



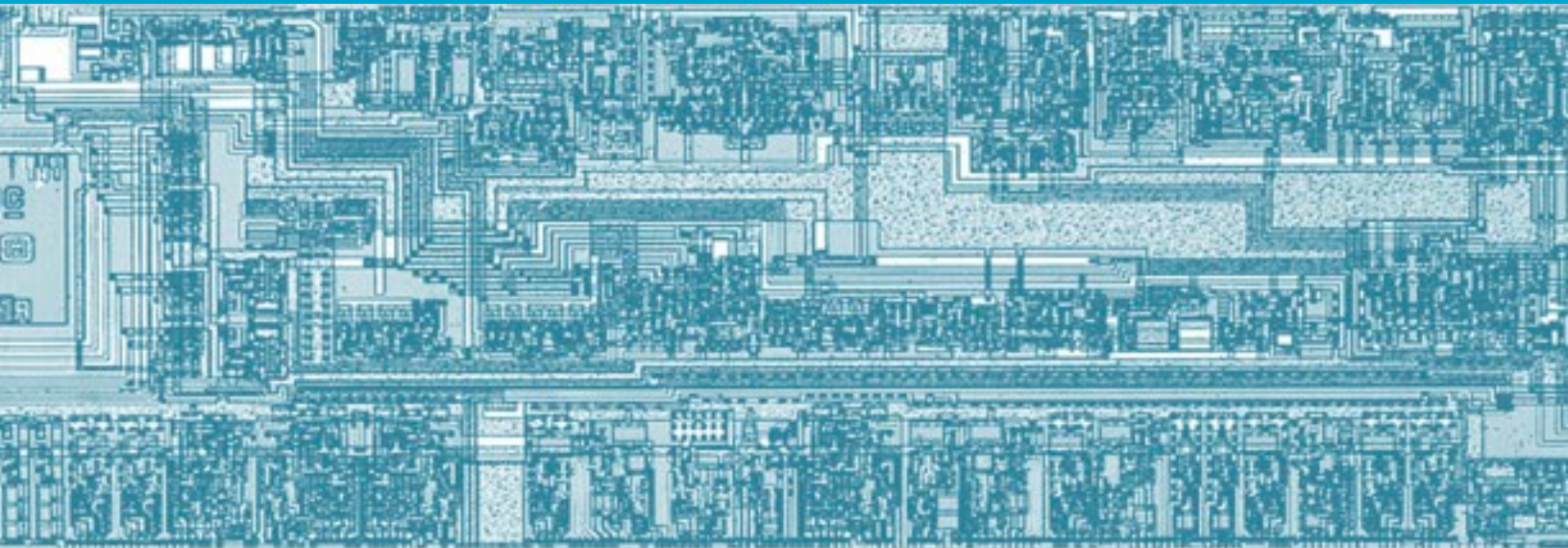
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A SILICON CATALYST NEWSLETTER

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On June 1, we expanded our global footprint with the launch of SiliconCatalyst.UK. The reception has been absolutely brilliant. Managing Partner Sean Redmond hosted the accelerator's first thought leadership event, "Cracking the Code to Semiconductor Startup Innovation in the UK" at Bletchley Park, the birthplace of the world's first programmable digital electronic computer. The event attracted a who's who of semiconductor royalty in the UK. Attendees were treated not only to a tour of the Colossus, but also to the latest vintage of Castello Redmond, a Montepulciano fermented, aged, and bottled by the host himself.

Through the microcosm of the Silicon Catalyst ecosystem, it truly is a small world. Though a partner in Silicon Catalyst, I am the founder and CEO of the marketing firm [LGB, LLC](#). My firm's first customer in semiconductors was GlobalFoundries. The same GlobalFoundries who is providing foundry services to the likes of Silicon Catalyst Portfolio Companies Ayar Labs, Owl Autonomous Imaging, and Eridan Communications, all three of which are reshaping their respective markets. GlobalFoundries officially had 3 employees when I started with them. That number has grown to over 15,000. Fast forward, and under the auspices of the dynamic, affable, and world class CEO, Tom Caulfield, the company has gone public, trading at multiples of the IPO price. Small world because none other than Morgan Stanley's Mark Edelstone, no stranger to Silicon Catalyst, who will be a panelist at our upcoming Semi Forum on December 8th, was the lead player in the GlobalFoundries IPO deal. Coincidentally, Mark sits on the GSA's Morris Chang Award committee, the very committee that voted Silicon Catalyst Advisor Wally Rhines as this year's recipient of that coveted Morris Chang Exemplary Leadership Award. And never to forget the continued contributions of two of our first partners TSMC and Synopsys who believed in our value proposition from day 1 and continue to provide our startups with world class foundry services, design tools and IP. Truly a small, but extremely influential world here at Silicon Catalyst.

I'm happy to announce that my friend Junko Yoshida, the former global editor at EETimes, a publication where she spent the last three decades, has launched a new and exciting endeavor with her partner Bolaji Ojo called the Ojo-Yoshida report, a subscription-based news/analysis newsletter and website. Some of their valuable insights can be found within the pages that follow.

When we launched the incubator in the UK, we ran an ad in the Telegraph in London with the title, "when the chips are down, the world turns to startups." In this ever-changing, more complex global dynamic, startups are more relevant than ever before. Plain and simply, we are about what's next.®

WELCOME

CHAIRMAN'S CORNER
RICK LAZANSKYChairman and Co-Founder,
Silicon Catalyst
serial entrepreneur
and incubator fanaticRick's
Tried-and-True
Fundraising
Recipe

This quarter's column is all about identifying and engaging with venture capital firms. I've been wanting to write more for entrepreneurs that might offer timely help. There wasn't even a close second choice when I thought about what that might be.

First, let's take a look at the numbers. According to the National Venture Capital Association, there were 1,965 venture capital firms in the USA managing \$548B AUM (assets under management) entering 2021. That's about 50% of the world's venture capital. Roughly \$164B was invested by these firms in '20. That compares to about \$30B invested by angels, and there are roughly 300K such angels, though these numbers vary considerably. Conventional wisdom, if there is such a thing in seeking investment, is that an entrepreneur should be prepared to reach out to 'a hundred or more'. Reaching out to a random selection of one hundred makes little sense, whether they be VC, corporate VC, Angel groups, or individual angels. A strategy is definitely needed - qualify them, and then figure out how to best engage them.

Let's start with VC. There are five things you should know before you put one on your list.

1. Is what they invest in what your company is going to do? That seems

pretty basic, but there's no end to rationalizing how your company is going to change that.

2. How big is the fund? - that controls how much they need to invest in each company. \$20M-\$50M funds make \$500K to \$1M investments. \$1B funds need to make much larger investments, and typically later stage investments.

Raising an investment is a full-time job.

Understand first what investment(s) you'll need. Then find those VCs. If you're looking to raise less than \$1M, maybe that first investment should come from angels that are known to and well respected by the VC community.

3. How far into the fund are they? - typically new investments are made in the first 3 or so years of a fund that runs 10 or more years. Keep them off your list unless they have 'dry powder'.

4. Have they already invested in a potential competitor? Typically VCs don't want the inherent conflict.

5. How close to home do they invest? Some are quite wide-ranging geographically. Many are not.

Set your expectations properly - you may need to reach out to 100 or more potential investors. Keep a well-organized and prioritized list. The first thing on that list should be to get access to [Pitchbook](#). It's the most efficient source of information. Don't run through that list one at a time - prioritize ten or twenty and proceed in parallel - there's a lot of idle time waiting for replies. Recognize that raising an investment is a full-time job, and you need to do it well. The entrepreneurs most respected by investors are those that are dedicated, very communicative, and have **grit** (= passion and perseverance).

Be creative about engaging with them. Yes, its best to have a warm introduction. That's almost always an advisor, prior investor, or friendly angel, incubator, or accelerator. Recognize that they're spending their social capital when they make an

introduction. Typically, I don't make blind introductions. I'll work with the entrepreneur to craft a clever paragraph or two for introduction, then use that to ask the introduction requested if an introduction is interesting and okay to make, and I try to limit such introductions to companies I really want to recommend. It's almost always successful.

None of that feels particularly creative, though. These days I'm trying to do more research, find and meet with companies that the investor has already invested in. Then make introductions between 'my' entrepreneurs and 'their' startups, and get that warm introduction from someone they've already invested in. I don't know if it works any better - I haven't been doing it this way very often, or for very long. What I have realized though is that it gives us a much better insight into each investor, and what their focus and interests are.

One last thing to keep in mind is that it's not really all that hard to meet a VC over coffee, particularly if you're doing research and really value their experience and insight. Getting in front of the entire investment committee is hard. Getting as far as coffee and a good conversation is not. And, angels drink coffee too. Do always remember to thank them for their time (and coffee) - and follow that up with a written note - longstanding advice from my Mom that still holds true.

I'll end with a few reading suggestions. I read Medium articles enthusiastically these days - medium.com/leadership-previews gives a much better overview of VC funds than most.

Here's one of many good 'blogs' and ideas from one such VC www.primemoverslab.com and www.nfx.com has useful insight for founders. The venture community is changing faster - my favorites do a lot of blogging about what's on their mind. I very much appreciate the openness of sharing of their ideas. There are many that do such.



Portfolio Companies

CURRENT



ALUMNI



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Silicon Catalyst Launches UK-based Accelerator

June 1, 2021 | Santa Clara, California and Stewkley, England

Silicon Catalyst, the world's only incubator focused exclusively on accelerating solutions in silicon, announced today SiliconCatalyst.UK, bringing Silicon Catalyst's platform locally to the UK and European start-up community. Heading SiliconCatalyst.UK is Sean Redmond, an experienced semiconductor executive with international experience and a strong connection to the United Kingdom.

Silicon Catalyst's mission is to help semiconductor hardware start-ups succeed. The ecosystem that Silicon Catalyst has created lowers the capital expenses associated with the design and fabrication of silicon-based integrated circuits (ICs), sensors, and microelectromechanical systems (MEMS) devices by providing advanced design tools and services from a comprehensive network of In-Kind Partners (IKPs). The Portfolio Companies in the Accelerator utilize IKP tools and services including design tools, simulation software, design services, foundry PDK access and MPW runs, test program development, tester access, and banking and legal services. The world-class Silicon Catalyst network of advisors and investors further facilitates their journey from idea through prototype toward volume production. See siliconcatalyst.uk for further background about the Accelerator.

"The UK has incredible innovation

through its world-class universities, already significant startup community, and support from the government," said Sean Redmond. "We look forward to working closely with the U.K. start-up ecosystem, bringing a small part of Silicon Valley to further accelerate



Silicon Catalyst UK event participants at the Colossus Gallery, National Museum of Computing, www.tnmc.org/colossus

entrepreneurial teams to their full potential. We will be hosting a webinar on Wednesday, June 23, 2021 and invite members of the semiconductor value chain to attend and learn more about our comprehensive accelerator program." Registration details will be available shortly.

Nick Kepler, Chief Operating Officer of Silicon Catalyst, said "Silicon Catalyst exists to help start-ups, and we're excited for the opportunity to accelerate the technology innovation happening in the United Kingdom. Over the last six years, Silicon Catalyst

has made available to its Portfolio Companies over \$100 million dollars of in-kind services and helped them to raise more than \$250 million dollars in funding. In addition, many of our Portfolio Companies credit their success to the extensive network of nearly 200 advisors which saved them literally years by avoiding mistakes that most start-ups make."

"I am delighted to help launch Silicon Catalyst in the U.K. Having recently worked closely with the U.K. government, industry, and universities to guide their industrial digital strategy, this launch is a great opportunity to put that work into action for U.K. semiconductor start-ups," said Sean Redmond.

"Start-ups can capitalize on major growth opportunities in areas such as IoT and machine learning with fast, low cost and low risk access to best-in-class SoC design technology," said Phil Burr, senior director of strategic programmes, **Arm**. "Combining Silicon Catalyst's support with Arm Flexible Access for Startups, which provides free access to Arm IP and tools for prototyping silicon, will help startups get to working prototypes as quickly as possible, accelerating innovation in the UK."

"Silicon Catalyst has opened the doors to Silicon Valley for us," exclaimed Huw Davies, CEO of UK startup **Trameto**. "In addition to affordable access to high-value In-Kind Partners like TSMC,

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Synopsys, and Advantest. Trameto has been strongly supported by experienced semiconductor industry veterans such as Mark Ross, ex-CTO of Cypress Semiconductor, as technology contributor and advisor, and John East, ex-CEO of Actel, as advisor.”

