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Developing New Growth
Opportunities And Businesses At
The Intersection Of Smart Systems,
Services And The Internet Of Things

Internet of Things Investment & Corporate Development Report

May 2017

Harbor
Research

The light at the end of the 5G tunnel...

Every new generation of wireless networks delivers faster speeds and more functionality for devices. 1G brought us the very first cell phones, 2G let us text for the first time, 3G brought us online, and 4G brought us the speeds we enjoy today. But as more devices come online, 4G networks have just about reached their limit of what they're capable of, at a time when connected devices are growing at an exponential rate.

Now, we're headed towards 5G, the next generation of wireless. It will be able to handle 1000x the traffic of today's networks and up to 10x faster than 4G LTE. An HD movie will download in under a second... 5G will be the foundation for smart grids, virtual reality, autonomous driving, and every other category of the IoT. So what is 5G?

Essentially, 5G will be a combination of technologies that improve the efficiency and security of networks. We believe this is still a long way from becoming a reality, but the foundation of this technology is already seeing plenty of action. The foundation includes:

- » Millimeter wave spectrum: This section of spectrum has never been used before for mobile devices, and opening it up means more bandwidth for everyone
- » Small Cell Networks: millimeter waves have a tougher time traveling through obstacles, and small cell networks solve this problem through a relay of base stations.
- » Fiber: Small cells need signals, signals come from macro cells (base stations) and these signals will need to be connected (backhaul) by fiber networks.

This month we saw an aggressive bidding war emerge in spectrum, with Straight Path Communications entertaining offers from AT&T and Verizon, as well as continued consolidation in fiber from our friends at Oak Hill and Crown Castle.

We believe we're still a long way from the technology needed to support a 5G network, but carriers are quickly moving to acquire the foundational assets for this revolution in telecommunications.

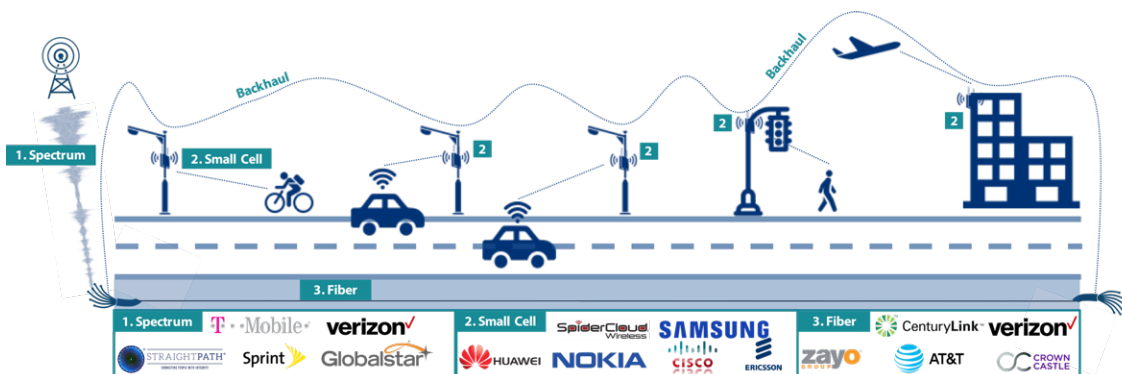


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Prior to joining Harbor, Colin was an analyst at Chicago based hedge fund, Coe Capital Management, where he focused on discovering, vetting, and executing growth and turnaround investments in public US equities in many sectors, including leading research on semiconductor technologies and capital equipment/components, as well as medical devices and diagnostics, network services, industrial manufacturing, transportation, natural resources, and consumer goods.

HARBOR RESEARCH EXAMINED IoT COMPANIES FOR KEY MOVES

The month of April saw \$2.5B in investment, primarily saturated in network infrastructure and cloud monitoring technology. However, we are also seeing an uptick in consolidation of container applications and wrote a quick primer because if you don't know what this is, you should.

This month we saw an aggressive bidding war emerge in spectrum, with Straight Path Communications entertaining offers from AT&T and Verizon, as well as continued consolidation in fiber from our friends at Oak Hill and Crown Castle.

We believe we're still a long way from the technology needed to support a 5G network, but carriers are quickly moving to acquire the foundational assets for this revolution in telecommunications.

Companies You Should Be Watching

Straight Path Communications

M&A and Investments

- » Fiber: Crown Castle International acquires Wilcon, Wave Broadband acquires Cascade
- » Network Hardware/Services: Airgain buys Antenna Plus, Riverbed acquires Xirrus, Sierra Wireless buys GlobalTop Technology's module business,
- » Industrial: Cognex buys ViDi Systems, Thales buys Guavus, ABB acquires Bernecker + Rainer
- » Connected Car: Siri acquires Automatic
- » AR/VR: AMD acquires VC-backed Nitero
- » Energy: Qundis buys Kalorimeta
- » Blockchain: Spotify acquires Mediachain

People Moving

- » Qualcomm Rearranges Tech Team, James Thompson Named CTO
- » Verizon hires former Ericsson CEO, Hans Vestberg as head of Network and Tech
- » Zoox hires new Chief Safety Innovation Officer
- » 802 Secure hires Michael Raggo as Chief Security Officer

