incumbents (Table 16). Motorola and Aruba saw their market share weaken by 1.9% and 1.6%, respectively, over the course of 2013. Cisco gained 1.4% Y/Y as the company moved to bundle wireless products with other networking business. We expect this generally trend toward share erosion by both Cisco and smaller players to continue in 2014.

Table 16: Market Share Changes

| Company | Q3'12 | Q3'13 | Δ Market Share |
|---|---|---|---|
| OTHERS | 8.2% | 11.8% | 3.6% |
| MOTOROLA | 4.8% | 2.9% | -1.9% |
| ARUBA | 12.3% | 10.7% | -1.6% |
| CISCO | 53.7% | 55.1% | 1.4% |

Source: Dell'Oro Group

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





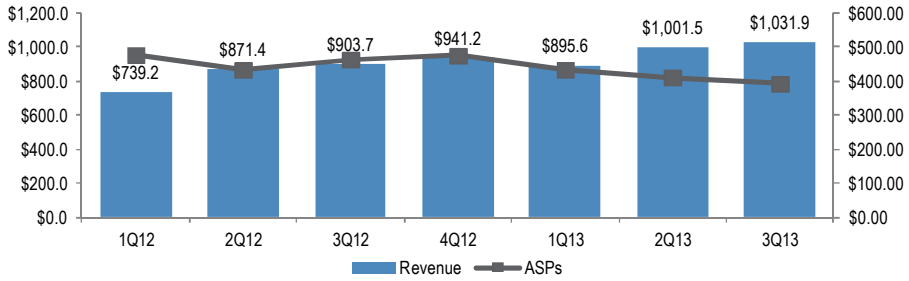
## Sustainability of Gross Margins

In this section we first review the revenue and pricing picture in the enterprise WLAN market. Next, we review recent trends in unit growth to look at where things are heading. We also apply scenario tests to examine potential downside based on ASPs and units. Lastly, we review the gross margin landscape as competition heats up. Competitors fall into one of two categories in our opinion: point-solution vendors or full-solution vendors. While point-solution vendors are only exposed to the WLAN market, full-solution companies have the ability to bundle WLAN with other products. On the other hand, point solution providers tend to be more agile and innovative. However, we believe the WLAN market is reaching a point of maturity which positions broad based vendors to take share from point solution vendors. We see this manifesting itself mainly in the battle between Cisco and Aruba but believe Cisco could increase pressure on a number of smaller vendors as it works to gather in the fast growing WLAN market. We believe all of this manifests itself via pressure on ASPs and margins.

### Revenue Grows while ASPs Continue to Drop

Historically, enterprise WLAN market revenues have grown at a very high rate. As you can see in Figure 108 below, the market has pushed forward with 21% Y/Y in Q1'13, 15% Y/Y in Q2'13, and 14% Y/Y in Q3'13. The annual view shows the same story with growth of 34.4% in 2010, 31.9% in 2011, and 21.1% in 2012. It is noticeable that the market is starting to taper off slightly while still growing at double-digit rates. However, revenue growth is not occurring in a fundamentally sound pricing environment. As you can see in the chart below, ASPs have been eroding rapidly with a few exceptions. In Q3'13, enterprise WLAN ASPs were $392.57, down 4.5% Q/Q and 15.2% Y/Y. With this, ASPs have declined 4.5% a year since 2003. We expect ASPs to continue to drop as competitive intensity continues to increase.

Figure 108: Historical Enterprise WLAN Revenue and ASPs




Source: Dell'Oro Group

### Can the Market Continue to Ship Ever Increasing Units?

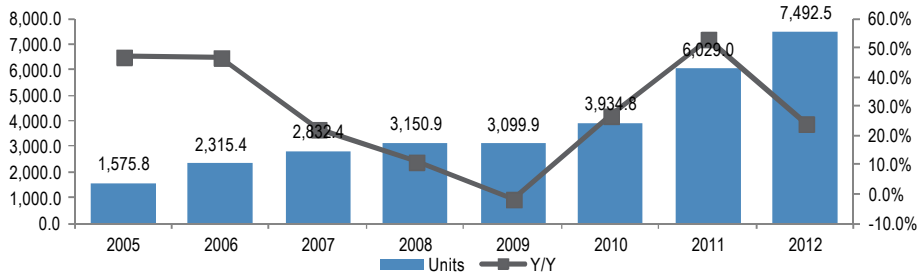
The sequential growth rate in units tends to vary significantly and therefore masks some of the underlying dynamics. For instance, units in Q3'13 grew to 2.63m, up 35% Y/Y. This exceeds the growth rate of the trailing three quarters (25%, 33%, 21%). In Figure 109, we look at unit growth over the past 8 years. Despite reaching its all-time high in 2012, we believe that units will continue to trend down over time. In 2012, the enterprise WLAN market grew by 24.3%, down 28.9% from the previous year. Also, the growth rate in 2012 is below the historic average for this

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com



market. Moving forward, we expect this rate to remain within the range over the medium term as enterprise continues to postpone any investment.

**Figure 109: Historical Enterprise WLAN Units**




Source: Dell'Oro

After reviewing pricing and volume, we believe the risk to consensus expectations is mainly in unit growth. Currently, we estimate that the enterprise WLAN market will grow by 18.6% in 2013 and 14.8% in 2014. With this, we are forecasting unit growth of 35.8% and 25.0% in 2013 and 2014, respectively. Based on our revenue and unit forecast, we are expecting ASPs to decrease of 12.7% in 2013 and 8.2% in 2014. In Table 17 and Table 18, we apply various ASP and unit scenarios based on our revenue and unit forecast of $4.1B and 10.69m, respectively, in 2013 and $4.7B and 12.72m, respectively, in 2014.