“ST works with a large number of innovative tech start-ups across the world to help them develop and industrialize their products and get to market faster, targeting automotive, industrial, personal electronics and communication infrastructure applications,” said Kirk Ouellette, Vice President Strategic Marketing and Strategy Development, **STMicroelectronics**. “Our engagement as a Silicon Catalyst Strategic and In-Kind Partner helps us find and engage with relevant start-ups, and surrounds them with the supportive Silicon Catalyst ecosystem that is critical to their success. We look forward with excitement to engage with many more start-ups and the various tech ecosystems in the U.K. with this additional Silicon Catalyst team.”

“We are pleased to be working with SiliconCatalyst.UK to ignite the next generation of innovation,” said Steve McDonald, **Synopsys** VP of Sales for Europe. “The strengthening economic pull from new market verticals for custom silicon is creating tremendous opportunity for chip design start-ups. With a distinguished track record enabling emerging businesses, Synopsys provides Silicon Catalyst portfolio companies with state-of-the-art tools and IP that reduce risk and accelerate time-to-market.”

“It has been a pleasure for Real Ventures to partner with Silicon Catalyst over the past several years,” said Mark McDowell, Partner at **Real Ventures**. “Silicon Catalyst is



Senior chip industry executives met at Bletchley Park to debate how to crack the code for U.K. semiconductor startup innovation and scaleup, appropriately in front of one of the code-breaking machines at the National Museum of Computing.

incubating a fascinating collection of semiconductor hardware start-ups. As investors in SPARK Microsystems we have experienced how the Silicon Catalyst ecosystem surrounds each start-up with support that de-risks our investment.”

“**Saliency Labs** joined Silicon Catalyst earlier this year and has already gained extensive value,” said Vaysh Kewada, CEO of U.K. start-up Saliency Labs. “Silicon Catalyst provides start-ups with far more than in-kind services. It facilitates deep connections into the semiconductor industry through its advisors, who have spent time getting to know the company well, and then introduce and facilitate business-critical relationships. These relationships are already proving invaluable to Saliency Labs, and we look forward to continuing to work with Silicon Catalyst.”

Agile Analog, based in Cambridge U.K., is Silicon Catalyst’s newest In-

Kind Partner. John Hartley, CCO said, “We look forward to helping the Silicon Catalyst Portfolio Companies by quickly customizing their analog IP needs using our programmatic, systematic and repeatable methodology.”

“As Silicon Catalyst has grown, we have been impressed that many of their start-ups are developing interesting technologies to address important problems in the world,” commented Kirill Kuzmichev, Principal at **NanoDimension**. “In addition, the support of the Silicon Catalyst ecosystem, from partners providing tools and services to advisors providing expertise, increases the chance that each of these start-ups will succeed. Silicon Catalyst is one of the best places to look for good investments in semiconductor hardware.”

More information is available at siliconcatalyst.com, siliconcatalyst.uk and siliconcatalystangels.com

Silicon Catalyst startup incubator launches in UK

by Peter Clarke | eeNews Europe <https://www.eenewseurope.com/news/silicon-catalyst-incubator-comes-uk>

June 1, 2021 - Silicon Catalyst, the California-based incubator focused on semiconductor startups, has announced the formation of a UK office.

Veteran EDA executive Sean Redmond is heading up **SiliconCatalystUK**.


Silicon Catalyst was founded in Silicon Valley in 2014 as a mentoring and networking company, partly in response to a lack of venture capital funding. It provides startups with advice and lower-cost access to essential suppliers who in

return get to engage with pre-evaluated startups.


More than 400 start-up companies have engaged with Silicon Catalyst since April 2015, with a total of 38 startup and early-stage companies being selected for admission to the accelerator.

The incubation model has helped startups with the design and fabrication ICs, sensors and MEMS by providing advanced design tools and services from a network of “in-kind partners” and services that extend out to foundry PDK access, MPW runs and legal and banking services.

**Cracking the Code
to Startup Innovation in the UK**



We look forward to seeing you on Tuesday, **12th October**,
from **2 p.m. to 6 p.m.**, for a cracking good time
at SiliconCatalyst.UK’s semiconductor leadership event
(physical attendance) jointly with the NMI.



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Silicon Catalyst is Bringing Its Unique Startup Platform to the UK

By Mike Gianfagna | SemiWiki | June 8, 2021

Silicon Catalyst is a unique startup incubator / accelerator that focuses exclusively on accelerating solutions in silicon (including chips, IP, MEMS & sensors). The organization has an extensive support infrastructure that includes preferred access to IP, design tools, business infrastructure and fab/assembly. They also provide a broad network of industry advisors and access to investment capital. In short, everything a silicon-based startup needs to get off the ground as quickly and efficiently as possible. We've covered many aspects of this special organization on SemiWiki. You can catch up on the buzz here. Read on for the details of how Silicon Catalyst is bringing its unique startup platform to the UK.

For those of us who live and work in Silicon Valley, it's easy to believe all silicon startups start here. In fact, there is ground-breaking work going on around the world. A recent press announcement detailing the newly admitted companies to the Silicon Catalyst accelerator drove home this point.

Relevant questions include why the UK? And why now? Silicon Catalyst held a press briefing before the announcement that answered these, and many more questions. As for why the UK, some points were offered, below. I have added my own comments in parenthesis:

- Tremendous semiconductor talent recognized globally

(remember Arm started in Cambridge)

- Top universities recognized globally (OK, we've all heard of Cambridge and Oxford)

- A history of innovation in semiconductor solutions (the UK leads the world in compound semiconductor development)

- An increasing number of UK startups have found Silicon Catalyst and applied to the accelerator (Trameto/Wales, Saliency Labs/Oxford are currently in the program)

As for why now, I think the answer is clear. Moore's Law is slowing - migration to the next process node is still important

in a dense and highly advanced package. Fueling this kind of innovation means new technology and new architectures. This is where startups make significant contributions and the support provided by Silicon Catalyst is making a big impact on the whole ecosystem - my opinion. To wrap up these questions, Silicon Catalyst explained that there are three new In-Kind Partners joining from the UK. These are the folks who provide all the support mentioned previously. They are: **Agile Analog**, **SemiWise** and **SureCore**.

Heading SiliconCatalyst.UK is **Sean Redmond**, an experienced semiconductor executive with international experience and a strong connection to the United Kingdom.

Sean has the background and experience to build a strong Silicon Catalyst presence in the UK. I had the opportunity to chat with Sean a bit. Sean has experience working with the UK government and so understands what's needed to ignite a higher level of innovation in the region. Visibility, support and promotion



SEAN REDMOND

CEO VERTIZAN LIMITED
VICE CHMN ELECTECH - UK
VP ARC
VP EMEA CADENCE
VP & GM EU VERISITY

of the UK's substantial innovation assets will be important in his view. Silicon Catalyst brings the right resources and focus to help. He described a new funding program from the UK government to fuel innovation - this will fit well with the startup incubation provided by Silicon Catalyst. There is a memorable comment from Sean: *"The bedrock of technology development is semiconductor"*. I couldn't agree more.

The press release announcing the UK expansion provides more background on the new operation. Noteworthy are the organizations that

weigh in with supportive comments; the list includes Arm, STMicroelectronics, Synopsys and Real Ventures. Silicon Catalyst has substantial support across the semiconductor ecosystem.

The SiliconCatalyst.UK organization will be hosting a webinar for start-ups, university staff, investors, and potential in-kind partners on Wednesday, June 23, 2021. The webinar will feature presentations by Vaysh Kewada, CEO of Saliency Labs in Cambridge and Huw Davies, CEO of Trameto in Wales, both UK companies in the Silicon Catalyst incubator, as well as other Silicon Catalyst partners and

guest speakers. I encourage you to attend this webinar to learn more about how Silicon Catalyst is bringing its unique startup platform to the UK. Registration details will be available shortly, watch their website. For those of you that are part of (or know of) a semiconductor startup, Silicon Catalyst's application deadline for their next screening cycle is January 10, 2022 - further details at their website.

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U.K. Should Emulate Israel for Semiconductor Startups to Succeed

Senior executives from the U.K. semiconductor industry met at Bletchley Park to discuss how to nurture and grow the country's semiconductor startups.

Reprinted from EETimes Europe / October 14, 2021 Nitin Dahad

This week, some of the most successful senior executives from the U.K. semiconductor industry gathered at the birthplace of modern computing, the Bletchley Park National Museum of Computing, to discuss how to crack the code to chip startup innovation in the country.

It was rather like a re-run of Captain Ridley's shooting party [see my note at the end of this story], quipped Sean Redmond, managing partner of the incubator Silicon Catalyst, co-host of the gathering this week with the National Microelectronics Institute (NMI). The two organizations announced a collaboration just a couple of weeks ago to work on creating the right environment for more U.K. semiconductor startups to be more successful globally.

The gathering this week was aimed at bringing together in a room those who can potentially help make that happen, discuss what are the challenges and the possible solutions. There were successful chip and EDA industry veterans like Jalal Bagherli, Simon Davidmann, and Stan Boland, as well as other influencers in the ecosystem such as John Goodacre and Neil Dickens, plus of course various startup founders, as well as government representation on semiconductor industry policy.

The debates on challenges are for semiconductor startups in the country threw up some common themes, as

we heard from two startups, Saliency Labs and Cascoda, as well as the panel discussion that followed.

It won't be anything new for those familiar with the U.K. scene over the last 20-25 years as it's the same old story: lack of long-term capital for scaling up, access to talent, and the right kind of support from government programs. On the latter point, one panelist said many U.K. startups have to apply for DARPA funding in the U.S. or look for European Union grants, as there's no real program for them in the U.K.

The CEO and co-founder of Saliency Labs, Vaysh Kewada, talked about her experience as a new startup established in 2020, and how as part of the Silicon Catalyst program the company already raised its first funding in March 2021, and is about to close its second round of funding to build the company's prototype chip. She highlighted the top three needs of a semiconductor startup as supply chain, customer integration, and hiring at speed. On the supply chain, she said being part of Silicon Catalyst helps, especially since their SoC is multi-platform. Customer integration is also essential as, she said, "We need to be able to show traction and demonstrate integration with a customer's requirement, hence the need to work closely with customers."

Saliency Labs is developing a high-speed photonics chip for AI

acceleration. The company has shown that photonic processors can process information much more rapidly and in parallel, something electronic chips are incapable of doing. Their work on this was published in the Nature journal earlier this year. Kewada said, "The market needs a new compute platform as a result of the end of Moore's Law and with AI compute requirements doubling every three months. With the rise of silicon photonics, we have been able to come together as a team to create hybrid photonic in-memory compute. Photonics can enable us to get up to 50x improvement in inferences per second per watt compared to electronics."

Meanwhile, Bruno Johnson, CEO of Cascoda, explained how his company played the long game having established the company in 2007 and without having the support of a dedicated chip industry support network as provided by Silicon Catalyst now. He talked about how Cascoda worked over many years to realize their vision of enabling standards-based IoT to address the huge lack of interoperability in the industry. It invented a new type of radio demodulator which offers a significant increase in range by improving receiver sensitivity, without sacrificing power consumption and with no need for a power amplifier. Johnson's approach to growth is to work on developing a scalable technology that integrates into existing infrastructure, and work



NITIN DAHAD

Nitin Dahad is a Editor-in-Chief of embedded.com, and a correspondent for EE Times, and EE Times Europe. Since starting his career in the electronics industry in 1985, he's had many different roles: from engineer to journalist, and from entrepreneur to startup mentor and government advisor. He was part of the startup team that launched 32-bit microprocessor company ARC International in the US in the late 1990s and took it public, and co-founder of The Chilli, which influenced much of the tech startup scene in the early 2000s. He's also worked with many of the big names - including National Semiconductor, GEC Plessey Semiconductors, Dialog Semiconductor and Marconi Instruments.

with or be part of standards bodies (he's involved with the Thread Group as well as the Open Connectivity Foundation).

THE PANEL: WHERE ARE WE NOW, WHERE DO WE WANT TO GO?

Having heard from the two startups, the panel dissected where is the U.K. semiconductor industry right now as regards nurturing startups, and where could the industry learn from.

Tim Ramsdale, CEO of Agile Analog, a four-year old startup who recently closed a \$19 million funding round, highlighted that the semiconductor industry is a long-term play, in the range of 20-30 years. "But in the U.K., the appetite for investing in semiconductors wasn't really there, say five years ago. We also need larger ecosystem players here," he commented, the latter point referring to the ability to get a wider skills and talent pool to enable hiring locally.

John Reilly, the sales director for silicon partners in EMEA, India and Russia for Arm, illustrated how Israel has managed to succeed with nurturing its chip startup ecosystem and how this could be a model for the U.K. "Our business in Israel is almost exclusively with startups. So what lessons can we learn? Well, if you look at the Israeli military, it churns out a pool of experienced resources [who then go on and do their own tech startups when they leave]." In addition, he said success breeds success. "This is when successful entrepreneurs go and help other startups and also become role models themselves."