Partnerships

- » Network Services: Comcast joins LoRa Alliance
- » Industrial: ABB and IBM partner for industrial AI
- » Insurance: Liverpool Victoria partners with TH_NK for IoT

Technology You Should be Watching: Containers

- » M&A: Oracle acquires Wrecker, Microsoft buy Deis
- » Private Funding: Sapho, PortWorx

Private Funding

- » AR/VR: Pluto VR debuts with \$14M Series A
- » Vehicles: Renovo, Otonomo, Aurora Innovation, Luminar, Valens, Luminar, Mobvoi, Valens
- » Platforms: Sensoro, Plume, Tinicum
- » Medtech: Neural Analytics
- » Network / Network Services: GoTenna raises \$7.5mm
- » Robotics: UiPath
- » Security: Ledger
- » Smart Home: August Home
- » Storage: Snowflake Computing, Tegile

New Funds:

- » Seedplus, an early IoT investor, raises an \$18mm
- » Javelin Venture Partners raises a \$125mm fund
- » Founders Factory invests in its first two A.I. startups

Least Valuable Players:

- » Juicero raises \$120mm for a connected juicer
- » Square buys Yik Yak's engineers for a fraction of the company's peak valuation
- » Intel's private market valuation of Cloudera is halved in its I

Spectrum value: How much are carriers willing to pay for these scarce assets in 5G?

01

COMPANIES YOU SHOULD BE WATCHING

Companies You Should Be Watching

Spectrum: Straight Path Communications (NYSE: STRP) grew their market cap by 6x this month as a bidding war emerges for the company's spectrum assets.

Why is there a bidding war? This has been covered in nearly every tech outlet, so here's the quick and dirty from Straight Path's eventful 2017:

- Jan 12th: STRP [settles](#) with the FCC for \$100mm, surrenders their 5G licenses, but they're told they can keep \$85mm in cash if they sell before 2018
- Apr 10th: AT&T [offers](#) to purchase the company for \$1.6B or a 162% premium
- Apr 13th: [Rumors](#) of a Verizon bid begin circulating
- Apr 25th: New [mystery](#) bidder tops AT&T's offer. AT&T has 5 days to match
- May 10th: The deadline for a matching offer was 12pm ET, but there was no news to reflect any new bids.

Why is this spectrum so valuable? These licenses are an essential component for building a 5G network capable of handling increased download speeds. They're designed for use by IoT products like self-driving cars that require a consistent signal but commonly operate out of the reach of Wi-Fi. Additionally, the mmWave spectrum is not interchangeable and the supply is limited.

What kind of spectrum do they own? The licenses Straight Path owns cover the 39 GHz and the 28 GHz band. Both will enable higher capacity and faster data transmission, but the 39 GHz (roughly 86% of their licenses) has proven to be more difficult to use because it's a space-to-earth directional frequency versus the earth-to-space direction of 28 GHz. Interference from signals originating in space is [still a hurdle for telcos](#).

So 28 GHz is the golden goose. Who else owns it? Verizon. Sort of. When they [bought XO Communication's](#) fiber network assets earlier this year, they also purchased a lease of the spectrum, with an option to buy at the end of 2018.

How much of this value is hype? There's some logical comp-math you can find [here](#) suggesting it's only worth \$289mm, but the analyst has no telecommunications background. However, it points out the valuation nightmare and the potential hype that's getting priced in to these assets. The corporate strategy teams at AT&T and VZ may have more information and insight to the future of networks, but it looks quite frothy from the sidelines.

What have we learned? As far away as 5G might be, the infrastructure assembly is in process, and with limited spectrum licenses and high valuations, carriers clearly believe these assets have the ability to decide between success and failure.

Oak Hill's quietly build a leadership position in fiber assets

02

M&A and INVESTMENTS

M&A and Investments

Fiber: Crown Castle International (NYSE: CCI), the wireless infrastructure real estate investment trust (REIT) **acquired** Wilcon to increase their fiber assets and enhance small cell capabilities.

- What do they do? Wilcon has built 1,900 route miles of fiber, mostly in Los Angeles and San Diego.
- Why did Crown Castle acquire them? Upon closing the acquisition, Crown will own or have rights to over 28,000 route miles of fiber. This will complement their tower-heavy holdings in the near term, and longer term, it will provide them with the opportunity to capture more incremental capex from carriers as fiber is the largest cost and underlying asset to small cell deployments.
- Strategy? CCI has **traditionally** been a tower company, but they're moving to a fiber provider focused on small cell opportunities. In the past two years, they've purchase three fiber operators: FiberNet (17,500 route miles), Senesys (10,000 route miles), and 24/7 Mid-Atlantic (800 route miles).
- Competitors? There's heavy small cell competition from the likes of Zayo, Lighttower, and more recently, Verizon and T-Mobile. It's widely **rumored that Zayo** (NYSE: ZAYO) is the next target of these larger players, especially Crown Castle given their more focused position in the value chain of network infrastructure and services when compared to the larger carriers like Verizon and T-Mobile.
- Valuation? CCI has \$320mm in cash and \$13.5B in debt and holds a valuation of 57x trailing twelve month EV to EBITDA. ZAYO has a slightly higher leverage ratio and they're valued at 13x EV to EBITDA.