**Table 17: 2013 Scenario Tests**

$ in millions

| | | Units | | | | |
|---|---|---|---|---|---|---|
| | | 9,413.8 | 9,668.2 | 10,177.1 | 10,685.9 | 11,194.8 |
| ASP | $342.34 | $3,222.7 | $3,309.8 | $3,484.0 | $3,658.2 | $3,832.4 |
| | $352.41 | $3,317.5 | $3,407.1 | $3,586.5 | $3,765.8 | $3,945.1 |
| | $362.47 | $3,412.3 | $3,504.5 | $3,688.9 | $3,873.4 | $4,057.8 |
| | $372.54 | $3,507.0 | $3,601.8 | $3,791.4 | $3,981.0 | $4,170.5 |
| | $382.61 | $3,601.8 | $3,699.2 | $3,893.9 | $4,088.6 | $4,283.3 |
| | $402.75 | $3,791.4 | $3,893.9 | $4,098.8 | $4,303.7 | $4,508.7 |

Source: J.P. Morgan estimates.

**Table 18: 2014 Scenario Tests**

$ in millions

| | | Units | | | | |
|---|---|---|---|---|---|---|
| | | 11,769.3 | 12,087.3 | 12,723.5 | 13,359.7 | 13,995.9 |
| ASP | $314.40 | $3,700.2 | $3,800.2 | $4,000.3 | $4,200.3 | $4,400.3 |
| | $323.65 | $3,809.1 | $3,912.0 | $4,117.9 | $4,323.8 | $4,529.7 |
| | $332.89 | $3,917.9 | $4,023.8 | $4,235.6 | $4,447.3 | $4,659.1 |
| | $342.14 | $4,026.7 | $4,135.6 | $4,353.2 | $4,570.9 | $4,788.5 |
| | $351.39 | $4,135.6 | $4,247.3 | $4,470.9 | $4,694.4 | $4,918.0 |
| | $369.88 | $4,353.2 | $4,470.9 | $4,706.2 | $4,941.5 | $5,176.8 |

Source: J.P. Morgan estimates.

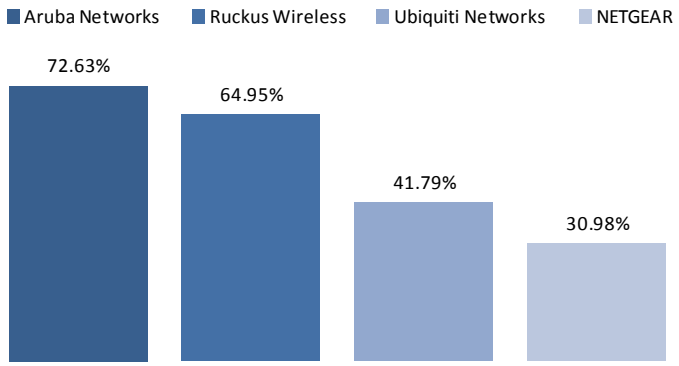
Currently, our central case is for the enterprise WLAN market to reach $4,099m and $4,706m in 2013 and 2014, respectively. This is based on a unit forecast that is slightly higher than the growth rate of 24.3% in 2012. However, we are also assuming an accelerated deterioration in ASPs that is significantly above the historic rate of 4.5%. Taking both of these factors into consideration, we still believe we are being relatively optimistic. If units and ASPs come in below our base case by 5% in 2013, revenue decline by ~$400m. Now, applying a 19.2% decrease in ASPs (ASPs

declined 13.9% in 2011) and keeping our base case unit forecast we would expect to see revenues drop ~$307m. *We believe the risk is to the downside of our current market estimates*.

**The Margin Picture**

As we mentioned earlier, the market is made up of point- and full-solution vendors. Based on differing corporate structures, we believe some companies are capable of becoming more aggressive on pricing if the overall market shows any sign of slowdown. Based on our revenue forecast, we anticipate pricing pressure to remain on its long-term glide path with the occasional quarter of relief. In Figure 110 we compare the company-wide gross margin of various wireless vendors. We believe that premium margins in this market are going to be harder to maintain over time as competitive intensity remains high. In this circumstance we see companies already accustomed to lower gross margins as better positioned than those with outsize profitability. In this context we expect Aruba to face gross margin pressure when/if pricing becomes more combative at the higher-end (Cisco) and the lower-end (Ubiquiti, Ruckus, and Netgear). Aruba's gross margin of 72.6% is substantially above the peer group, and therefore, at high risk of erosion in our opinion.

Figure 110: Wireless Vendor LTM Gross Margin




Source: Bloomberg

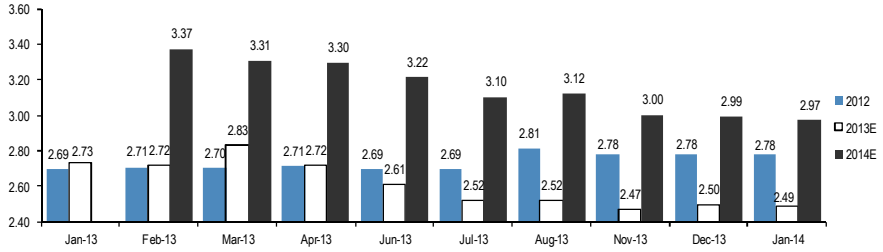
Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com



# Macro Overview

Our proprietary 55 country GDP aggregate indicates Real GDP growth of 2.97% Y/Y in 2014, better than 2.49% Y/Y in 2013. Currently, we do not expect any revisions to 2014 global GDP estimates and, if anything, we believe estimates can slip further. As you can see in Figure 111 below, 2013 growth estimates decreased ~24 bps since February 2013. Despite starting off 2013 with an estimate of 3.37%, the outlook for 2014 dropped ~40 bps – the rate of change has slowed with current 2014 estimates sitting just below 3.0%.