Reilly certainly has a key point. Two of Israel's military units, unit 81 and unit 8200, have alumni who have launched many successful technology startups. Since they are elite units looking at things like security and intelligence, and whose remit is to use technology to develop solutions that keep Israel safe, they have excellent skills and experience of using technology to solve real world problems.

When they come out of the units, they already have teams that have worked together successfully so often come together to form their own startups - an example of a recent one is NeuroBlade, who just raised \$83 million for its compute-in-memory chip. Hailo is another example. According to one report earlier this year, soldiers and officers who served in Unit 81 between 2003 and 2010 have since then founded many startups - in fact around 100 veterans from the unit at the time founded 50 companies and have raised over \$4 billion, with valuations over \$10 billion.

Coming back to the panel, Alec Vogt, director northern Europe for Synopsys, talked about the importance of an incubator like Silicon Catalyst for startups. "In the U.K., there is no lack of creative ideas. However, what happens next is not so great. Because there isn't an appetite for longer term investment in semiconductors in the U.K., the ecosystem supporting semiconductor investments is weak, and there are no real government funding programs." He then said that there was a danger of the country closing in on itself. "We need to be open, create a pool of talent, bring expertise and funding

here so that the great ideas can have more chance of becoming a success."

The Silicon Catalyst and NMI collaboration is meant to address some of the issues around access to various aspects of support, including tools and in-kind benefits from key partners of the network, plus access to funding sources.

Redmond said, "The UK has world class research universities and a track record for semiconductor innovation. It also has fifteen semiconductor fabs specializing in advanced processes for photonics, power and mixed-signal RF applications. This manufacturing base has been extended with a strong MEMS, PICs and ASIC ecosystem. Combining these local assets with international partners and entrepreneurial drive creates a springboard for semiconductor startup success." Hence, his vision was to help create a better support network for semiconductor startups to help them grow.

Meanwhile, the legal entity behind NMI, called TechWorks, was keen to work with Silicon Catalyst to 'de-risk' the path to growth for chip startups in the country. The CEO of TechWorks, Alan Banks, said, "By cultivating collaboration and ensuring government recognition of the semiconductor sector in areas such as automotive, IoT, communications, AI and edge computing, we have ambitions to facilitate the next generation of semiconductor companies building on the legacy of companies such as Arm, Wolfson, Icera and, more recently, Graphcore."

Note: 'Captain Ridley's shooting party' was the cover name used by secret service agents from MI6 and intelligence experts who headed out to Bletchley Park in 1938 to activate the secret base that became the home of the code breaking center, where Alan Turing and many others broke a number of German codes, including that of the Enigma machine.

SILICON CATALYST Webinar



Gems of Advice – A Practical Guide to Maximizing Exit Value for Technology Companies

Silicon Catalyst is a startup incubator that exclusively focuses on semiconductor-related startups. They do a lot of events to support and advise those startups and their ecosystem. In a recent panel focused on maximizing exit valuations there was a 20-minute introduction segment moderated by two veterans of the industry. The wisdom imparted by these two luminaries was substantial and capturing the practical and actionable advice offered will be the focus of this piece. First, a couple of introductions.

Pete Rodriguez has run public companies and startups over the past 30 years. He now runs Silicon Catalyst, helping others follow in his footsteps. Pete's storied career dates back to LSI Logic, where he was a major account manager. He was also CMO at Virage Logic, CEO of Xpedion Design Systems, and CEO of Exar Corporation. He was VP & GM of Interface and Power at NXP Semiconductors before joining Silicon Catalyst.

Pete spent twelve years as an entrepreneur with three different startups and has raised over \$30 million in venture capital. He is currently on the board of Hysai, advisory board of Alphacore and Harvest Management Partners and an observer on the boards of Mentium Technologies, Espre Technologies and Owl AI. He retired from the US Naval Reserves with the rank of Commander. He is a graduate in strategy and policy of the Naval War College and holds an MBA from Pepperdine University, an MSEE from Cal Poly Pomona, and a BS in Chemical Engineering from the California Institute of Technology. It's safe to say that there is probably no scenario for a public or startup company that Pete hasn't seen.

Joining Pete was **Warren Lazarow**, described by Pete as "the world's greatest lawyer". Warren is nationally

and internationally recognized as one of the market's leading advisors to technology-focused companies and investors. He primarily focuses on the corporate representation of public and private technology companies, venture capital and private equity firms, and investment banks. He is a boardroom-level advisor who frequently serves as outside general counsel, helping management teams, boards of directors, and investors shape and execute their business strategies.

Over the course of his career, Warren has handled more than 200 M&A transactions ranging from \$1 million to \$10 billion. He has been chosen four times for inclusion on Forbes Magazine's prestigious "Midas List" of the technology industry's Top 100 Dealmakers Worldwide. Warren offers a unique blend of a strategic thinker and trusted advisor, as well as quite possibly the world's greatest lawyer.

The practical insights offered by these two gentlemen amount to the margin of victory for any entrepreneur willing to listen. How to evaluate an exit, how to build an advisor and investor network, and how to focus



**PETE
RODRIGUEZ**

on what really matters are a small sample of the topics discussed. This conversation offers the closest thing available today to a blueprint for success if you are a technology startup. The following are some of the key insights offered.

PETE'S WORDS OF WISDOM FOR ENTREPRENEURS

Pete offered this advice first – as a CEO of a startup, you only have to focus on two things – bookings and cash. Bookings means you're winning, and cash means you get to stay in business. Simple, but powerful advice. If you don't have a product yet, that's getting in the way of bookings, so get your product done! An added comment is to get to cash flow positive as soon as possible – this is how you control your destiny. Pete offered an anecdote to clarify the importance of practical thinking.

During the dotcom explosion, Pete saw a company turn down a \$3 billion offer because they wanted \$3.3 billion. Four years later, that company closed its doors. For every high-profile success story there are hundreds that didn't go well. Be practical and don't be greedy.

More entrepreneur guidance – VCs are not your friends. Take care of yourself and your employees and spend VC money wisely. When it comes time to sell your company, pick your partner for the deal carefully. Find someone who is willing to work hard for you and bring you value. Regarding competitive analysis, there are many approaches to try and handicap your company's value and chances for success. At the end of the day, a few simple metrics are good predictors for success. You *will* get more money for your company if:

- **The market is strong**
- **Your revenue is growing**
- **If you can create a good fit and vision for the acquirer**
- **If your product enables the acquirer to create something new**

Pete gave an example of the last one – while at a public IP company, he acquired a small IP company and he was able to implement the new IP in the acquirer's standard cells and memories, opening a new royalty stream from foundries.

Being first matters as well. Pete recounted a story of a first mover getting an exit value of \$1 billion while the third player in the market with a very similar product got a \$30 million value. Timing has other dimensions. Pete was involved in a company that got an offer of \$12/share. Instead of taking that offer, the company continued for about five years, doing three additional acquisitions and a lot of hard work. They were ultimately acquired for \$12/share. He went on to explain that offer timing has many dimensions to consider. Opportunity cost is a big one. Accepting an offer at Series A may seem premature. There is so much more ahead. However, if you add the time, accumulated risk and liquidation preferences from later

funding rounds, the early offer might be a good one. This is a personal decision, but worth consideration.

A final comment from Pete – don't be too greedy. If you're doing a startup just for the money, you're in the wrong business. You need to be doing it because you love the technology, you want to win, you like solving problems and you like working with smart people.

AND WARREN'S ADVICE FOR ENTREPRENEURS AND CEOs OF PRIVATE COMPANIES

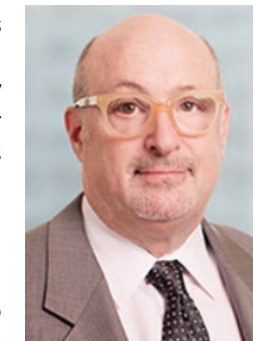
Warren echoed Pete's comment about choosing your partners wisely. This includes lawyers, outside auditors (if needed), investment bankers (if you choose to use them – many private companies do not), and investors. **Choose investors who know something about your market.** They can help guide you to your ultimate exit. Today's exits take the form of either a special purpose acquisition company (SPAC) deal (an indirect way of going public), a traditional IPO (direct or underwritten) or an acquisition by a strategic company or a private equity firm. Warren explained that a private equity deal typically occurs when the company has been around a while and the investors are getting "deal fatigue".

Warren explained that likely acquirers should be somewhat obvious. Carefully chosen board of directors and advisors will help with this. The acquirer may be your customer, but more likely it will be your competitor. Large companies take notice when a small, nimble company can take share from them. A well-connected board and advisor team will also

know of adjacent markets where your company may fit.

Warren spent a bit of time discussing investment bankers. As mentioned, not all startups use them. Given the very high rate of M&A activity, banks can require a fee that would be too dilutive of the ultimate deal. Warren's advice is to "shop around", talk to many bankers. He pointed out that, unlike lawyers, bankers don't charge by the hour.

Regarding how to get more money for your company, Warren echoed many of the comments made by Pete. **He also offered that having options for the exit is a critical item.** Without it, your acquirer will simply wait until your price declines. Competitive term sheets are the antidote for this problem. Another approach to neutralize a low-ball offer is to secure commitments for additional funding, likely from your existing investors. This reduces the perceived pressure a single acquirer can exert.



**WARREN
LAZAROW**

Regarding this strategy, another important point offered by Warren was the need for the entire organization to be "on the same page" regarding strategy, funding, outlook, and plans. He pointed out that the management team, investors, board members, and advisors for most startups are listed on the public website. Potential acquirers can and will contact these folks and look for inconsistencies and/or weak points in the story. The leadership team should decide who is authorized to return those calls and what will be said. Others need to be counseled to not engage. Potential investors should hear the same story from everyone.

To learn more

These are some of the key pieces of advice offered by Pete and Warren. The panel discussion that followed brought in multiple perspectives from bankers, VCs and CEOs. You can watch the entire event here:

siliconcatalyst.com/silicon-catalyst-webinar-maximizing-exit-valuations-for-technology-companies

THE OJO-YOSHIDA REPORT TECHNOLOGY IN CONTEXT



What We See: Five Keys to Chip Industry's Future

By Junko Yoshida and Bolaji Ojo

Two reporters who have been covering the global semiconductor industry for 25 years, Bolaji Ojo and Junko Yoshida, have teamed up this fall to launch [The Ojo-Yoshida Report](#), a subscription-based news/analysis newsletter and website.

The Ojo-Yoshida Report goes beyond conventional tech reporting to explore both the intended and unintended consequences of technology innovation. As the semiconductor industry advances at seemingly breakneck speed, everyone from senior executives and frontline managers to the marketing crew must keep ahead of the news cycle, reflect on what's happening, question the conventional wisdom, and ensure the organization is positioned to win the long game. The problem is finding the time to conduct this critical exercise.

That's where we come in. As we've done throughout our careers in tech journalism, we're here to make sense of it all. Right now, at The Ojo-Yoshida Report, we have spotted five trends with consequences that will matter to you.

1. SUPPLY CHAIN: JIC OR JIT?

The pandemic has forced participants across the automotive, semiconductor, manufacturing, and distribution industries to reconsider Just-in-Time (JIT) practices. We hear a chorus singing, "It's about time. End JIT."

The Ojo-Yoshida Report disagrees. Now is not the time to dredge up the discredited concept of Just-in-Case (JIC) inventory management. JIC is a poor replacement for JIT.

Let's rewind the clock to 2001, when a widespread inventory glut, fueled by faith in JIC, led to one of the worst downturns in semiconductor industry history. The turn of the millennium was a heady time of seemingly boundless industry growth. Demand so outstripped supply that many companies signed long-term supply agreements, setting the stage for the glut that followed when demand

inevitably crashed. Cisco Systems alone ended up writing off as much as \$3 billion worth of inventory.

But massive inventory builds have never worked in an industry chronically incapacitated by inaccurate forecasts. JIC didn't work then, and it won't work now.



JUNKO YOSHIDA

Even in good times, JIC is not for the fainthearted. It can result in a hidden pool of inventory. Suppliers, with limited oversight or even awareness of how much inventory is out there, resort to manufacturing without knowing how much stock is in customers' facilities. JIC can be disastrous for an industry that already has poor visibility into demand.

The calls to reinstate JIC are a knee-jerk reaction to the current undersupply situation. But JIC is not the solution to a failed supply-chain strategy.