Fiber: Oak Hill makes another fiber asset acquisition through **Wave Broadband's acquisition** of Cascade Networks. **We covered** their fiber history last month.

- Why? Oak Hill is a private equity shop that's been executing on an **aggressive** fiber acquisition strategy through their holding **companies** Wave Broadband, Metronet, Wave, Atlantic Broadband, and Wide Open West.
- Where does Wave Broadband fit? The companies vary by geographic focus, and Wave covers the Pacific Northwest. Their acquisition of Cascade adds 350 route miles of fiber across Washington and will supplement their existing infrastructure across Washington, California, and Oregon. It's the company's 22nd acquisitions since launching in 2002, and this past September, they **raised \$125mm** to expand their asset holdings.

Riverbed's SD-WAN offering expands with their acquisition of Xirrus

Network Hardware: Airgain (NASDAQ: AIRG) buys Antenna Plus for \$6.4mm.

- What do they do? Antenna Plus has a range of mobile, in-building and outdoor antenna solutions for private network government, public safety, and automatic vehicle locator markets. They also make antennas for connected kiosks/vending machines.
- Why did Airgain buy them? Airgain makes antennas for a number of devices, including set-top boxes, Wi-Fi routers, and digital TV's. The acquisition adds to its product line-up with GPS, cellular, Wi-Fi, and private radio frequency antennas.
- Valuation? Disclosed financials reflect that Antenna Plus generated 2016 revenues of \$7.5mm, so it looks like the deal was less than 1x TTM sales. Management also stated that they expect the transaction to be accretive within 2017. Airgain has \$45mm in cash, \$2.7mm in debt and trades at 20x trailing twelve month EV to EBITDA.

Network Services: Riverbed (NASDAQ: RVBD) [acquired](#) Xirrus, a wireless networking specialist.

- What do they do? Xirrus essentially builds enterprise-grade Wi-Fi kits that deliver multiple access points in a single framework.
- Why is Riverbed buying them? Riverbed is one of the leading WAN (wide area network) optimization vendors, which are private networks that connect branch offices of large corporations, enabling them to control and secure their long distance network connectivity without having to rely on the public Internet. Xirrus will be used to expand the capabilities of software defined WAN offering, SteelConnect by adding enterprise grade Wi-Fi functionality with high density access points and cloud services.
- What's software defined networks (SDN)? Think of transportation in Manhattan. The roads are the network, and the cars, buses, bikes, and pedestrians are packets of data. Now, imagine there was some sort of master traffic planner, whose role was to make sure everyone gets to their destination as quickly and safely (reliably) as possible. They can manipulate the rules such as moving a lane in an empty road to one with gridlock or giving bikes, trucks, and cars their own lanes so they don't interfere with each other. This is what SDN does. Network administrators can manage data traffic responsively to ensure efficiency and reliability.

Cognex makes its fifth acquisition in industrial vision over six months

- Who do they compete with? Steel connect competes with Silver Peak's [Unity EdgeConnect](#), [Versa Networks](#), [Citrix's NetScaler](#), [Cloudgenix](#), and [Cisco's Meraki](#) solution.
- Valuation? Financial details of the deal were not disclosed beyond Xirrus's annual revenues being between \$50 to \$100mm, and Riverbed was [brought private](#) by Thoma Bravo in 2015.

Industrial: Cognex (NASDAQ: CGNX) [acquired](#) ViDi Systems, a maker of deep learning AI for industrial machine vision.

- What do they do? ViDi's software uses artificial intelligence to improve image analysis where it's difficult to predict the full range of image variations that could be encountered. Using feedback loops, the software then trains the system to distinguish between acceptable variations and defects.
- Why did Cognex acquire them? Cognex has pursued an active industrial vision-based M&A strategy recently, acquiring 3D vision companies such as Boulder-based [Chiaro Technologies](#) in November 2016, [EnShape](#) in October 2016, and [Aqsense](#) in August 2016, as well as barcode verification provider [Webscan](#) in December 2016. As most of these are sensor platform technologies, ViDi's AI solutions will provide the engine to the industrial data collection.

Industrial: Thales acquires machine intelligence and big data analytics platform, Guavus for \$215mm.

- What do they do? Guavus is an eleven year old machine analytics platform who's found a niche in supporting infrastructure for large communication service providers, including the five largest North American mobile operators, 4 of the top five internet backbone carriers in the world, and seven of the top eight cable operators.
- Why did Thales acquire them? Thales' [push into IoT](#) data management will be well-suited for Guavus, and their core markets in aviation, trains, energy, and city infrastructure will be logical adjacent markets for Guavus, after conquering the communications space.

"The most important deal ABB has ever done" - CEO, Ulrich Spiesshofer

Industrial: ABB acquired Bernecker + Rainer Industri-Elektronik (B&R), an open source machinery and factory automation platform for an [estimated \\$2B](#).