**Figure 111: Global GDP Growth Estimates Point to a Modest 2014**




Source: J.P. Morgan, OECD

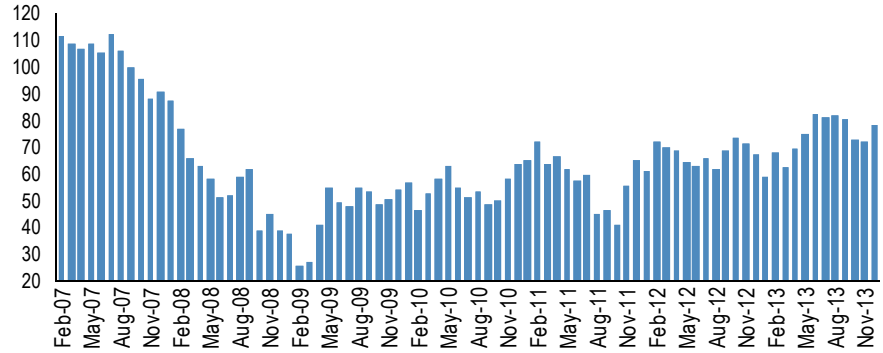
The United States, Europe, and China continue to show mixed signals. US GDP and consumer confidence finish 2013 on a strong note versus a slowing environment at the end of 2012. China is a completely different picture compared to the end of 2012 – Chinese consumer confidence deteriorated while GDP remains at ~7.7%. Europe appears to be stabilizing with unemployment turning the corner and confidence indices pulling back to par.

## US

*US consumer confidence slowly recovers*

US consumer increased 9.3% Y/Y in 2013 with Q2'13 and Q3'13 growing 15.1% and 24.6%, respectively. The confidence index declined to 58.4 in January after finishing at 66.7 in December. However, there was a slight recovery in Q1'13 to 61.9 (-10.9% Q/Q, -6.9% Y/Y). The index finished the year at 78.1, up from 64.8 and 66.7 in 2011 and 2012, respectively. While this is an improvement on an absolute basis from last year, we remain cautious as the fiscal picture is still quite cloudy.

**Figure 112: US Consumer Confidence**

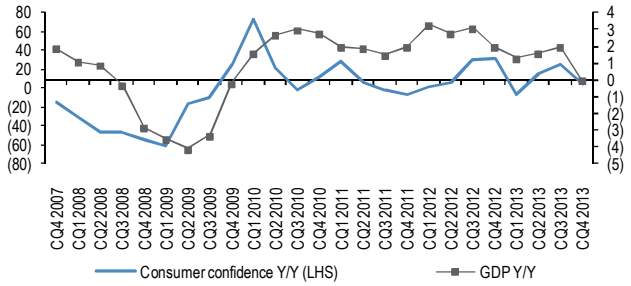



Source: Bloomberg.

*US GDP growth picks up in H2 2013*

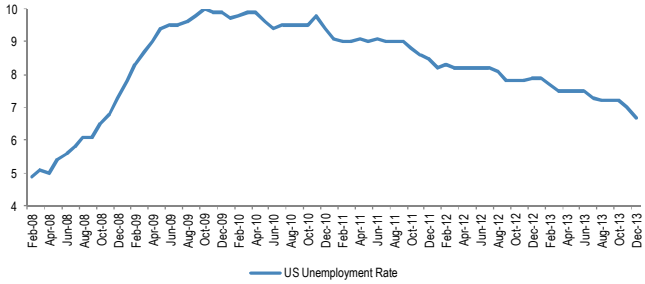
US GDP growth started 2013 slowly after growing 1.3% and 1.6% in Q1'13 and Q2'13, respectively. GDP growth in Q3'13 was 2% Y/Y which is down from 3.1% Y/Y in Q3'12. Unemployment inched down in Q4'13 to 6.7% after starting the year at 7.9%. The largest move came in Dec 13 when unemployment dropped by 30 bps – note that a majority of this shift has to down with lower employment base from participant falling out of the job market, in our opinion.

**Figure 113: US GDP and Consumer Confidence Y/Y Trend**




Source: Bloomberg.

**Figure 114: US Unemployment Rate Declined in Q4'13**

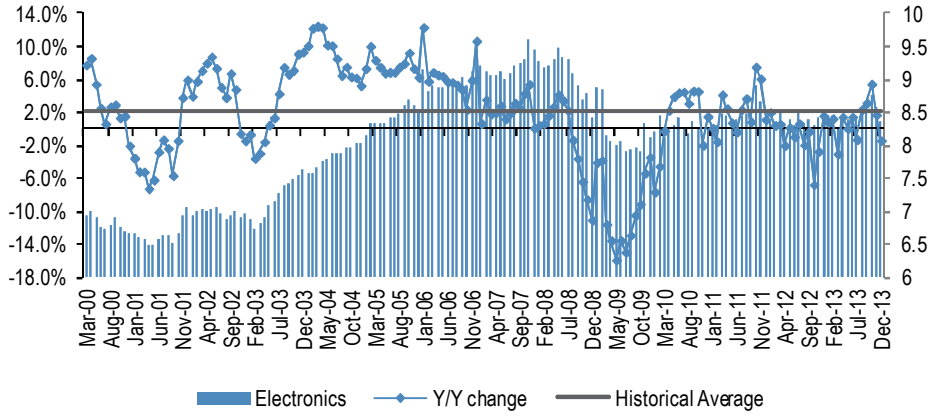



Source: Bloomberg.

*US retail electronic sales remain unchanged*

After growing 5.5% Y/Y in October, retail electronic sales changed by 1.8% and -1.4% in November and December, respectively. The market was relatively unchanged as Q4'13 grew 0% Q/Q and 2% Y/Y.

**Figure 115: US Electronics Monthly Retail Sales Data - Y/Y Change**




Source: Bloomberg.

## China

*Chinese consumer confidence deteriorated in Q3'13*

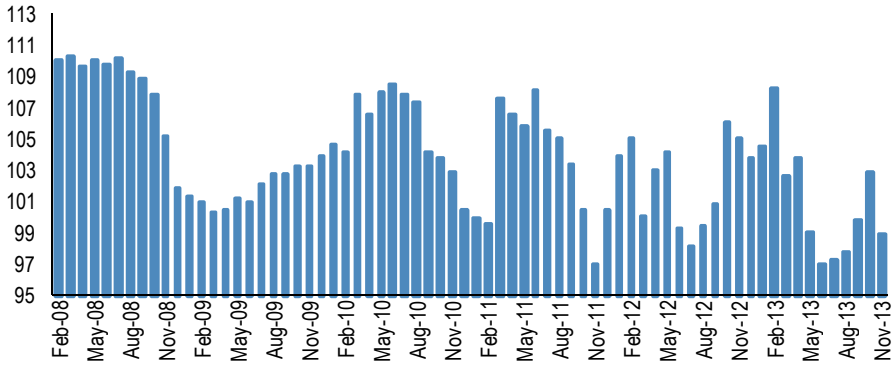
After reaching its highest point since June 2010 in February, the index fell to the trough of 2013 in June. Consumer confidence recovered slight during the summer and increased steadily towards the end of the year. However, in November the index decline to 98.9, down 5.9%Y/Y. While the trailing 6-month absolute value trend is encouraging, the year-over-year basis doesn't look a promising; the past 7 months have declined from this view. We remain cautiously with the ongoing month to month volatility and therefore, we are somewhat skeptical with regards anticipating sustainable levels of 100+.