What should the industry do instead? Work closely with suppliers and share information on orders, inventory, forecasts, and manufacturing-capacity utilization. Full disclosure of critical information would reduce the impact of a severe snapback in demand patterns. OEMs and fabless suppliers should also consider investing in semiconductor suppliers and foundries. Currently, the capital expenditure burden is borne primarily by IDMs and foundries, hence their overly cautious fab and plant investment strategies. Fabless companies, especially, must step up and help defray costs at their foundry partners to reduce the cyclical swings.

That's what we advise. But what will the industry players do, considering their history? We expect everyone to rally around key players, including chipmakers and foundries, for a few years. Once the current shortages abate, however, most companies will soon revert to their old ways. Semiconductor suppliers that have aggressively raised prices today without consulting customers or explaining the rationale for the higher ASPs won't get much sympathy from OEMs.

The lessons of prior shortages must be applied now to flatten the curve of the next supply/demand cycle.

Read the full story: [JIC is a Poor Replacement for JIT](#)

2. FINER PROCESSING NODES AT STAKE

As leaders in the semiconductor industry have learned over the years, extreme-ultraviolet (EUV) lithography is hard. A recent MIT Technology Review places the sophistication of EUV in the "Manhattan Project category class." Ojo-Yoshida Report contributor Ron Wilson describes the complexity of EUV lithography as "almost science fiction."

So when researchers at lithography provider ASML completed the long, arduous, and complex process of EUV development, the masters of semiconductor R&D congratulated one another, believing that the industry had secured a path to finer processing nodes. Long live Moore's Law!



BOLAJI OJO

Virtually all the key chip players, from Intel and IBM to TSMC and Samsung, rallied around ASML's EUV effort, simply because success would have been impossible for each company to achieve on its own. But it's never a good idea to put all your eggs in one basket. Today, the industry is left with no short- or even intermediate-term alternative to ASML's EUV program.

The smooth operation of global trade in advanced technology is crucial. Given the tight integration between ASML, its equipment users, and its own suppliers, even a modest restriction in trade — whether through geopolitical disputes or disruptions in transportation — could grind the entire supply chain to a halt. This applies not just to manufacturing equipment, but to the consumables — illumination sources, masks, chemicals and so on — that must be continually delivered to manufacturing sites in Taiwan, South Korea, and the United States.

EUV may represent one of the most complex and challenging supply chains created by humans. Simultaneously — and ominously — it's also one of history's most fragile supply chains, leaving far too much at stake.

Read the full story: [What's the Big Deal with EUV?](#)

3. FOLLOW TESLA'S PLAYBOOK, AND THIS IS WHAT AUTOMAKERS WILL GET

Tesla's Full Self-Driving (FSD) software, prematurely released on public roads, has taught us a few key lessons. Tesla itself will not necessarily learn them, but they pose consequences for the rest of the automotive industry.

a) Forget about the promised day when you'll be able to buy a family robo-van. That day isn't coming.

b) Tesla's yet-to-be-improved FSD software has proven one thing: human drivers' incredible ability to drive defensively. When human drivers are paying attention, they overwhelmingly excel at anticipating, interpreting, and managing potentially dangerous encounters with vulnerable road users and fellow drivers. If not for human drivers' manual interventions, many "elite" Tesla owners testing FSD software would have crashed, crumpled, or driven into the ditch. Credit for the safety of Tesla's FSD software does not accrue to the machine, but to human drivers.

c) When automated features such as hands-free highway driving become more broadly available, expect the National Highway Traffic Safety Administration (NHTSA) to lean into more regulation.

The requirement for driver-monitoring systems (DMS) in ADAS is a given — and you'll need a damn good DMS if you are serious about effective driver monitoring. But DMS is only the first step. Expect regulators to enforce stricter operational design domains (ODDs) for Level 2 and Level 2+ cars. NHTSA could "ban the use of Level 2 partial automation systems in proximity to vulnerable road users such as cyclists and pedestrians," suggests Colin Barnden, lead analyst at Semicast Research. The feds might even develop designated ODD describing "precisely where Level 2 partial automation can be activated."

If that happens, the proposed ODD would corral Tesla's Autopilot/FSD, as well as GM Ultra Cruise and Ford's Blue Cruise within "limited-access environments" away from urban settings.

Read full story: [When Teslas Crash, 'Uh-Oh' Is Not Enough](#)

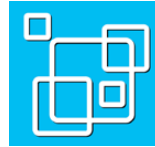
4. CAN YOU MANAGE SHIFTS IN GEOPOLITICS?

In current politics, globalization is out and nationalism is in. The "sovereignty" trend has caught fire worldwide.

In the two decades before the world flipped in 2021, China was the only economic power emphasizing domestic chip production. Now, political leaders in the world's other large economies — the U.S., Europe and Japan — are fostering the buildout of foundries on their own shores.

Caught in the middle is Taiwan Semiconductor Manufacturing Co. (TSMC).

THE OJO-YOSHIDA REPORT TECHNOLOGY IN CONTEXT



There have been persistent concerns that a potential takeover of Taiwan by China could threaten TSMC's viability. That scenario would bring the global semiconductor supply chain to its knees, and it's the reason political leaders worldwide are lobbying TSMC to expand beyond Taiwan.

"The nexus of business and politics is not a comfortable place to be," [Chris Miller](#), assistant professor at the Fletcher School of Law and Diplomacy at Tufts University, writes in The Ojo-Yoshida Report. He imagines that TSMC's leaders and the rest of the chip industry would rather focus on the things they're best at, such as etching circuits onto wafers, "[but] now semiconductor executives have a new task in their job descriptions."

TSMC isn't alone in contemplating the cost/benefit of building fabs in locales that have invited it to do so. This dilemma affects Intel Corp., Samsung, GlobalFoundries, and everyone else. Intel CEO Pat Gelsinger, for one, has urged that the EU "take control of its destiny" by making critical semiconductors in Europe.

The real test for semiconductor executives is not whether they can get government funding this year or next, but whether they have the savvy to manage the political pressure while enacting plans to maximize yield and profit margins at their new fabs.

Read the full stories:

- [The Geopolitics of TSMC](#)
- [Intel, Chipmakers, and The Fear Card](#)

5. PREPARE FOR SMOOTHER CHINA-U.S. RELATIONS

There are growing fears that China-U.S. relations could follow the arc of post-Cold War relations between the U.S. and Russia. Those concerns are misplaced, however, and reflect the recent news cycle rather than the realities of the substantive, if complicated, relationship the two nations have built over several decades.

The U.S. views China as a strategic competitor, a description the Chinese government would see as unlikely to change anytime soon. As a result of this perception, which gained strength during the Trump administration and persists even now, Chinese and American technology companies must navigate tortuous and heavily restricted paths for business engagement.

That is the current situation, and it will be many years before the two economic and political combatants finally calm the

most tempestuous aspects of their relationship. However, it would be a mistake for businesses to get so wrapped up in the wrangling that they fail to see the forest for the trees. The fact is companies on both sides of this geopolitical divide conduct a high volume of business together today and will continue to do for the foreseeable future.

We believe the posturing and jostling for political and military advantage by the two governments will continue to skirt the boundaries of their mutual economic interest. We further contend that the quarrels will reach a peak sometime in the next five or so years, during which the restrictions on enterprise engagement will get tougher before the two rivals ratchet down the tensions and then finally sit down together to resolve their issues.

China and the U.S. appear keen to step back from the inflammatory chatters of the last several years. On Monday, Nov. 15, U.S. president Joe Biden and Chinese leader Xi Jinping held [an hours-long virtual meeting](#) to discuss a range of issues, an indication of the desire to reset parts of the relationship. They didn't achieve their objectives, but the fact that they are talking makes it clear they will eventually find a way to resolve some of the more intractable problems.

Ultimately, within the next five to 10 years, China and the U.S. will sign a memorandum of agreement on contentious trade issues in areas such as communications, security, and intellectual-property protection. This will happen because the countries have no other option. Their economies have become so tightly linked that continued disruption of business activities will hurt enterprises on both sides. Too much is at stake for the two nations to continue banging heads for much longer. Technology innovations and the varied uses — both military and commercial — of electronics have worsened the spats between China and U.S. in recent years, but the realization will dawn on them that decoupling their interwoven supply chains will benefit no one.

Will electronics companies be prepared for a less combative climate? Patience is required, but companies that keep engaging with partners in China or focus on building out their businesses in the region will benefit from the opening of the country's borders to the free flow of economic activities.

To read more stories like these, please visit The Ojo-Yoshida Report and subscribe: www.ojoyoshidareport.com

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Forum 4.0 details can be found at the Events page: siliconcatalyst.com/semiconductor-forum-fall-2021

ADVISOR PROFILE

MISHA BURICH

Taking risks and listening to customers are two fundamental tenets of Misha's career

Silicon Catalyst's Advisor Ecosystem is one of the many benefits offered to companies in its incubator program. These benefits also include the In-Kind Partner Ecosystem that offers substantial cost savings for the development of a chip as well as its Investor Partners to help secure funding. While saving or raising money is an important benefit, focusing on the right product and the right market is really everything. This is where the Advisor Ecosystem makes a difference. The combined knowledge of this group can offer any startup the margin of victory through its guidance and experience. When someone joins this esteemed group of nearly 200 Silicon Valley veterans it's big news. Here, we will focus on Misha Burich - his life, his accomplishments, and his path to join the Silicon Catalyst Advisor Ecosystem.



MISHA BURICH
SILICON CATALYST
ADVISOR

architectures and the design of the chips that powered those architectures. It was the early 1980s, and the technology available to assist in the design of these chips was just beginning to emerge. Misha saw an opportunity to improve this process, so in 1984 he did something that very few had done before. He left Bell Labs, and with four other colleagues he formed Silicon Design Labs, a very early EDA company. Misha took a significant risk with this decision and risk-taking has become an important aspect of Misha's career and his successes. Taking risks and listening to customers are two fundamental tenets of Misha's career. They are valuable lessons for any startup.

Silicon Design Labs merged to become Silicon Compiler Systems and was ultimately acquired by Mentor Graphics, one of the leading companies in the new field of electronic design automation, or EDA in 1990. A couple of years later, Misha was once again ready to take more risks and so he left Mentor Graphics to start another software company, this time in a new area - theater and animation. Instinct Corporation was sold to a larger company in this market in 1995, logging another successful startup effort for Misha.

INNOVATION AND PUBLIC COMPANIES

Misha spent the next five years at Cadence Design Systems, the leading company in the now more mature field of EDA. He was able to spend a lot of time with customers during this time - an important activity for Misha. At the end of 2000, he joined Altera Corporation, one of the two leading FPGA companies, as a senior VP.

First, he led the software team to re-engineer the design platform that is used by Altera's customers to take full advantage of their programmable families of products. Later, he also led the FPGA design teams to introduce new architectural concepts and take advantage of the latest process nodes from TSMC. He was also Altera's chief technology officer, leading innovation that resulted

EARLY LIFE

Hailing from Belgrade, Misha was inspired by the US moon landing. That led him to come to the United States and receive his master's and PhD degrees in Electrical Engineering from the University of Minnesota. Misha's love affair with technology began to really blossom at that time and he has remained in the United States to the present day. After his university work, Misha joined Bell Labs in Murray Hill, New Jersey, one of the most advanced and prestigious research organizations in the world at that time.

INNOVATION AND STARTUPS

Misha began his research at Bell Labs in digital signal processing, which led to an interest in computer

in hundreds of patents every year, as well as funding university research efforts worldwide.

Misha was closely involved with all major customers to discuss their longer-term requirements and match Altera's technology to their needs. He retired after a 13-year career at Altera, starting another chapter of Misha's life. This is where we pick up the story of his involvement with Silicon Catalyst.

JOINING SILICON CATALYST

The semiconductor ecosystem is a tight-knit community. Many of its leaders and innovators know each other, either as colleagues, competitors, or both. Misha's relationship with Pete Rodriguez and Rich Curtin brought him into the ranks of the Advisor Ecosystem. Beyond Pete and Rich, Misha knows many of its members. An interesting case is John East, the former CEO of Actel, a fierce competitor of Altera. There are many such examples within the group. As Misha explains, prior rivalry becomes the basis of mutual respect and substantial combined knowledge in the setting provided by Silicon Catalyst.

Misha brings a storied career of startup successes as well as the orchestration of public company dominance. His knowledge of chip design, EDA technology, how to start a company and how to manage a team to a successful outcome, both small and large, are skills that become highly valuable to any startup. Like many of the members of the Silicon Catalyst Advisor Ecosystem, Misha focuses on areas that align with his interests and experience. This is where he can add the most value. The breadth of the team means that there is almost always very capable and interested advisors ready to help an incubator company.