- What do they do? B&R was founded in 1979 and has historically made programmable controls for machines used in discrete manufacturing, specifically by automakers BMW, Daimler and Volkswagen. More recently, the company has put all their chips into machine and factory automation.
- Why did ABB acquire them? ABB's considered [2nd place](#) in industrial automation, against lifetime rival Siemens leading the charge, and ABB's CEO confirmed this characterization, saying that Siemens is number one in factory automation and ABB is number one in process automation but now a key player in factory automation.
- Valuation? The best estimates we could find were [\\$600mm](#) in fiscal 2016 revenues, and this would equate to a 3.3x trailing twelve month sales multiple. Not bad for "[the most important deal ABB has ever done.](#)"

Connected Vehicles: SiriusXM (NASDAQ: SIRI) [acquired](#) connected car company Automatic for over \$115mm.

- What do they do? Automatic offers a device that users plug in under their dashboard and syncs data to their mobile app such as trip logging, engine light diagnostics, crash alert, parking tracking and more. More importantly, Automatic's been building partnerships with insurance providers who then provide subsidies to their policy holders to use the devices.
- Why did SiriusXM acquire them? The acquisition adds to the company's connected car, data collection offerings, allowing them to stay relevant while users utilize mobile media for in-car entertainment. And even though this retrofitted monitoring is likely only a temporary success because OEMs will build this technology into vehicles on proprietary platforms, there's still a market for tape adapters, so this device might have a fat tail.
- Competitive advantage? Automatic can integrate and coordinate with other devices like Nest and wearables like Pebble. In this way, Automatic goes above and beyond other OBD-2 dongle companies to create the first true V2X offering we've seen.
- Valuation? There was no financial data released besides the acquisition size which would be frustrating as a shareholder, but SIRI's now holding a mere \$230mm in cash on \$6B in debt while garnering a 17x trailing twelve month EV to EBITDA valuation

AMD's effort to catch up in VR with their acquisition of Nitero

AR/VR: Advanced Micro Devices (NASDAQ: AMD) [acquires](#) VC-backed Nitero, who builds wireless chips for streaming VR content from desktop computers to headsets.

- What do they do? Nitero is one of the few companies in the world building 60 GHz mmWave radio technologies, especially for wireless VR. More simply, they're enabling wireless VR through a high rate data connectivity (the same frequency that Apple's wireless charging patent claims; see "Product Announcements" section).
- Why did AMD buy them? AMD's been facing pressure against Intel and Qualcomm who have already built [wireless divisions and 60 GHz](#) technologies for virtual reality, and this acquisition reflects AMD ensuring a seat at the table in the VR ecosystem.
- Who else is doing this? As noted, the big players like Intel and Qualcomm are exploring this technology, but we'd recommend keeping an eye on [Peraso](#), who recently raised a [Series C](#) led by Integrated Device Technologies (NASDAQ: IDTI) and SiBEAM, a subsidiary of Lattice Semiconductor.

Energy: Qundis, a sub-metering business owned by HgCapital, [was sold](#) to German indoor climate control group Kalorimeta.

- What do they do? Qundis's connected meter devices are used to monitor data about heat and water usage in households and their acquirer Kalorimeta is a provider of climate-intelligence solutions for buildings.
- Who's the winner here? HgCapital will mark a 3.5x investment multiple on a 30% IRR from the 2012 investment.

Blockchain: Spotify acquired blockchain startup Mediachain to connected artists with the tracks hosted on the company's service.

- What do they do? Mediachain has developed a decentralized, peer-to-peer database to connect applications with media and the information about it, as well as an attribution engine for creators. They also developed a blockchain-enabled cryptocurrency that rewards creators for their work.
- Higher level? They were using blockchain to help solve problems with attribution.
- Why Spotify? Last year, Spotify settled a licensing dispute over unpaid royalties after failing to obtain licenses to reproduce musical work. The lawsuit claimed that as much as 25% of the activity on the platform is currently unlicensed, and Spotify was forced to [pay \\$25mm](#) to settle. Now, the [IPO rumored](#) company has the technology to locate and pay these royalties.

Qualcomm replaces CTO with Wi-Fi expertise

People Moving

Qualcomm names EVP of Engineering, James Thompson to CTO, and they're moving the former CTO, Matt Grob to EVP of Technology.



- **Takeaway:** This is likely a product of the NXP merger, but both will still report to CEO Steve Mollenkopf. New CTO, Thompson, will now oversee corporate R&D and engineering after a strong record of developing the company's W-CDMA, LTE, and Wi-Fi technologies, and Grob, who was CTO for 6 years and pushed development for 5G-NR and LTE-U will continue the efforts on both technologies.

Verizon hired former CEO of Ericsson, Hans Vestberg, as VP of Verizon's new Network and Technology team.

- **Takeaway:** Verizon recently reorganized the company into three main divisions, and they brought in Vestberg to lead the newest division, Network and Technology. He will be tasked with leading the company's wireless fiber strategy, and the move comes less than a year from his departure from a 7-year, recently **thorny** tenure as CEO at rival Ericsson.

Zoox, the stealth-mode autonomous driving technology supplier **hired** Mark Rosekind, the former head of the National Highway Traffic Safety Administration (NHTSA) as Chief Safety Innovation Officer.