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





Figure 116: Chinese Consumer Confidence Grew Q/Q in November

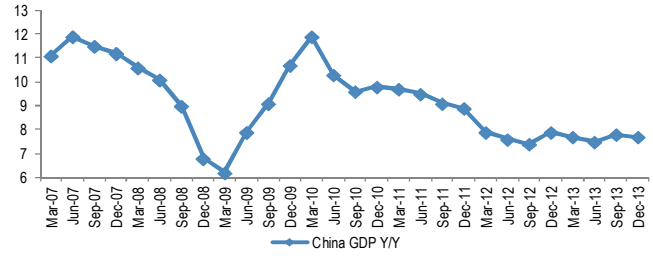



Source: Bloomberg.

*China GDP growth remained relatively flat in Q4*

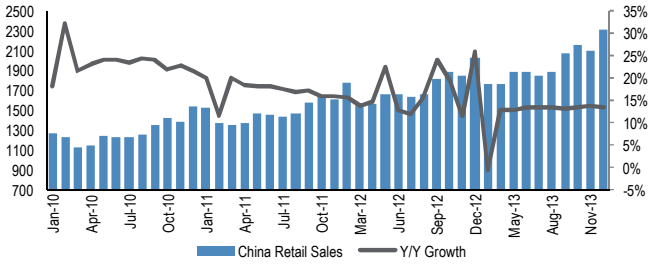
Chinese GDP expanded 7.7% Y/Y in Q4 compared to 7.5% and 7.8% in Q2'13 and Q3'13, respectively. Q4'13 growth is down 20 bps from 2012 and down 120 bps from 2011. Chinese retail sales grew 14% Y/Y in Q4'13. Sales grew by 13% Y/Y in December and were in line with retail growth throughout the end of the year – 13%, 14%, and 14% in September, October, and November, respectively.

Figure 117: China GDP Growth Declined Slightly in Q4




Source: Bloomberg.

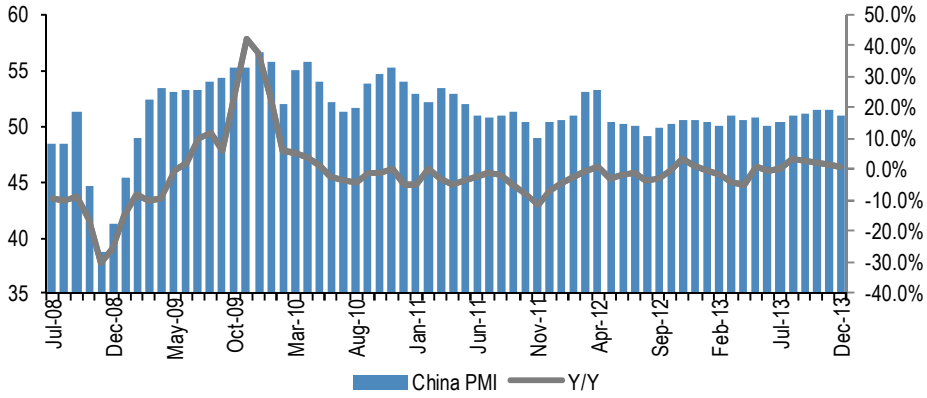
Figure 118: China Retail Sales Grew in Q4




Source: Bloomberg.

Chinese PMI rose 1.6% Y/Y in Q4'13, up from 1.1% Y/Y in 2012 and -8.6% Y/Y in 2011. The index slowed down in December to 0.8% after growing 1.6% in November and 2.4% in October.

Figure 119: China PMI Index Increases

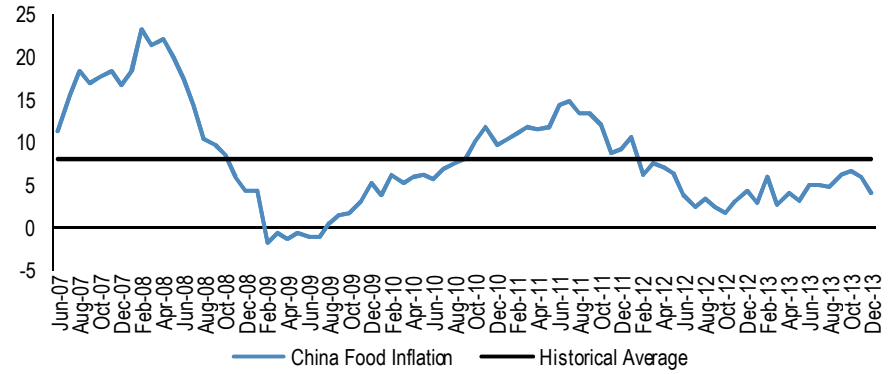



Source: Bloomberg.

*Chinese food inflation at relatively low levels*

After bottoming out in October of 2012, food inflation reaccelerated through the first half of 2013. In October of 2013 it reached its highest point in almost 18 months but then quickly slide to 4.1 (below the 5 year average of ~8.1) which around the level of inflation seen in February of last year.