This is the power of the Silicon Catalyst model. It creates a winning environment for new CEOs and experienced leaders alike. In a recent conversation with Misha, new trends in the semiconductor industry were discussed. He pointed to non-traditional uses of chip technology as a leading indicator. The ability to access massive amounts of data from sensor networks and analyze that data to form actionable strategies was cited. AI becomes a critical enabler here as well. This kind of technology can change our daily lives in many ways, from self-driving cars to more efficient supply chains to dramatically improved health care.

These exciting innovations are what drives Misha Burich and the rest of the Advisor Ecosystem. The unique setting created by Silicon Catalyst is allowing these innovations to flourish, thanks in part to the expert guidance of people like Misha. Truly, it's about what's next ®.

Silicon Catalyst Advisor
Dr. Wally Rhines
Awarded the Coveted
GSA Morris Chang Award

Congratulations to our colleague, mentor/advisor and industry luminary Wally Rhines, recipient of the 2021 GSA Dr. Morris Chang Exemplary Leadership Award, the industry's most distinguished accolade.

In addition to being an Advisor at Silicon Catalyst, Dr. Rhines is President and CEO of Cornami, Inc., a fabless software/semiconductor company focused on intelligent computing for fully homomorphic encryption and machine learning. He was previously CEO of Mentor Graphics for 25 years and Chairman of the Board for 17 years. During his tenure at Mentor, revenue nearly quadrupled and market value of the company increased 10X. Prior to joining Mentor Graphics, Dr. Rhines was Executive Vice President, Semiconductor Group, responsible for TI's worldwide semiconductor business.



DR. "WALLY" C. RHINES
PRESIDENT AND CEO OF
CORNAMI, INC.

Dr. Rhines has served on the boards of CirrusLogic, QORVO, TriQuint, Semiconductor, Global Logic, PTK Corp. and as Chairman of the Electronic

Design Automation Consortium (five two-year terms). He is a Lifetime Fellow of the IEEE. Additionally, his experience includes four years on the board of SEMATECH, three years on the board of SEMI-SEMATECH and twenty years on the board of SRC (Semiconductor Research Corporation). Dr. Rhines holds a Bachelor of Science degree in engineering from the University of Michigan, a Master of Science and PhD in materials science and engineering from Stanford University, an MBA from Southern Methodist University and Honorary Doctor of Technology degrees from the University of Florida and Nottingham Trent University.



Check out Dave French's fireside chat with Dr. Rhines, discussing their work together, starting at the beginning of their careers at Texas Instruments. siliconcatalyst.com/silicon-catalyst-advisor-wally-c-rhines-tapped-to-receive-gsas-highest-honor



INDUSTRY NEWS

MOSHE GAVRIELOV: PREVIOUSLY CEO AT XILINX, VERISITY AND EVP AT CADENCE, CURRENTLY A MEMBER OF THE TSMC BOARD OF DIRECTORS

Sean Redmond's interview with Moshe Gavriellov

SEAN REDMOND

I'm delighted to introduce Moshe Gavriellov, the ex-CEO of Xilinx, current board director of TSMC, and a very good friend to the UK semiconductor industry. Tell us about your connection with the UK Moshe and why you like spending time here?

MOSHE GAVRIELOV

I was born in Israel, but I actually grew up in London and I spent several formative years here when I was a child in London. I just always loved going back and walking around London. Then following that, I actually had an opportunity to run LSI logic's international business based out of the UK. The European headquarters was moved to Bracknell. So I spent two years managing the European business and then it expanded to all of the international business out of Bracknell. So I spent another two years of my life in the UK. So between the seven early years as a kid and two years, much, much later as an adult, I've always liked coming to the UK. I have a lot of friends in the UK. I have tremendous admiration for the engineering capabilities in the UK, which truthfully, I think have been underutilized and under exploited, over the years. So for me, there's just a very warm spot in my heart for everything from the UK.

SEAN: Moshe, you've been the CEO of a fabulously successful startup, Verisity, that was IPO of the year on Nasdaq in 2001. What advice would you give to new semiconductor startup CEOs that you wish you knew when

**SEAN REDMOND**

**FOUNDER & CEO,
VERTIZAN
MANAGING PARTNER,
SILICONCATALYST.UK**

you started taking on that role as the CEO of Verisity?

MOSHE: Well that was indeed a unique opportunity. It was first and foremost a great set of people. And I would say, you need to make sure in particular in a startup, that you have people you want to work with, right? Because startups tend to be so intense and they tend to have small teams where people perform several functions. There's no sort of infrastructure. I would say, first and foremost, make sure that you like the people you're working with, because you will spend a lot of time with them.

And then, you know, there's always a question. How do you drive the company? Do you drive it towards an exit, which is an acquisition, or do you try to build an independent company? And, I believe, that

the proper approach is if you do things with the intention of it being a well-run significant company that can grow and remain independent, then you have more options.

And then if, and when, as most startups end up, they do get acquired. We were fortunate at Verisity. We went public in 2001, which is not an easy time to go public. And then we were public for four years before we were acquired by a much larger player. But I would say, try to think about the medium and the long-term and use that as the driver of what you're trying to do. And don't just do it based on short-term thinking, because I think that if you compromise and just try to get things done for the short term, you really are restricting your options going forward. And it's worth keeping that in mind when you're running even a small company to keep the medium and long-term in mind in terms of your goals and expectations.

SEAN: Excellent. Thank you, Moshe. Very few startup CEOs go on to run one of the largest semiconductor companies in the world. And you successfully made that transition. What's your view on taking risks when you're starting new projects? Clearly startups are by their very nature, new, innovative, quite often doing things that have never been done before. And so in making decisions about taking

Keep your eye on the differentiation, make sure that you exploit it and you're very aggressive at driving it.

technology risk or market risk to develop products for yet to be defined markets, what's your take on that very difficult decision in terms of risk-taking.

MOSHE: You know, as you point out very correctly, startups are risky and that's okay. They're also a lot of fun. There's a lot more freedom when you're running a startup because you don't have tremendously difficult, big company issues. You can make decisions very quickly and you can pivot quite quickly. I would say that with the issue of risk, I think the most important thing to do is to have a clear understanding of what your core differentiation is. And as long as you have a clear understanding of what you have, which is different, either in terms of the technology and the markets and relentlessly drive to exploit that, then you're more likely to be successful. And I would say that anything which really is not differentiated, or maybe is just focused on reaching a lower price point, but without a clear technology or market differentiation, it's very risky.

And the reason is that those price points are not defined by you. They are defined by what the competition is prepared to sort of accept, right? So you can sort of say, okay, you know, mine will cost half as much. Well, it could cost half as much as what your competitor is selling it for today, but if they want to protect their market, which they typically will, and you're a small player, then just sort of reducing the price, beyond what you believe they can do is not something you can control. And so keep your eye on the differentiation, make sure that you exploit it and you're very aggressive at driving it as profoundly as you can, because then I believe you'll be more successful in delivering success, going forward.

SEAN: Excellent advice Moshe for new CEOs out there. What's the hardest thing they're going to have to face as a CEO?

MOSHE: Well, this is a cliché, but it's actually true. The CEO role is a very lonely one and in the startup world it's even lonelier. Because there's so many things that you need to do as a CEO and there's not the broad support structure. My advice is to make sure that you have, and I don't know if mentor is the right word, but you have someone, who's not part of your team, but who you can be open with and who will listen to you and hopefully has the experience. Who will be able to share their thoughts based on what you're presenting to them. It's something I actually am trying to do now, since I'm retired, and I'm not in any active operational roles. I like to do board roles and primarily make myself available to the CEOs and actually to some of the staff. Sharing my thoughts with them without trying to run the companies for them, which I have no interest in doing, I think is one of the biggest benefits that I provide. And I personally had that option where there was someone who was outside our industry. I could always call and he was always happy to hear what my challenges were and to share his opinions. That neutral person who's really there as a sounding board and is a constructive sounding board is invaluable. And I would say that for CEO startups, if you can find someone like that, normally they don't have to be friends, but normally there's sort of a respect that you have to that person and that person has towards you, is very helpful and was very helpful to me.

www.tsmc.com

**MOSHE
GAVRIELOV**

**TSMC
INDEPENDENT DIRECTOR
MEMBER,
AUDIT COMMITTEE
MEMBER,
COMPENSATION COMMITTEE**

Mr. Gavriellov served as President and CEO of Xilinx, Inc. from January 2008 to January 2018 and as a director of Xilinx, Inc. from February 2008 to January 2018. Prior to that, he served at Cadence Design Systems, Inc. as Executive Vice President and General Manager of the Verification Division from April 2005 to November 2007, and CEO of Verisity, Ltd. from March 1998 to April 2005. He also served at a variety of executive management positions in LSI Logic Corp. for nearly 10 years, and engineering and engineering management positions in National Semiconductor Corporation and Digital Equipment Corporation. Currently, Mr. Gavriellov is the Executive Chairman of Wind River Systems, Inc. in U.S. (a nonpublic company) and a director of ForetelliX in Israel (a nonpublic company). Mr. Gavriellov holds a bachelor degree in electrical engineering and a master degree in computer science from Technion—Israel Institute of Technology.



SILICON CATALYST PORTFOLIO COMPANY OVERVIEW

Lelantos

Revolutionizing the world of gas sensing

Lelantos raises seed funds for new era of gas sensing

October 11, 2021 | New York, NY and Silicon Valley, CA

Lelantos, a developer of semiconductor gas sensors for Internet of Things (IoT) monitoring applications targeted to the oil and gas industry as well as heating, ventilation, air-conditioning and refrigeration market (HVACR), has raised seed funding to further develop and commercialize its patented gas sensing technology. Lelantos was recently awarded a National Science Foundation SBIR Phase II grant. Concurrently, Lelantos has also received funding from the Silicon Catalyst Angels, a group of early-stage angel investors based in Silicon Valley. The combination of the SBIR grant and the equity investment enables Lelantos to expand the team and move forward with their product development plan.

"Securing this initial funding is a very important step forward for the company," said Dr. Stylianos Siontas, CEO and co-founder of Lelantos. "Our vision is to provide pervasive environmental monitoring and safe working conditions in the oil and gas, and HVACR market. We appreciate the shared commitment from these early investment groups to enable this vision."

Lelantos was founded in 2019 by Columbia University professor, Dr. Ioannis Kymissis and Dr. Jose Bajamonde, CTO, alongside Dr. Stylianos Siontas. The foundational technology was developed in Dr. Kymissis's lab over the last 5 years. Lelantos implements a novel approach to sense the presence and identity of the target gas molecules by leveraging functionalized piezoelectric films that can be fabricated on conventional silicon microchips. This approach enables a single sensing device able to identify a myriad of target gasses while offering an unparalleled combination of size, power, and cost, enabling widespread adoption in Internet of Things (IoT) applications. The

opportunity to commercialize the technology was initially enabled with the award of an NSF STTR Phase I grant in 2020.

"We are pleased to witness the strong investment support in Lelantos combined with the SBIR II grant. We have been extremely impressed by the team and their continued advancement of a technology that could have a material impact on addressing leak detection applications in the oil and gas industry. Aegex is strongly invested in this space and continually seeks innovative sensor technologies that we can support in integrating into our IoT solutions. With this milestone, we will be expanding our support and continue to commit resources to accelerate the Lelantos technical development and path to commercialization," said Thomas Ventulett, CEO of Aegex Technologies, LLC, a global provider of certified intrinsically safe solutions targeted to the industrial market.

In April 2021, Lelantos joined the Silicon Catalyst incubator to take advantage of the expanded design and manufacturing ecosystem. The mission of Silicon Catalyst is to lower the capital expenses associated with the design and fabrication of silicon-based IC's, sensors, and MEMS devices. For over seven years, the Silicon Catalyst partner ecosystem has enabled early-stage companies to build complex silicon chips at a fraction of the typical cost. Additionally, the startups can tap into the world-class Silicon Catalyst advisor and investor network.

"Lelantos' gas sensor technology addresses a critical market that is already very large and will grow dramatically in the coming years. As a Portfolio Company in our incubator, we are pleased to see that they are making great progress in executing on their commercialization plans," said Pete Rodriguez, CEO, Silicon Catalyst.

ABOUT LELANTOS

Lelantos is revolutionizing the world of gas sensing, developing a new generation of IoT compatible gas sensors targeted to high value monitoring applications in threat detection, industrial safety, environmental and air quality



monitoring as well as medical diagnostics. Current gas sensors suffer from inherent weaknesses such as bulky size, high power consumption and high cost. As such, they prohibit effective monitoring in IoT oriented use cases that require pervasive sensing to be provided by autonomous, battery operated sensors with wireless connectivity. In contrast, Lelantos sensors can achieve up to 1000x more compact size, lower power consumption and lower cost than currently utilized systems. With its transformative sensing technology, Lelantos is enabling the widespread adoption of gas sensing in IoT applications and the disruption of the market providing a true chemical sensor for the Internet of Things.