- **Takeaway:** The NHTSA is in charge of federal vehicle regulations, so it's easy to see the value of Rosekind for autonomous vehicle technology firm that he was previously regulating. Most recently, the new DOT Secretary Elaine Chao stated that she was reviewing guidelines enacted under Rosekind, but she cited concerns about the job losses; Whereas the industry is widely concerned about state to state variances in laws and the requirements to hand over data, potentially revealing trade secrets and proprietary information.

802 Secure, the IoT security company who just **raised \$6mm** in funding, hired Mike Raggio as its chief security officer.

- **Takeaway:** 802 Secure is working to secure the fragmentation of different OS and applications in the IoT market, and the hiring of Michael Raggio is a major vote of confidence for this company. Raggio's an IoT security expert who's written two books on data security, frequently presents at industry conferences, and he's briefed both the Pentagon and FBI on the topic.

Comcast adds leverage to LoRa and ABB partners with IBM on industrial AI

04

Partnerships

Partnerships

Comcast joins LoRa alliance

- Why should you care? This move follows Comcast's [October announcement](#) of testing low-power wide-area (LoRa) network with chip manufacturer Semtech Corp (NASDAQ: SMTC), and it officially pits the cable provider against network providers and LTE/5G disciples AT&T and Verizon who have been targeting similar verticals such as smart metering and asset tracking.
- What is it? When compared with WiFi, LoRa is a wireless network that's cheaper and optimizes the life of batteries. The technology is owned by Semtech, who acquired it from French startup Cycleo, and it's a more distributed concept when compared with Sigfox or LTE-M because they allow each mobile operator partner to roll out the infrastructure on an independent basis, so anyone can succeed or fail. However, Semtech's the sole supplier of LoRa chips and make \$0.50 on each one sold, so it's not exactly open-source as it's marketed.
- Who else is leveraging LoRaWAN? Cisco has piloted a LoRaWAN offerings with the Hamburg Port Authority in German, Softbank is using the network to supplement their NB-IoT applications
- A great primer on these networks can be found [here](#).

ABB, IBM [partner](#) for industrial artificial intelligence.

- Why? Whereas ABB's rival, GE is acquiring companies like Bit Stew and Wise.io for artificial intelligence, ABB will be utilizing Watson. These technologies will be used in industrial for tasks such as identifying root causes, decreasing downtime with predictive maintenance, and optimizing energy use.

Liverpool Victoria (LV), the largest insurance provider in the UK, partners with TH_NK to develop strategies to insure driverless cars and the Internet of Things.

- Why? LV has vowed to increase their digital spend to \$110mm over the next three years in an effort to keep up with the innovative rental insurance and IoT-focused startups like Lemonade and Trov, who we highlighted [recently](#).

Wireless charging is still a dream, but it's nearing reality

05

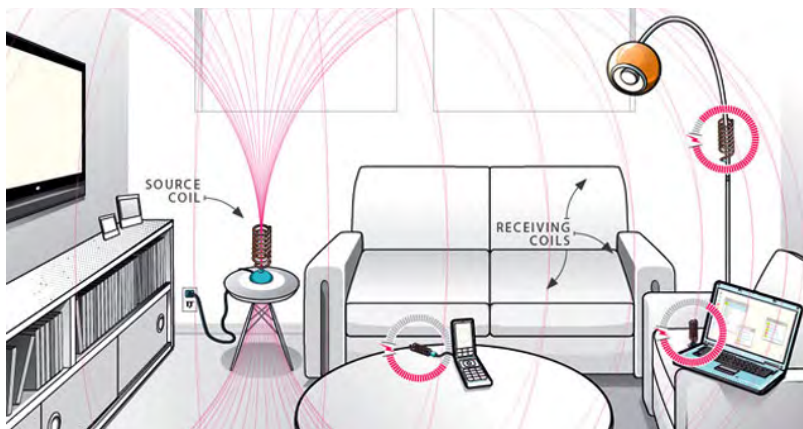
Product Announcements

Nvidia (NASDAQ: NVDA) is developing edge camera analytics. [Continuing](#) the narrative on Mobileye's potential as a software company, Nvidia's following the same path of using their graphics processing units (GPUs) as deep learning data centers inside the devices.

- What are they doing? Check out [last month's introduction](#) for more detail, but they're basically moving the cloud back to the device. Back to the silicon, to be specific.
- Why is processing move to the edge? Bandwidth, latency, privacy, and availability. Bandwidth's becoming an issue with cloud processing, particularly for video with cameras moving to 4k, so this is the first of many data processes transitioning away from the cloud.

Apple's released a patent indicating their investigation of wireless charging over radio frequencies.

- How does this work? The [patent's](#) titled, "Wireless Charging and Communications Systems with Duel-Frequency Patch Antennas," and it utilizes the beamforming antennas we highlight in this month's 5G playbook to locate and focus a signal for improved range and charging speed. Further, the patent cites transmitting power through the 60 GHz which utilizes high rate data connectivity ([up to 7 Gbps](#)) over small distances.
- Who else is doing this? Earlier this year, [Disney Research](#) debuted a room where multiple devices could be charged wirelessly. However, Integrated Device Technology (NASDAQ: IDTI) has been leading innovation in this space since its emergence – we profiled them in the [March article](#) on Fiber consolidation.