**Figure 120: Chinese Food Inflation**



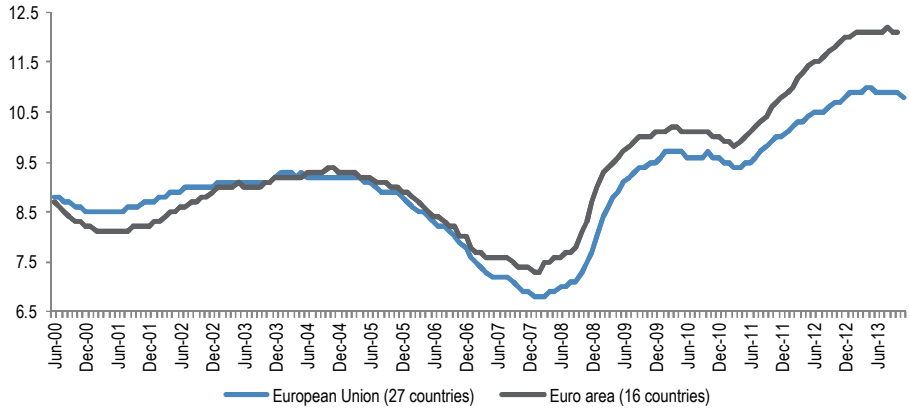

Source: Bloomberg.

## Europe

*European unemployment rate stabilizes*

After reaching 11% in April of 2013, the EU27 unemployment has recovered slightly in Q4'13. The rate inched down to 10.8% in November, down from 10.8% in Oct 13 and at parity with Nov 12. The EA16 unemployment rate is a different picture – the unemployment has resides at ~12.1% since Mar 13. While the unemployment rate is higher Y/Y, it appears to have stabilized and began to recover, in our opinion.

**Figure 121: EU27 and EA16 Unemployment Rates**



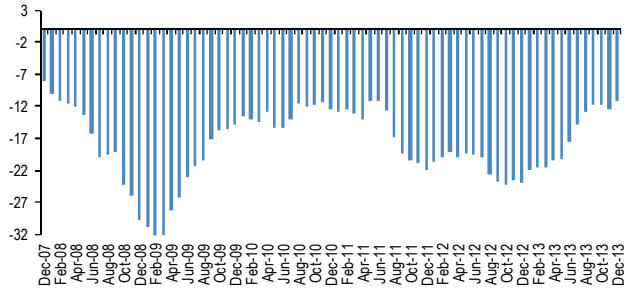

Source: Eurostat. The euro area (EA16) includes Belgium, Germany, Ireland, Greece, Spain, France, Italy, Cyprus, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia and Finland. The EU27 includes Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden and the United Kingdom

*European confidence finishes 2013 on a strong note*

After reaching -24.2 in October of 2012, European consumer sentiment improved through 2012 and 2013. In Dec, the index inched up to -11.1, up from -12.4 in Nov

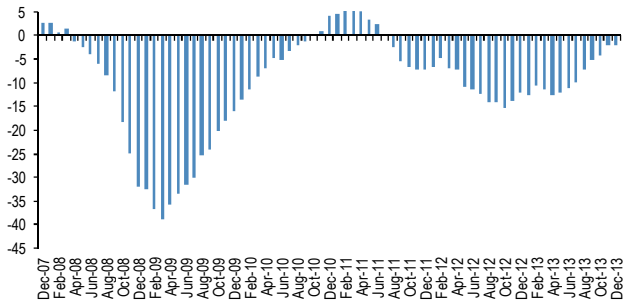
13 and -24.0 in Dec 2012. Meanwhile, the industrial confidence index also made headway. The index finished 2013 at -2 which is up significantly from the levels at the end of 2012. December was on par with November – we generally do not focus on month to month variation and expect the index to continue to improve. The retail business index declined sequentially but improved significantly from the prior month – -1.6 in Dec 13, up from -5.6 in Nov 13 and -10.2 in Dec 12. Despite the positive trends, we continue to remain cautious on enterprise sentiment as we look forward to 2014.

**Figure 122: European Consumer Sentiment Slightly Recovering**



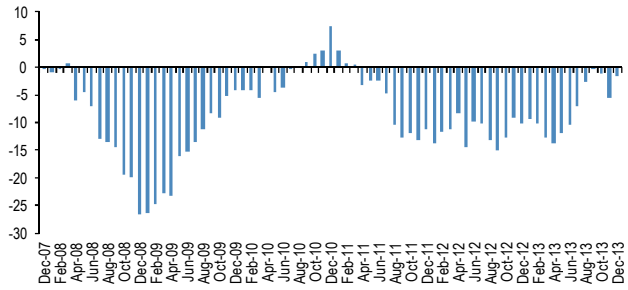

Source: Europa

**Figure 123: European Industrial Confidence Continues to Recover**




Source: Europa

**Figure 124: European Retail Business Index Improving**

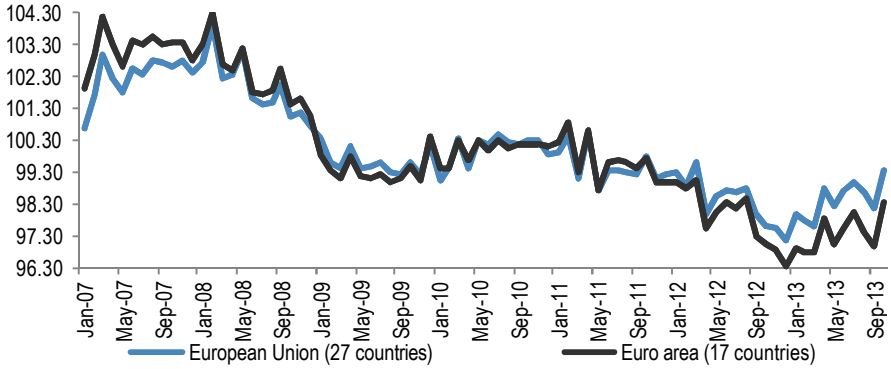



Source: Europa

*European consumer…*

After reaching a trough at the end of 2012, European retail volume has performed relatively well. In Dec 2013, the index was flat M/M, up sequentially and up 1.8% Y/Y. The corresponding EA17 index was flat M/M and up 1.5% Y/Y.