Problem / Market Opportunity

Our beachhead market is identified in the detection of hazardous hydrocarbon leaks in the oil & gas and HVAC market.

Starting with the first use case, this involves methane emissions from the oil & gas industry, which has two dimensions to it, the safety aspect as methane is flammable and can lead to explosions and the environmental one as it is a potent GHG. One third of methane emissions originate from the oil & gas industry summing up to 82Mt/yr with an associated financial product loss of \$64B.

Driven by strict climate regulations, but even more so from a clear financial perspective, oil companies are trying to keep natural gas as a cleaner alternative to coal and are pushed to satisfy environmentally sustainable investors. To that point the world's 80 largest players responsible for 1/3 of global production have committed to reducing emissions by 10 times. It is agreed that 40% of emissions are fixable at zero net cost and the best way to reach that goal is to lower the cost of pervasive leak detection methods.

There is as such a clear unmet need for large scale, distributed, persistent monitoring solutions.

Similarly to methane, the second use case concerns the detection of flammable refrigerant leaks in the HVACR market. As refrigerants are extremely harmful GHGs, regulations have imposed their phasing out and replacement with environmentally friendlier materials. However, the problem is that these new gasses are flammable, therefore, new regulations require leak detection systems in place specifically in confined spaces. Based on these regulations leading equipment manufacturers such as Trane, Carrier and Johnson Controls are currently incorporating detectors into their new line of products.

There is again a clear regulation-driven market need for large scale, pervasive monitoring that requires compact, cheap sensors in commercial and residential cooling applications.

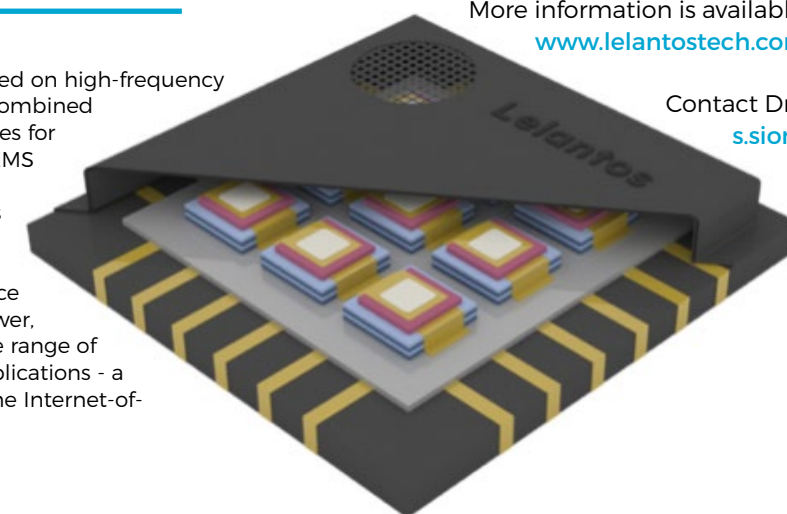
Solution / Product

Lelantos' gas sensing technology, based on CMOS integrated piezoelectric resonator arrays is a transformative approach, optimal for IoT applications and is fully compatible and leverages the mature semiconductor infrastructure making benefit of full wafer processing. Our protected IP for the direct integration of these arrays onto conventional CMOS circuits leads to 1000 times more compact size lower power and lower cost in contrast to current technologies while offering superior detection performance. As a foundationally superior sensing technology, Lelantos is enabling the widespread adoption of gas sensing in IoT applications and the disruption of the market providing a true chemical sensor for the Internet of Things.

More information is available at:
www.lelantostech.com

Contact Dr. Stylianos Siontas:
s.siontas@lelantostech.com

Lelantos technology is based on high-frequency piezoelectric resonators. Combined with our patented processes for the integration of such MEMS devices with receptors suitable for differential gas sensing and classification on conventional CMOS microchips, we can produce unparalleled, ultra low-power, low-cost sensors for a wide range of high-value monitoring applications - a true chemical sensor for the Internet-of-Things.



PORTFOLIO COMPANY NEWS
QUADRIC.IO

CEO Interview: Veerbhan Kheterpal of quadric.io

by Daniel Nenni | August 27, 2021

It was my pleasure to meet Veerbhan Kheterpal. Veerbhan has founded three technology companies and has full stack expertise spanning software to silicon across Edge & Datacenter applications. Currently, he is a CEO & Co-Founder of quadric.io, a company that has created a new processor architecture for high performance on-device computing.

Prior to quadric.io, Veerbhan was a technical co-founder of 21, Inc where he was focused on bringing power-efficient ASICs to the cryptocurrency space. Veerbhan served in various roles ranging from designing custom ASICs (3 production chips in 18 months), developing web scale blockchain backends & building consumer facing mobile apps. Prior to 21, Veerbhan co-founded Fabbrix, Inc, which was acquired by PDF Solutions. Fabbrix was focused on software that enabled design for manufacturability of complex Integrated Circuits. Veerbhan is an entrepreneur at heart and always looking for breakthroughs in technology, relationships and parenting.

WHAT'S THE BACKSTORY OF QUADRIC?

In 2016, we started building an agricultural robot that was going to transform first, vineyard management, and eventually, crop management of any kind — reducing costs, minimizing arduous tasks for humans, and maximizing crop returns. While this might seem like a lofty goal, I was working with two talented partners, and we had just built and shipped a very complicated technical product in the bitcoin computing space. With our combined technical backgrounds,

and access to cutting edge technology, we had no doubt about our ability to build this first-of-its-kind robot that would transform the agriculture industry.

We had just one problem: we couldn't make it work. I mean we made it work — we wrote code and developed software and designed and built hardware prototypes that functioned. But we soon came to realize these prototypes would never become the affordable, scaleable, commercially viable products we had envisioned.

Why not? In short, the existing technology platforms built with CPUs and GPUs simply didn't support the compute performance and capacity that was required with the power footprint. This forced us to conduct a deeper inquiry into the power consumption of our software. This led us down a path of inventing a new processor architecture; one that generalizes the dataflow paradigm and delivers on a higher level of power efficiency for a wide range of algorithms in Machine Learning, Computer Vision, DSP, Graph Processing & Linear Algebra.

WHAT PROBLEM ARE YOU SOLVING?

Quadric's processor is built by developers for developers. Developers are creative beings. Just like we were attempting to get cutting edge algorithms to work on our robot,

VEERBHAN KHETERPAL
CO-FOUNDER & CEO
QUADRIC.IO

developers continue to push the envelope of algorithms in order to bring delightful experiences to everyday devices. Recent examples of these algorithms are driven by rapid research in AI models. Once they have developed their dream algorithm, they start pulling their hair out when trying to deploy it at scale. Existing computing solutions for deploying intensive workloads are either too power hungry (think

GPGPUs) or too restrictive in capability (think AI chips/accelerators). Further, AI inferencing doesn't run on its own, it is frequently accompanied by classical data processing steps which require the developers to include additional specialized hardware such as FPGAs/DSP chips. Besides the hardware complexity, this leads to additional software integration complexity. Quadric's architecture makes it easy to ship high performance AI inference combined with classical data processing with a single software model.

Further, quadric's architecture is scalable which means that if a certain power/performance combination does not fit your application, just pick a different size of our hardware keeping the software the same.

HOW FAST DOES ON-DEVICE AI GET DEPLOYED? WHAT ARE THE APPLICATIONS?

Over the past several years we have seen at scale AI inference deployments

in the cloud. A few examples such as recommendation engines and voice assistants come to mind. However, cloud deployment of inference has its limitations primarily due to privacy or round trip latency reasons. Due to latency reasons, robotics, automotive, video game consoles & smart sensors have already deployed on-device compute solutions and are gaining volume with tremendous momentum.

Recently, we are seeing privacy driven requirements that need compute to move away from the cloud and be deployed on-device. Driven by privacy laws, the security industry is going through this transformation. This is driving the next generation of devices to include on-device inference capability.

If you step back and view AI as tomorrow's "data driven" software as opposed to yesteryear's "code driven" software, we are going to see a future with more than 80% of devices performing some sort of deep neural network in the next 5 years.

WHAT ABOUT ON-DEVICE TRAINING OF MACHINE LEARNING MODELS?

Great question. Training at the Edge or on-device training has been very difficult so far due to lack of specialized hardware and the diversity of processors at the Edge. As the next generation of devices gain specialized compute capabilities, it becomes feasible to perform limited amounts of training on the device itself. Now, the possibility of it alone doesn't drive adoption — you need powerful drivers to move the market. We are seeing one such driver starting to affect this change where a limited set of customers are looking for on-device hardware capability that allows them to portion the AI training algorithm on the device itself. This is different from solutions like homomorphic encryption that also attempt to preserve privacy.

To summarize, it's still early days of "training at the edge" but the driving

forces are assembling and multiple solutions are being proposed.

ON-DEVICE INFERENCING MARKET IS SUPER HOT. HOW DOES QUADRIC STAND OUT?

Software and hardware scalability.

Most solutions in AI chip space are focused on accelerating layers and topologies that are well known today. However, this means the developer is locked into the family of DNN architectures of today. AI is changing fast and still taking large innovative leaps. Because quadric's hardware is general purpose, our software can scale to any data parallel workload. This gives developers the superpower to ship any new algorithm whether it is a new type of DNN layer or a domain transformation without limitations.

Further, a single instance of quadric's architecture can scale from 200 milliwatts to 20 watts. This gives us scalability across multiple applications and makes it worthwhile for large customers to adopt quadric's solution. quadric's solution is also designed to deliver cutting edge performance while providing this level of software and hardware scalability.

THE INDUSTRY IS MOVING TOWARDS USING MULTIPLE DOMAIN SPECIFIC ACCELERATORS. HOW DOES QUADRIC FIT IN?

Quadric has taken a general purpose dataflow approach to the high performance computing problem. Our secret sauce is in the co-design of our instruction set and the accompanying compiler software that optimize for simultaneous compute and data movement. Most others are taking a DNN specific dataflow approach that quickly becomes obsolete as AI models evolve. The key is to acknowledge that the full system requires AI inferencing that is accompanied by custom data preprocessing or post processing algorithms. Due to its general purpose nature, quadric's architecture can

replace multiple types of accelerators (DSP, Vision, AI) with a single one. This leads to a win for our customers on several axis:

- **2x-3x Faster Software Integration**
- **2x-3x Faster Hardware Integration**
- **2x-5x Higher Performance/Watt**
- **2x-3x Lower Latency**
- **2x-3x Lower Cost**

AS AN ENTREPRENEUR, WHAT ADVICE WOULD YOU GIVE SOMEONE FOUNDING A STARTUP OR THINKING ABOUT STARTING ONE IN THE SEMI SPACE?

The semiconductor space is relatively harder for startups. This requires the right mix of short term thinking while having an organic path to building a long term defensible moat. My advice to entrepreneurs is to think critically about the semiconductor product and their value proposition. Here some questions that you want to answer:

- Am I creating enough short term value to be able to build my company while having a path to becoming a sizable enterprise? E.g. The biggest risk that investors perceive is the "defensible path to scaling beyond the first few design wins".
- Is my product going to get easily commoditized after everyone realizes its value? Eg. First movers on bitcoin mining chips made profits which later disappeared due to intense competition that caught up quickly.
- How fast can competition catch up?
- Do I have a defensible moat even if a better product comes along?

Another key feature of valuable semiconductor companies is that they are not hardware companies! You have to think about software as early as possible in the game. At quadric, we built the software before we built the hardware. We also consistently invested more than 70% of R&D capital in software. This strategy has worked well for us.



PORTFOLIO COMPANY NEWS mmTRON



Silicon Catalyst and mmTron are helping to make mmWave 5G a reality

by Mike Gianfagna | February 22, 2021

Everyone is talking about 5G these days. The buildout is beginning. The newest iPhone supports the new 3GPP standard. Excitement is building. But there is a back story to all this. Silicon Catalyst recently added a new company called mmTron to their incubator program. These folks are millimeter wave experts and that turns out to be quite relevant for 5G. I had a chance to catch up with mmTron to explore this new addition to the Silicon Catalyst Incubator. What I discovered was there is a critical portion of the 5G buildout that has some serious challenges. Challenges that mmTron is uniquely positioned to solve. Read on to learn about the 5G back story and how mmTron's innovative products will contribute to delivering on the promises of 5G. Silicon Catalyst and mmTron are helping to make mmWave 5G a reality.

THE TEAM

First, a bit about the two folks I spoke with. Dr. Seyed Tabatabaei founded mmTron in 2020. He has substantial expertise in millimeter wave technology having led design efforts at MaCom, Agilent, Endwave and Teramics before founding mmTron. Seyed has assembled a team with exceptional skills in this specialized and critical area, drawing on experience from satellite and defense applications.