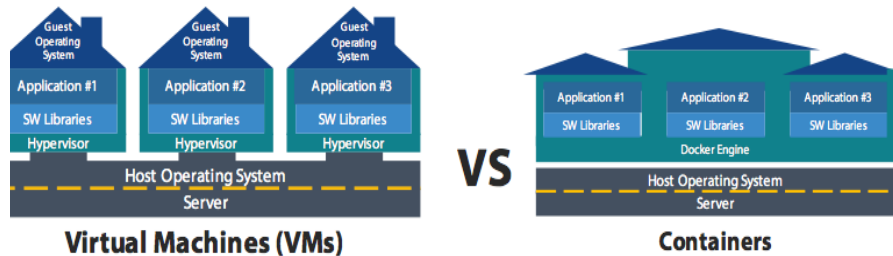


Containers: A replacement for SaaS?

06

Technology You Should
be Watching

Technology You Should be Watching: Containers



Source: Harbor Research

We're seeing a spike in interest in containerized application technology, so here's a quick primer.

- What problem does it solve? For years, developers have struggled when a supporting software across various environments in traditional virtual machines (VMs). This could mean moving from a dev's laptop to a test environment, data center, or virtual machine. These various coding environments and even network topology cause bugs and major headaches for developers, but containers solve this issue.
- How do containers solve this? A container consists of an application, plus all its dependencies, libraries and other binaries, and configuration files needed to run it, bundled into one package. By containerizing the application platform and its dependencies, differences in computing environments and underlying infrastructure are eliminated.
- Any downsides? When compared with virtual machines (VMs), security is a concern. Containers are less isolated from each other than vertical machines, so if there's a vulnerability, it can affect other containers, though several companies like Aqua Security have emerged to solve this problem.
- Simpler? Think of VMs as houses and containers as apartments. With a house, you have your own standard infrastructure – electricity, water, heating, etc, but they're expensive and often contain more room than you need. Apartments, on the other hand, come in all kinds of sizes, so you rent what you need and can easily relocate; But the building shares electricity, water, etc, causing a vulnerability to run across a number of units.
- Replacement to SaaS? SaaS is based on multi-year, user count contracts, and the expenses impact EBITDA because of their impact on operating expenses, whereas containers as a service (CaaS) are based on one payment, can be capitalized for on-premise costs, and offers full user ownership of the data.

Large companies across a diverse set of industries are investing in containers

A summary of the container investment activity in the past month:

Oracle [acquired](#) Wrecker, the Dutch provider of tools to for automating the process of testing and deploying code.

- What do they do? Wrecker specializes in management tools for the popular container applications Docker and Kubernetes, allowing developers to quickly create and manage containers to test code.
- Why did Oracle buy them? Oracle has been [vocal](#) about their bets on hybrid storage technology after a severely late entrance to the cloud, and Wrecker will be enable management and automation features for hosted container offerings on their cloud service, essentially increasing developer productivity.

Microsoft [acquired](#) Deis, the company behind tools for building and managing container orchestration services, from Engine Yard.

- What do they do? Deis makes open-source tools for Google-incubated Kubernetes container service, including workflow, a manage and deploy platform, and a service broker that allows apps to talk to each other.
- Why did Microsoft buy them? The [Azure Container](#) service is agnostic and supports all major container frameworks like DockerSwarm and Mesos, but Kubernetes is quickly becoming the standard, especially with this investment from Microsoft.

Sapho, a platform for building micro apps for legacy enterprise software packages, [raised \\$14mm](#).

- Takeaway: Sapho grew revenues 320% on a 200% increase in customers in 2016, and this follows last year's emergence from stealth mode with a \$16mm [Series A](#) while touting customers such as CBS Interactive, Google, and Turner. The company has preconfigured micro apps, from sales to HR, and a flexible pricing package ranging from \$2-10/user/month, depending on the size of the company and regardless of how many apps are utilized or how much they're used.

Portworx, the software startup building storage for containerized applications, [raised \\$20mm](#) in Series B funding.

- Takeaway: This round was a who's who of corporate and leading VC firms because of their ability to manage data in the container infrastructure stack. This includes GE Ventures, Mayfield, and Sapphire. The startup offers infrastructure agnostic features such as volume persistence, high availability, data security, and automation, and it integrates with DockerSwarm and Mesosphere.

Otonomo's data marketplace is getting attention from all areas of transportation

07

Private Funding

Private Funding

Augmented Reality / Virtual Reality

Pluto VR, a two year old VR/AR company focused on multi-user interactions raise a [\\$14mm Series A](#), led by Maveron, the shop founded by Howard Schultz.

- Takeaway: Pluto's founder, John Vechev, previously built the video game publisher, PopCap Games, which was sold to Electronic Arts (NASDAQ: ERTS) in 2011 for \$650mm, and he subsequently spent a few years as a GM of Electronic Arts (NASDAQ: ERTS) before starting Pluto. Given the importance of betting on the leaders in these early rounds, we're excited to watch Pluto VR grow.