Figure 125: European Retail Trade Volume Stable

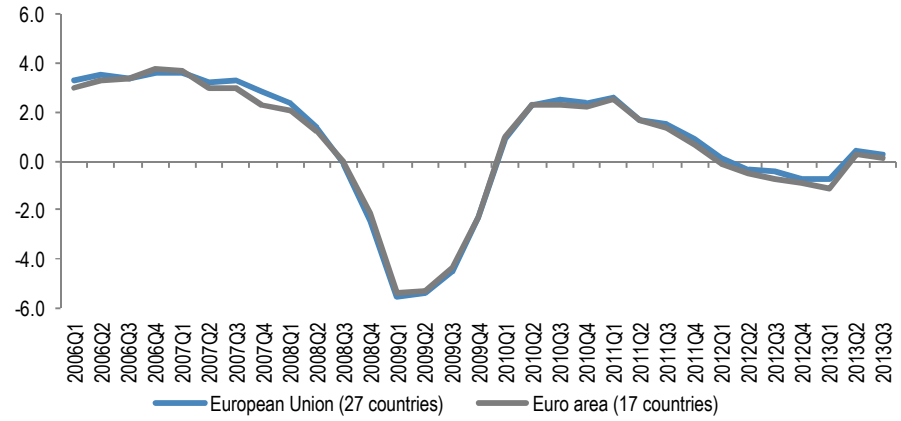



Source: Eurostat. The euro area (EA17) includes Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia and Finland. The EU27 includes Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden and the United Kingdom

*European GDP fades in 2H 2013*

After recovering from the 1H 2013, EU27 GDP grew 0.3% Y/Y which is slightly off the 0.4% Y/Y rate in Q2'13. However, Q3'13 was 70 bps above the contraction in Q3'12. The corresponding EA17 benchmark experience the same blimp in 2H 2013.

Figure 126: European GDP Turns Slightly Negative




Source: Source: Eurostat. The euro area (EA17) includes Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia and Finland. The EU27 includes Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden and the United Kingdom

**Companies Discussed in This Report** (all prices in this report as of market close on 24 January 2014)
Ciena Corp. (CIEN/$22.11/Overweight), Cisco Systems (CSCO/$22.20/Neutral), F5 Networks (FFIV/$104.91/Neutral), Infinera (INFN/$7.33/Overweight), Juniper Networks (JNPR/$27.72/Overweight)

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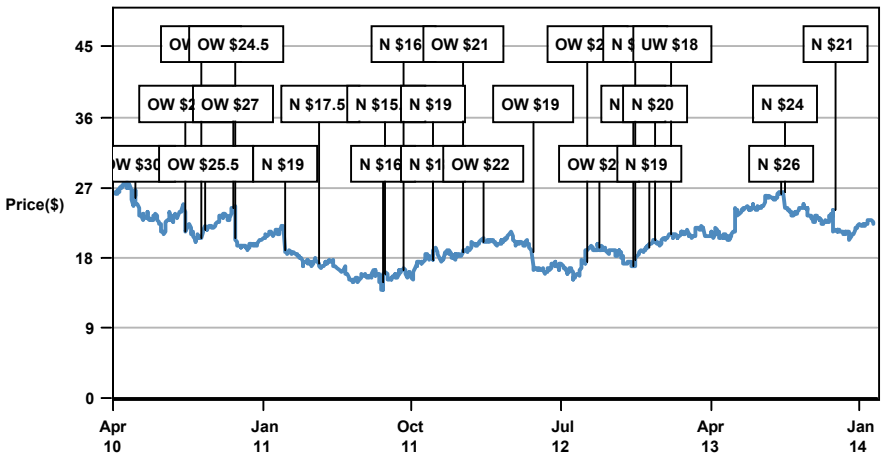
Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





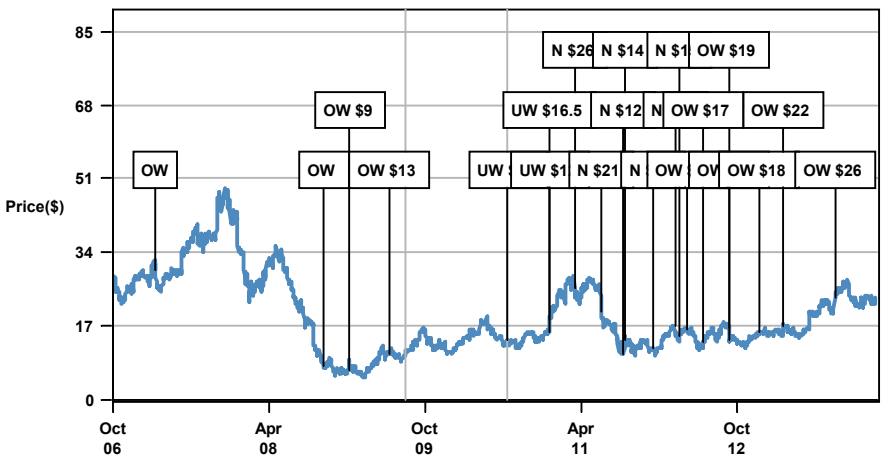
**Cisco Systems (CSCO, CSCO US) Price Chart**




Source: Bloomberg and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage May 13, 2010.

| Date | Rating | Share Price ($) | Price Target ($) |
|---|---|---|---|
| 13-May-10 | OW | 25.53 | 30.00 |
| 12-Aug-10 | OW | 21.36 | 25.50 |
| 10-Sep-10 | OW | 20.61 | 23.00 |
| 15-Sep-10 | OW | 21.59 | 25.50 |
| 08-Nov-10 | OW | 24.26 | 27.00 |
| 11-Nov-10 | OW | 20.52 | 24.50 |
| 11-Feb-11 | N | 18.92 | 19.00 |
| 14-Apr-11 | N | 17.25 | 17.50 |
| 08-Aug-11 | N | 14.94 | 16.00 |
| 11-Aug-11 | N | 15.92 | 15.50 |
| 14-Sep-11 | N | 16.35 | 16.00 |
| 07-Nov-11 | N | 18.03 | 18.00 |
| 10-Nov-11 | N | 17.61 | 19.00 |
| 03-Jan-12 | OW | 18.63 | 21.00 |
| 09-Feb-12 | OW | 20.00 | 22.00 |
| 10-May-12 | OW | 18.78 | 19.00 |
| 16-Aug-12 | OW | 17.35 | 20.00 |
| 10-Sep-12 | OW | 19.15 | 21.00 |
| 09-Nov-12 | N | 16.83 | 17.00 |
| 13-Nov-12 | N | 17.66 | 18.00 |
| 10-Dec-12 | N | 19.34 | 19.00 |
| 20-Dec-12 | N | 20.27 | 20.00 |
| 17-Jan-13 | UW | 20.95 | 18.00 |
| 09-Aug-13 | N | 26.26 | 26.00 |
| 15-Aug-13 | N | 26.38 | 24.00 |
| 14-Nov-13 | N | 24.00 | 21.00 |

**Ciena Corp. (CIEN, CIEN US) Price Chart**




Source: Bloomberg and J.P. Morgan; price data adjusted for stock splits and dividends.
Break in coverage Oct 08, 2008 - Jan 05, 2009.