DR. SEYED TABATABAEI
PRESIDENT & CEO
FOUNDER



GLEN RILEY
BSEE
ADVISOR

Glen Riley has recently joined mmTron as an advisor. Glen has a storied career in semiconductor companies that includes TI, AT&T and Qorvo. Glen has held several senior executive positions in general management, marketing, and sales. Glen currently is a board member and advisor for companies in the RF and optical markets. He previously knew Seyed as a customer and recently Silicon Catalyst put Glen back in touch with Seyed to become a key executive advisor.

THE 5G DESIGN CHALLENGE

It turns out much of the 5G build out occurring today is based on sub-6GHz spectrum implementations which are similar to the currently deployed 4G network. The substantial benefits of 5G (e.g., very high bandwidth and very low latency) will be delivered in the millimeter wave spectrum (i.e., 24GHz to 80GHz). Verizon is deploying some of this technology today and the new iPhone 12 can support that technology. These efforts are just the

beginning of the process and there is still much to do before the full benefits of 5G are realized.

At these frequencies the speed delivered to your handheld device will be equal to or greater than today's broadband residential connections. This is where the challenges of transmission for 5G exist. You've probably heard about the need for sophisticated antenna systems that support beamforming to make all this work.

Beyond antenna systems, there is also a big challenge to deliver electronics for high bandwidth and high-power transmission systems at reasonable cost. Most millimeter wave electronics available today are based on military and satellite applications, where commercial cost pressures aren't as severe. This is the area where mmTron delivers significant value over and above what is currently available from the existing RF / mmWave suppliers.



THE MMTRON SOLUTION

Thanks to its proven, patented architecture, mmTron technology can support 5G millimeter wave applications requiring higher power and higher linearity higher power and higher linearity better than other solutions. These key differentiating features mean fewer base stations and smaller phased array antenna systems are needed to deliver the same or greater capability. mmTron's high linearity products complement existing lower power silicon-based beamformer chips on the market. mmTron estimates that 5G infrastructure costs can be reduced by 40 percent or more using its technology and that is big news.

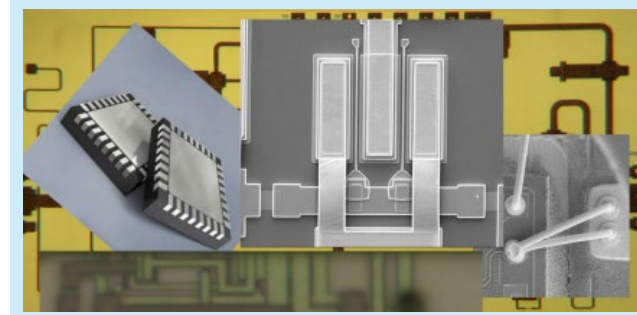
mmTron's outsourced fab and assembly/test ecosystem is already in place. RF silicon-on-insulator, gallium arsenide and gallium nitride technologies are used to deliver mmTron's products. When compared to other large companies that support this market, mmTron represents a disruptive force in the industry as shown in the figure below.

COMPETITIVE LANDSCAPE

mmTron is currently in discussions with several very large infrastructure manufacturers. The company will soon close a funding round and tape out its first family of products for first delivery in late 2021. The addition of mmTron to the Silicon Catalyst incubator illustrates the breadth of the program from a technology and market perspective.

You can learn more about mmTron and its new and disruptive technology here. Whether you're interested in learning more about their product offerings or contributing to the company's growth, you can inquire here. It looks like an exciting adventure as Silicon Catalyst and mmTron are helping to make 5G a reality.

For more information visit mmtron.com.



MMICs for mmwave

mmTron focuses on custom MMIC and RFIC design in GaAs, GaN, InP and SiGe processes, high frequency modules, components and sub-systems.

Wireless Communications 5G / 6G

mmTron's specialization in high-precision assemblies has proven success in wireless backhaul, commercial radar, mmwave point-to-point radio and more.

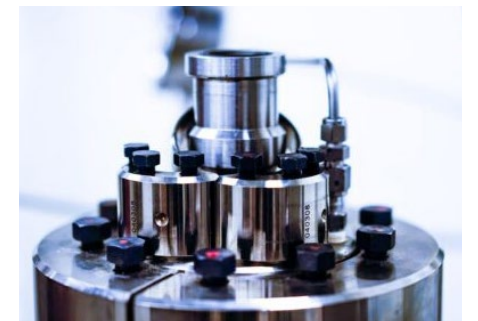


Aerospace & Defense

The mmTron Design Team delivers comprehensive solutions for the complex missions and programs in military and aerospace.

Instrumentation

Our microwave test equipment specialists use highly capable MMICs and modeling software to deliver high-functionality products at the rigorous standards of the scientific community.



Satellite Communication

Our millimeter-wave products empower space missions and enable satellite communications.

PORTFOLIO COMPANY NEWS
OWL AUTONOMOUS IMAGING



Owl Autonomous Imaging's camera technology improves vehicle sensors

Press Release from the Rochester Business Journal · July 1, 2021

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Owl Autonomous Imaging is one of 10 finalist companies with optics, imaging, and photonics-enabled technologies that is working with NextCorps' Luminate NY accelerator as part of its fourth cohort. Each company received an initial investment of \$100,000 and is participating in the six-month program, which helps the selected companies speed the commercialization of their technologies and businesses. On Sept. 30 at Finals 2021, they will compete for up to \$2 million in follow-on investment. Funding for the \$25 million program is being provided through the Finger Lakes Forward Upstate Revitalization Initiative.

"This cohort is comprised of an impressive mix of sophisticated new companies that offer industry-changing technologies and expertise," said Sujatha Ramanujan, managing director of Luminate. "The goal of the Luminate program is to support their work and help bring their ideas to market, while strengthening what has become a global powerhouse for photonics and imaging innovation."

The Rochester Business Journal is featuring profiles of the companies that are helping to write the next chapter in Rochester's history as the world's center for optics, photonics, and imaging (OPI).

We caught up with Chuck Gershman,



Owl Autonomous Imaging aids in preventing auto accidents through 3D thermal imaging and precise ranging to better the perception of sensors on vehicles.

Owl's CEO, to discuss how his company is improving automotive safety systems.

WHAT IS OWL AUTONOMOUS IMAGING?

Owl Autonomous Imaging has created a new camera technology that uses high-definition 3D thermal imaging with high-precision ranging to improve the perception of sensors that are used in cars, trucks, buses, and off-road vehicles to enable safe semi-autonomous or autonomous vehicle operation in all weather – day or night.

WHERE IS YOUR COMPANY HEADQUARTERED?

We are headquartered in Fairport. We also have a presence in Silicon Valley, North Carolina, Detroit, and are

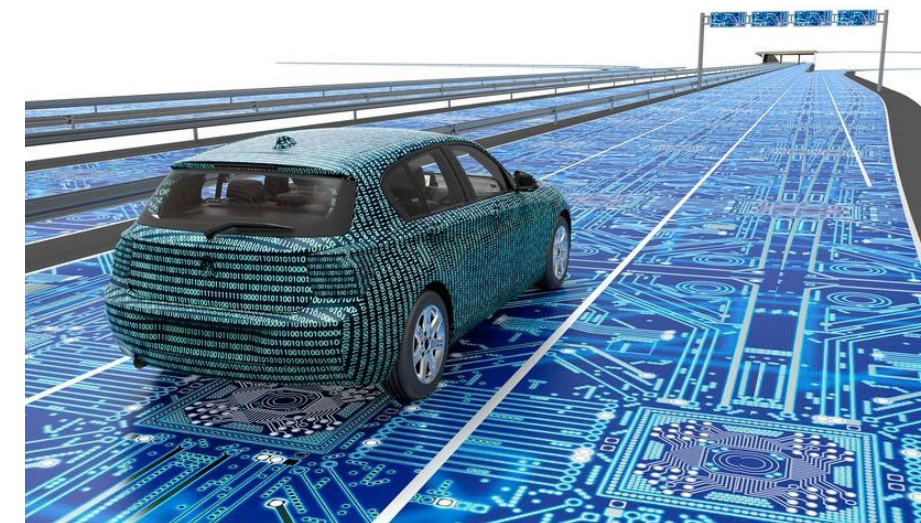
looking at expanding into Germany.

HOW DID YOU AND YOUR TEAM DEVELOP THE CONCEPT FOR YOUR PRODUCT?

The basis of our technology was developed as part of a challenge grant for the U.S. Air Force (USAF). The USAF wished to study the viability of using multi-spectral thermal imaging to track ballistic missiles in flight. After successfully demonstrating a camera that met the USAF viability study, we formed Owl to apply the technology to commercial mobility applications, including cars and trucks, for the safe operation of high-speed vehicles.

WHY DOES THE WORLD NEED THIS PRODUCT?

Over the past decade, in the US alone about 6,000 pedestrians are struck and killed by vehicles each year. About 76 percent of these fatalities occur in limited light conditions, often at dusk or dawn or at night. Why? Safe operation of vehicles requires sensor solutions that function day and night in all weather conditions. Recent studies by AAA and others show that pedestrian automated emergency braking systems are completely ineffective at night. Despite these potentially deadly shortcomings, these systems are quickly becoming standard features on most cars and trucks. Owl's sensor solution sees



an ideal fit for our company. Still in our first weeks in the program, we have already found Luminate to be true experts in the mentoring of early-stage companies. Its team is world-class with extensive real-world experience. They are committed to helping emerging companies strengthen their business foundations and professionalism in order to grow efficiently and effectively. This is my fifth startup company and Luminate has already taught me things I did not previously know.

WHAT ARE YOU HOPING TO ACHIEVE DURING YOUR TIME IN LUMINATE?

Luminate brings valuable expertise and can make introductions to help us build relationships within Rochester's camera and optical arena. This will enable us to expand headcount and grow our businesses. We are in expansion mode – hoping to double our staff, specifically in artificial intelligence, semiconductors, sensors, and robotics expertise, over the next year – and Luminate can help us by providing the relationships and fundraising to support that growth.

IF YOUR COMPANY WINS, WHAT DO YOU PLAN TO DO WITH THE FOLLOW-ON FUNDING?

Additional funding will support our growth trajectory and help us to accelerate the release of the A Sample 3D Thermal Camera product.

Luminate NY

To receive updates from Luminate, including the time and venue for Finals 2021, visit: luminate.org.

everything regardless of the time of day and easily enables safe automated operation of vehicles. This includes pedestrian and cyclist detection for emergency braking systems even at night or in foul weather.

HOW LONG HAVE YOU BEEN WORKING ON THIS TECHNOLOGY?

We have been working on this technology since 2018 and have made significant progress. We currently have pilots with traditional OEMs and tier-one automotive suppliers, and are in discussions with major suppliers for joint development agreements for integrated solutions. We are looking at partnerships with dozens of customers throughout the automotive industry.

WHO IS THE TARGET AUDIENCE FOR YOUR PRODUCT?

The market is significant: Roughly 100 million new vehicles (cars and light trucks) are sold every year. By 2024, 40 percent of new cars will be outfitted with advanced safety features, such

as those that could be augmented with Owl technology. And that only accounts for the commercial vehicles we know of today. There are also autonomous vehicles, construction, and agriculture vehicles that can benefit from our technology.

Our target market also includes heavy equipment manufacturers, smart city applications, and defense.

WHAT MADE YOU LOOK TO ROCHESTER TO FURTHER YOUR PRODUCT?

Rochester is the most prominent R&D region in the world for camera technology and expertise. We will continue our development here, as it makes perfect sense.

TELL US ABOUT YOUR EXPERIENCE BEING IN LUMINATE.

We first met Luminate at the SPIE Photonics Conference in San Francisco in January 2020. The program also came highly recommended by our investors in Rochester who saw it as

Below, is the link to our recent interview in RBJ.
owl-autonomous-imagings

Below, are the links to our podcast on Youtube and NextCorps' website:
www.youtube.com

NextCorps website (with audio options):
nextcorps.org/podcast/spotlight

PORTFOLIO COMPANY NEWS
OWL AUTONOMOUS IMAGING



Venture Creations company wins \$100,000 in New York state Luminate competition

OWL AI will join the startup program to help advance its patented thermal imaging technology

by Rochelle Allan | May 28, 2021

OWL AI, a client company in RIT's Venture Creations incubator, was a winner in the New York state-funded Luminate NY accelerator program.

OWL AI was among 126 applicants from 22 countries that rose to the top, winning a \$100,000 prize and entry into Cohort 4 of the program. Luminate NY is the world's largest accelerator program for optics, photonics, and imaging (OPI) startups, and is also instrumental in helping early-stage startups gain clear competitive advantages with the funds necessary to further their technological advancements.