Autonomous Vehicles

Renovo, the self-driving platform and [recently pivoted](#) company raised \$10mm in a round [led by Verizon](#).

- Takeaway: Renovo is best known for their electric, self-driving Delorean that was debuted at [Stanford in 2015](#). However, it seems they've left dreams of EV behind for autonomous tech. Verizon's inclusion in this investment is the latest in their "telematics" plays, bridging automated communications software and traditional transportation.

Otonomo, the vehicle data marketplace hopeful has raised \$25mm in a Series B round, led by auto supplier, Delphi.

- Takeaway: The monetization is the holy grail of any connected device, but this is an especially difficult practice in vehicles. Between the proprietary data structure of each OEM, massive legal moats of ownership, and security risks of user-anonymization, this is a challenge few companies will champion. But Otonomo has nine automakers signed up for their platform, which will provide a giant moat as the first mover.
- "I think the mobility of data is just as important as the security of data and we're working a lot on making that data secure as it moves through a value chain," [Raj Rao](#) of Ford Smart Mobility

Aurora Innovation, the stealth software and hardware provider for autonomous vehicles, [raised \\$3.1mm](#). The company's CEO was the CTO of Google's self-driving car unit until last August.

- Takeaway: In the midst of Uber's employees allegedly stealing millions of lines of code from Google, Aurora's had quite similar issues as they're the subject of a [lawsuit](#) Tesla filed in January, alleging that Co-Founder Sterling Anderson stole Tesla data. The company's CEO is Chris Urmson, who was the CTO of Google's self-driving car unit until last August.

Luminar's 22-year old CEO is entering the war for vision technology on vehicles

Luminar, the high-resolution computer vision sensor company (based on LiDAR) led by a 22-year old Stanford dropout, [raises \\$36mm](#). Peter Thiel's 1517 Fund, which invests in startups led by young founders, participated in the round for Luminar.

- Takeaway: Luminar's co-founder, Austin Russell seems significantly more promising than his Stanford dropout peer at Ink Labs (see "LVP" section). Like a seasoned vet, he's been quiet and modest about Luminar's tech, but he's forward about the major issues with current offerings being unable to process information fast enough at high speeds. The only teaser he's given us is the company's use of materials such as gallium arsenide (GaAs) instead of relying on existing components. For reference, GaAs's direct bandgap (versus silicon's indirect) makes it more efficient at absorbing and emitting light efficiently, but the cost has commonly been a major barrier.
- It's worth noting the ongoing power struggle for using LiDAR or camera-based machine vision systems in autonomous cars. MobilEye and Tesla are betting on camera-based vision, while Luminar, Velodyne, and others are placing their bets in the LiDAR basket. Expect to see this battle play out similarly as the feud between Blu-Ray and HD DVD did in the early 2000s.

VW and VC-backed Mobvoi form strategic partnership

- Volkswagen has [invested \\$180mm](#) in the voice recognition and language processing tech provider Mobvoi. The two companies are developing a joint venture to create AI technologies for VW vehicles. Founded in 2012, Mobvoi reportedly raised \$75 million in 2015. Volkswagen is setting up a joint venture with a Beijing-based technology company to develop artificial intelligence for the German carmaker's next generation of vehicles. "All cars will soon be digitalised, they will become like mobile computers," said Li Zhifei, Mobvoi's founder. "We want to enable voice interaction and personalised services and accelerating [the development of] driverless cars. The technology incubated in China will be adopted in Germany."
- The transaction comes as Chinese tech groups are increasingly closing the gap with rivals elsewhere in the world. VW and Mobvoi eventually hope to sell its products to rival companies, including Chinese equipment manufacturers.

Valens, the semiconductor manufacturer for distribution of ultra HD multimedia content in connected cars, [raises \\$60mm](#). The round was led by Israel Growth Partners (IGP), and includes Delphi, Samsung Catalyst Fund, Goldman Sachs and MediaTek as new investors.

Sensoro's wireless sensor networks gains interest from strategic venture

Platforms

Sensoro, the manufacturer of beacons that operate via wireless sensor networks, raised \$18mm series B.

- Takeaway: The round was led by Bosch, Sumitomo and Tsing Capital, and comes after their first financing round of \$10mm from Nokia Growth Partners in 2015. Sensoro is focusing on environmental monitoring and asset tracking and they anticipate to shipping over 100,000 environmental-related devices and 500,000 asset tracking tags in 2017 to support infrastructural development projects.

Plume, a manufacturer of wireless network extenders raised \$27.6mm. Their extenders plug into wall outlets to offer a clear internet signal in multiple rooms.

- Takeaway: The company's current focus is on their Plume Air Report, which allows consumers to measure their exposure and receive forecasts for pollution, and management will be using the latest round to expand their atmospheric forecasting platform to 60 countries.

Tinicum, a San Francisco-based buyout firm, has invested \$40mm in PAS, a provider of cybersecurity, process safety and asset reliability solutions for the energy, power and process industries. Tinicum focuses on late-stage investments in manufacturing, energy, technology, media and infrastructure.