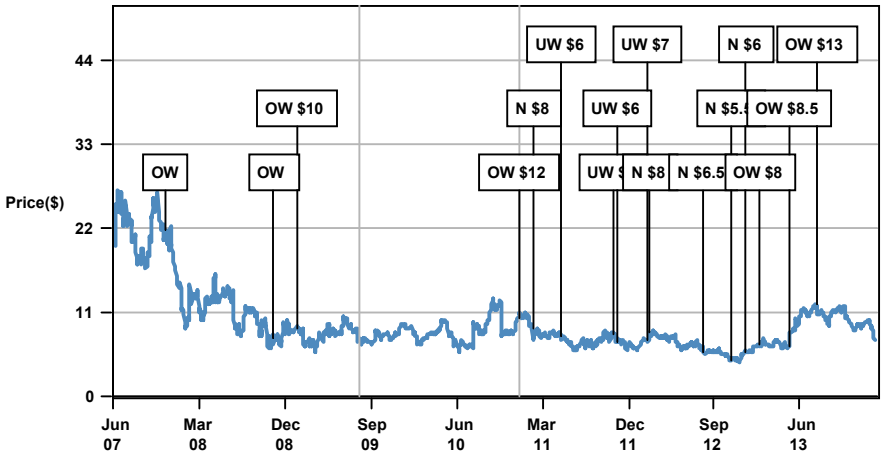
| Date | Rating | Share Price ($) | Price Target ($) |
|---|---|---|---|
| 28-Feb-07 | OW | 30.15 | - |
| 08-Oct-08 | OW | 7.87 | -- |
| 05-Jan-09 | OW | 6.98 | 9.00 |
| 29-May-09 | OW | 10.81 | 13.00 |
| 15-Jul-10 | UW | 13.78 | 11.00 |
| 08-Dec-10 | UW | 15.74 | 12.00 |
| 10-Dec-10 | UW | 18.36 | 16.50 |
| 08-Mar-11 | N | 25.68 | 26.00 |
| 09-Jun-11 | N | 20.29 | 21.00 |
| 26-Aug-11 | N | 10.45 | 12.00 |
| 01-Sep-11 | N | 13.78 | 14.00 |
| 09-Dec-11 | N | 12.03 | 12.00 |
| 21-Feb-12 | N | 17.00 | 16.00 |
| 08-Mar-12 | N | 14.79 | 15.00 |
| 04-Apr-12 | OW | 16.29 | 20.00 |
| 31-May-12 | OW | 13.55 | 17.00 |
| 27-Aug-12 | OW | 16.80 | 19.00 |
| 30-Aug-12 | OW | 13.67 | 16.00 |
| 13-Dec-12 | OW | 15.80 | 18.00 |
| 07-Mar-13 | OW | 17.15 | 22.00 |
| 04-Sep-13 | OW | 23.54 | 26.00 |

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





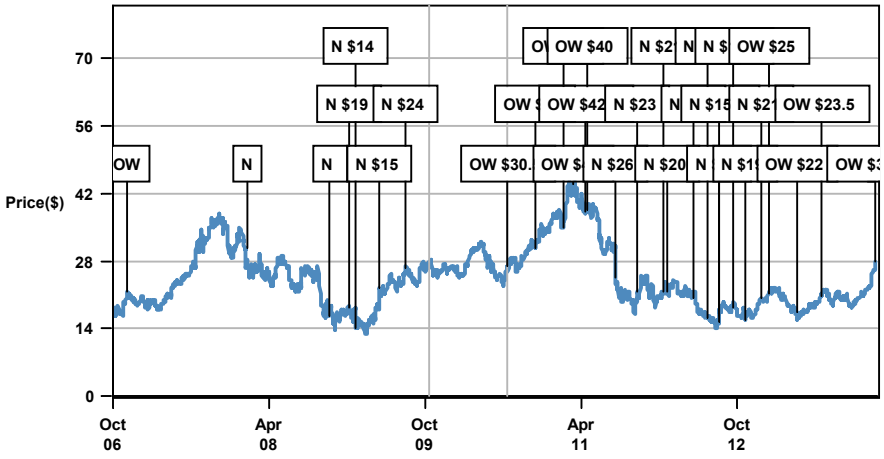
**Infinera (INFN, INFN US) Price Chart**




Source: Bloomberg and J.P. Morgan; price data adjusted for stock splits and dividends.
Break in coverage Oct 22, 2008 - Jan 05, 2009.

| Date | Rating | Share Price ($) | Price Target ($) |
|---|---|---|---|
| 16-Nov-07 | OW | 21.60 | - |
| 22-Oct-08 | OW | 7.52 | -- |
| 05-Jan-09 | OW | 8.98 | 10.00 |
| 16-Dec-10 | OW | 10.16 | 12.00 |
| 28-Jan-11 | N | 8.98 | 8.00 |
| 29-Apr-11 | UW | 7.82 | 6.00 |
| 14-Oct-11 | UW | 8.19 | 7.00 |
| 27-Oct-11 | UW | 7.08 | 6.00 |
| 30-Jan-12 | UW | 7.41 | 7.00 |
| 03-Feb-12 | N | 8.38 | 8.00 |
| 25-Jul-12 | N | 5.82 | 6.50 |
| 22-Oct-12 | N | 4.83 | 5.50 |
| 06-Dec-12 | N | 5.79 | 6.00 |
| 17-Jan-13 | OW | 6.79 | 8.00 |
| 25-Apr-13 | OW | 6.66 | 8.50 |
| 22-Jul-13 | OW | 11.97 | 13.00 |

**Juniper Networks (JNPR, JNPR US) Price Chart**




Source: Bloomberg and J.P. Morgan; price data adjusted for stock splits and dividends.
Break in coverage Oct 24, 2008 - Jan 05, 2009.