Medtech

Neural Analytics, a medical device company developing technology to measure, diagnose and track brain health, secured a \$10mm investment. The company added Ted Koutouzis of Reimagined Ventures to the board over this round, and it brings the total funding to \$27mm.

Network Hardware / Services

GoTenna, a hardware distributor of long-range phone use in locations without cell, internet or satellite service, raised \$7.5mm. The company was founded in 2012 after Hurricane Sandy wiped out cell towers.

Robotics

UiPath, the developers of robotic process automation software raised a \$30mm round Series A.

- Takeaway: UiPath was founded in 2012 and has found success in building apps for repetitive tasks, but this is their first round of financing. This niche of targeting the largest companies for cost cutting opportunities via automated tasks has brought on customers such as Lufthansa, Generali, Telenor, and Dong Energy.

Can August's smart locks redeem themselves in the smart home?

Security

Ledger, the enterprise-grade cryptocurrency security developer raised [\\$7mm](#).

- Takeaway: Ledger is planning to launch their hardware wallet for multiple currencies this year, and their key value proposition is the security they provide around this software.

Smart Home

August Home, the smart door locks and doorbell camera supplier, [raised \\$17.7mm](#).

- Takeaway: August was widely known as the infamous provider of [hackable doorbells](#) in the recent past, but the company's CEO hosted an interview at CES earlier this year and was transparent about the issues and need for improvements in their products.

Storage

Snowflake Computing, a cloud data warehouse service built on AWS and catering to smart cities [raised \\$100mm](#).

- Takeaway: Snowflake's architecture is built to manage traditional and unstructured data workloads, and they've targeted the frustrated Hadoop customers. The company's CEO often references the opportunities with IoT because of the semi-structured data created from connected devices which has stemmed their focus on smart cities.

Tegile, an enterprise flash storage solution provider, [raised \\$33mm](#).

- Takeaway: This raises comes on the heels of a 110% year over year increase in revenue in 2016, but the company is facing off in a heavily competitive environment with the likes of Dell Technologies, Pure Storage and Nimble Storage (Acquired by Hewlett Packard Enterprises which we [profiled last month](#)), and Cisco.

Startup capital for IoT ventures grows with two new funds closing their raises

New Funding

SeedPlus, an early stage internet of things investor [raised an \\$18mm fund](#).

- Takeaway: The fund was backed by Cisco, Eight Road Ventures, IFC, and Ratan Tata in an oversubscribed offering. They're seeking 5-6 deals per year with a check size of roughly \$350k to \$725k, and they have hired [Chirayu Wadke](#) as a partner to expand their focus on the Internet of Things startups.



Javelin Venture Partners, an early stage tech investor has closed its fourth flagship fund on a [\\$125 million target](#).

- Takeaway: Javelin makes seed and Series A investments across enterprise software, SaaS, ecommerce and digital media, and [they've invested in](#) Spotsetter (acquired by Apple), PowerCloud Systems (acquired by Comcast), and Prismatic (acquired by LinkedIn).

Founders Factory, the corporate accelerator founded by Founder Forum CEO, Brent Hoberman, [invested in its first two](#) A.I. startups: Iris.ai and illumr.

- Takeaway: The accelerator is aiming to co-create two new AI businesses within the incubator every year, for the next five years, and they've received funding from one of China's biggest tech investors, CSC. Iris.ai is a research assistant that acts as a search engine across 60mm open access research papers, and illumr is an analytic tool that turns complex datasets into predictable 3D patterns.



Oracle is hiring for a new [startup organization](#) inside it's North America operation, The Solution Engineering Organization.

- Takeaway: Oracle plans to invest in intelligent cloud applications via these new organizations, and they're looking to hire around 50 people in North America, between Reston, VA and Denver, CO.

The Steve Jobs of connected juice?

Least Valuable Players (LVP) of the Month:

The story of the month: Juicero, the supplier of a \$700 (now \$400) connected juicer is facing backlash after [Bloomberg](#) published an article revealing their \$7 juice packs could be squeezed by hand.

- Takeaway: Juicero [raised](#) \$120mm from venture from the likes of Google Ventures has been on the full defensive this week. The company's CEO, who's compared the juicer innovation to the feats of mainstream personal computer breakthroughs of [Steve Jobs](#), has justified the price with the convenience of preventing expired packs or recalled ingredients to be locked out. He's also offering customers a [full refund](#)....

Square (NYSE: SQ) buys [Yik Yak's engineers](#) for less than \$3mm after the company reached a peak valuation of \$400mm on a \$62mm raise in 2014.

Cloudera IPO's with a solid opening day debut, but the company was valued at [half its last private round](#).

- Takeaway: Despite our defense of their investing strategy [last month](#), Intel invested \$742mm in [Cloudera in 2014](#), and they're now about \$300mm underwater. However, Intel will receive first rights on acquisition proposals on the company which may offset the losses given the company's performance in the [first weeks](#), and it's likely a strategy to preserve the dominance in core markets for servers in the emergence of high-computing applications of big data.

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Disclosure: The author, Colin Ferrian, is long ZAYO. Colin wrote this article, it expresses his own opinions, and he is not receiving compensation for it.