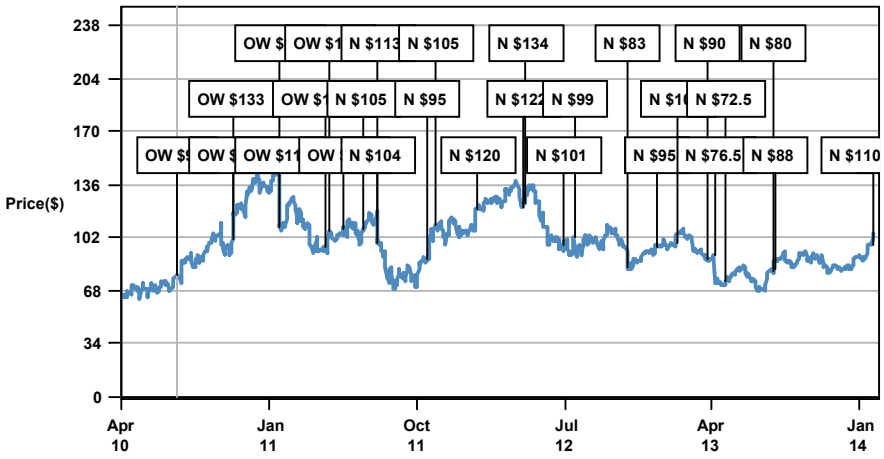
| Date | Rating | Share Price ($) | Price Target ($) |
|---|---|---|---|
| 21-Nov-06 | OW | 21.42 | - |
| 11-Jan-08 | N | 30.67 | - |
| 24-Oct-08 | N | 16.50 | -- |
| 05-Jan-09 | N | 18.39 | 19.00 |
| 30-Jan-09 | N | 14.16 | 14.00 |
| 24-Apr-09 | N | 22.33 | 15.00 |
| 24-Jul-09 | N | 26.55 | 24.00 |
| 15-Jul-10 | OW | 27.10 | 30.50 |
| 19-Oct-10 | OW | 30.54 | 35.00 |
| 24-Jan-11 | OW | 34.87 | 40.00 |
| 04-Mar-11 | OW | 44.11 | 48.00 |
| 14-Apr-11 | OW | 38.35 | 42.50 |
| 20-Apr-11 | OW | 38.47 | 40.00 |
| 27-Jul-11 | N | 24.66 | 26.00 |
| 14-Oct-11 | N | 21.56 | 23.00 |
| 09-Jan-12 | N | 21.53 | 21.00 |
| 27-Jan-12 | N | 21.69 | 20.00 |
| 23-Apr-12 | N | 20.17 | 22.00 |
| 13-Jun-12 | N | 16.36 | 19.00 |
| 23-Jul-12 | N | 15.22 | 17.00 |
| 25-Jul-12 | N | 16.50 | 15.50 |
| 10-Sep-12 | N | 18.21 | 18.50 |
| 24-Oct-12 | N | 15.99 | 19.00 |
| 20-Dec-12 | N | 20.35 | 21.00 |
| 17-Jan-13 | OW | 20.98 | 25.00 |
| 24-Apr-13 | OW | 17.36 | 22.00 |
| 22-Jul-13 | OW | 20.75 | 23.50 |
| 24-Jan-14 | OW | 27.72 | 30.00 |

Rod Hall, CFA
(1-415) 315-6713
rod.b.hall@jpmorgan.com





**F5 Networks (FFIV, FFIV US) Price Chart**




Source: Bloomberg and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Jul 15, 2010.

| Date | Rating | Share Price ($) | Price Target ($) |
|---|---|---|---|
| 15-Jul-10 | OW | 78.70 | 94.00 |
| 25-Oct-10 | OW | 100.83 | 106.00 |
| 27-Oct-10 | OW | 117.58 | 133.00 |
| 19-Jan-11 | OW | 141.78 | 151.00 |
| 20-Jan-11 | OW | 109.15 | 111.00 |
| 14-Apr-11 | OW | 96.70 | 108.50 |
| 21-Apr-11 | OW | 106.87 | 129.00 |
| 19-May-11 | OW | 108.18 | 122.00 |
| 23-Jun-11 | N | 107.62 | 105.00 |
| 18-Jul-11 | N | 113.94 | 113.00 |
| 21-Jul-11 | N | 98.87 | 104.00 |
| 21-Oct-11 | N | 88.92 | 95.00 |
| 04-Nov-11 | N | 109.62 | 105.00 |
| 19-Jan-12 | N | 120.00 | 120.00 |
| 16-Apr-12 | N | 122.04 | 122.00 |
| 19-Apr-12 | N | 124.21 | 134.00 |
| 28-Jun-12 | N | 97.80 | 101.00 |
| 19-Jul-12 | N | 102.75 | 99.00 |
| 25-Oct-12 | N | 83.00 | 83.00 |
| 20-Dec-12 | N | 96.44 | 95.00 |
| 24-Jan-13 | N | 98.81 | 105.00 |
| 22-Mar-13 | N | 89.03 | 90.00 |
| 04-Apr-13 | N | 90.42 | 76.50 |
| 24-Apr-13 | N | 74.89 | 72.50 |
| 22-Jul-13 | N | 80.34 | 80.00 |
| 25-Jul-13 | N | 81.42 | 88.00 |
| 23-Jan-14 | N | 97.48 | 110.00 |

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| IB clients* | 57% | 49% | 36% |
| JPMS Equity Research Coverage | 43% | 50% | 7% |
| IB clients* | 75% | 66% | 59% |

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