OWL AI was founded in 2018 by president and CEO Chuck Gershman and Chief Technology Officer Gene Petilli and joined Venture Creations in July 2020. The company has introduced a new patented sensor modality, which is being marketed as the "world's only monocular 3D thermal ranging solution." The modality promises high precision, representing a vast improvement in the resolution and cloud density of LiDAR. For example, it can classify cyclists, animals, pedestrians, and vehicles, while also calculating speed, direction, and position.

"We have found that curb sensors in automated mobility systems, like self-driving cars and driver-assist safety ADAS, in low light or no-light conditions, or in degraded visual environments like smoke, fog, glare, or snow, have been found to be ineffective," said Gershman. "OWL has developed a sensor that tackles this problem by increasing the probability for safe driving through all these conditions."

This sensor can detect and classify objects around a vehicle in any environment, ensuring that drivers are aware of their surroundings at all times. According to Gershman, nearly every automotive equipment manufacturer and their key automotive suppliers are talking with OWL about how to add high-definition 3D thermal imaging to their solutions.

The OWL founding team has been developing sensor solutions for more than 30 years, from the earliest days of the first digital cameras to multiple thermal imaging systems in space.



The team from Venture Creations company OWL AI, pictured here using thermal imaging technology, was awarded \$100,000 in the Luminate NY startup competition. OWL AI's patented thermal sensor modality can detect and classify objects around a vehicle in any environment, ensuring that drivers are aware of their surroundings at all times.

"As a Rochester-based company, OWL is thrilled to have been recognized and selected by **Luminate** for its Cohort 4," added Gershman. "Working with the Luminate team will dramatically help us as we grow our team locally and connect with world-class optical partners in the region."

"All of us at Venture Creations would like to thank New York state and Empire State Development for their continued support of our startup companies, and we are proud of the hard work and accomplishments of our member company OWL AI," said Peter Parts, interim director of RIT's Venture Creations incubator. "The Luminate NY competition brings together some of the absolute best and brightest optics, photonics and imaging companies in the world. By providing quality coaching and connections with industry professionals, Venture Creations creates an environment where these cutting-edge businesses can develop and thrive. New York state is an innovation hub, and Venture Creations is proud to be part of that ecosystem."

Luminate NY, which is administered by NextCorps, is funded by Empire State Development's Finger Lakes Forward Upstate Revitalization Initiative. Luminate has invested \$7.15 million in 30 startups and these companies, in turn, have raised \$26 million and collectively share a net worth of \$160 million.

PORTFOLIO COMPANY NEWS
TRAMETO



Making energy harvesting work for edge IoT devices

Micro energy harvesting, in the order of microwatts or milliwatts can provide potentially inexhaustible electrical energy captured from the ambient environment, ideal for IoT sensors.

By Huw Davies | July 16, 2021

IoT deployments continue to progress as organizations pursue digital transformation, and as smart living - in all its forms - holds the key to enhancing quality of life and sustainability.

IoT endpoints tend to be sensors or, less frequently, actuators that are connected wirelessly to an aggregating device or internet gateway. They are often deployed in large numbers and, in a scenario such as smart city, smart factory, or smart agriculture, dispersed over a large geographical area. The cost of carrying out field maintenance, such as replacing discharged primary batteries, is usually prohibitive. In addition, the discarded batteries represent an environmental burden that is increasingly unacceptable.

When designing endpoints, engineers can avoid the need for battery replacement by arranging sufficient energy supply to last for the expected lifetime of the device. This could be several years. A coin cell form factor is usually desirable due to size constraints. If the energy stored falls short of the system requirements, fitting a larger cell may be an option.

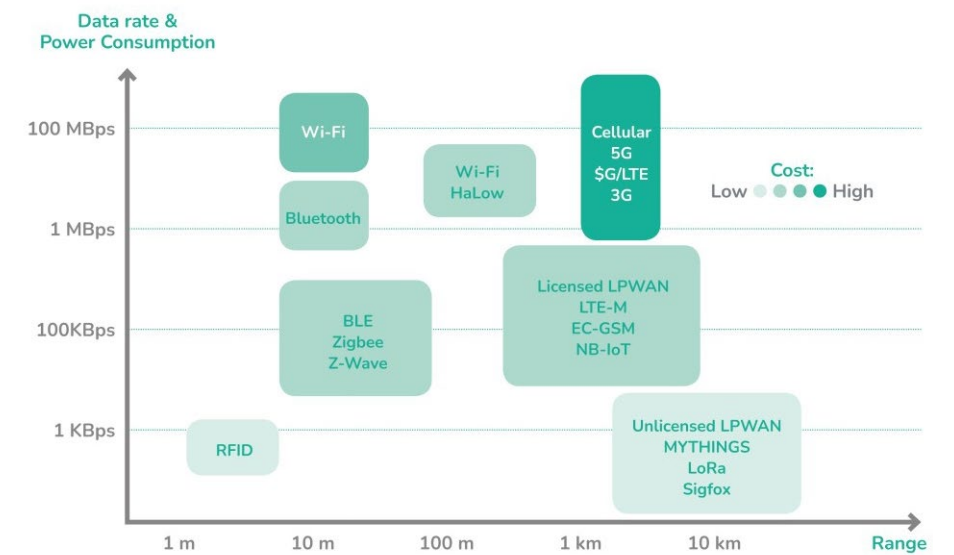


Figure 1. Comparison of popular IoT wireless communication technologies. (Source: BehrTech)

An alternative is to redesign the circuitry to reduce the overall system energy demand below the available cell storage. Either approach, or a combination of both, may fail to meet the target.

Micro energy harvesting, in the order of microwatts or milliwatts can provide a useful and potentially inexhaustible supply of electrical energy, captured from the ambient environment. This

can supplement or replace a primary cell, depending on the application and the ambient energy available. It may be possible for the harvested and converted energy to power the circuitry directly. On the other hand, storing the energy in a buffer until it is needed can be a more suitable approach.

In any case, a suitable source of ambient energy is required, capable of



HUW DAVIES
TRAMETO

Huw Davies, CEO and co-founder of Trameto, is a technology business leader with general management, founder roles, product marketing, business development and sales. He has worked in both startups and multi-national corporate organizations. His experience spans global business development, operational and financial management, licensing technology transfer, and collaborative research/commercial partnering. Huw's background is in semiconductors and consumer electronics, and he has extensive experience of working in Silicon Valley. He holds a BSc and PhD from Cardiff University and an executive MBA from the University of Bath.

PORTFOLIO COMPANY NEWS
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Power Consumption and Data Rates for Various Wireless Technology for IoT

	100 bps		10K bps		40K bps	
1 m	BLE4 / Zigbee	0.15	BLE4 / Zigbee	7.5	Zigbee	30
	BLE Mesh	0.15	BLE Mesh	7.5	Bluetooth	25
	Bluetooth	25	Bluetooth	25	WiFi	50
	WiFi	50	WiFi	50	LoRA	20
	LoRA	0.5	LoRA	10		
50 m	Zigbee	20	Zigbee	30	WiFi	200
	WiFi	100	WiFi	100	NB-IoT, LTE-M	200
	LoRA	0.5	LoRA	20	LTE, 5G Cellular	200
	NB-IoT, LTE-M	1.0	LTE, 5G Cellular	150		
1 km	LoRa	30	NB-IoT, LTE-M	100	NB-IoT, LTE-M	400
	Sigfox	30	LTE, 5G Cellular	200	LTE, 5G Cellular	400
	NB-IoT, LTE-M	20				
	LTE, 5G Cellular	120				

All units in mW

Figure 2. Comparison between data rate, bandwidth, and power consumption. (Source: Voler Systems.)

packets of data a few times per day or every few days. Others, such as security cameras, may need to send large amounts of data frequently or continuously. Depending on the application, the duty cycle may be reduced by filtering the data locally within the system before transmitting; a camera may be fitted with a movement sensor to start recording only when activity is detected, or embedded image processing may discard uninteresting data. Of course, the energy needed to filter the data must be compared with the energy saved by reducing the duty cycle, to ensure a net benefit.

AMBIENT ENERGY SOURCES

Having gained an understanding of the energy and power demanded by the wireless subsystem, it is possible to evaluate suitable ambient sources and micro energy harvesting technologies.

The main micro energy-harvesting technologies suited to powering these systems are arrays of solar cells, piezoelectric or electrostatic converters activated by vibrations, and Peltier devices that convert a temperature gradient into an electromotive force (EMF). RF energy sources captured through patch or coil antennas tend to be unsuitable for all but the most frugal IoT applications. **Figure 3** compares the typical energy densities associated with these technologies. Using this information, it

Energy sources	Power density	Harvesting methods
Solar (outdoors)	100 mW/cm ²	Solar cells
Solar (indoors)	100 μW/cm ²	Indoor solar cells
Vibrations (machine motion)	800 μW/cm ²	Electromagnetic
Wind	177 μW/cm ²	Generator
Thermal (industry)	10 mW/cm ²	
Radio frequency	300 μW/m ² to 2 mW/m ²	Patch antenna, magnetic coil antenna

Figure 3. Power density of harvested ambient-energy sources.

meeting the needs of the application. Among the various subsystems of the IoT endpoint, the radio places the most significant energy demand. It can be instructive to analyze the requirements here, to inform the design and integration of the energy-harvesting system.

RADIO SUBSYSTEM POWER CONSUMPTION

Choosing the most suitable wireless technology to provide the required data rate and communication range at the lowest possible power consumption is critical.

If the sensor is to be positioned only a short distance from an aggregator or gateway such as a hub or router connected to the Internet or through a local telecom exchange, a technology such as Bluetooth, Zigbee, or Wi-Fi may be suitable, depending on the required data rate and also on cost constraints. In other cases, such as where endpoints are distributed over a geographically large area, an LPWAN or cellular connection may be needed.

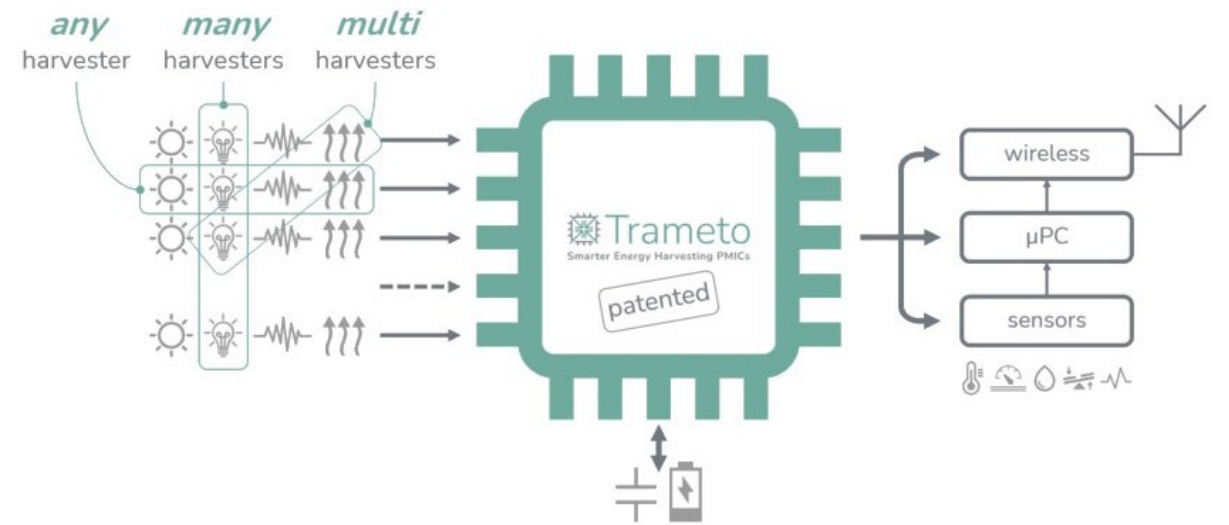


Figure 4. An EH PMIC handles the charging of the energy buffer and powering the application.

is possible to select a technology and begin developing a specification by assessing the sizes and performance of available components.

Solar cells with an area of 35-40cm² can generate about 0.5 Watts, assuming efficiency of about 20%. These are available for less than 1 USD each in volume, while piezoelectric harvesters are typically at least an order of magnitude more expensive and produce less energy. Solar cells are known to be less efficient when used indoors. However, some indoor solar harvesters have been introduced recently that claim to deliver sufficient output for low-power radios.

BRINGING IT ALL TOGETHER

Leveraging advances such as these, micro energy harvesting can be considered as a solution to reduce or eliminate batteries in IoT endpoints. Because the energy sources themselves are often irregular and not necessarily available when the IoT device needs to transmit or receive data, an energy buffer or storage device is usually needed. This can be a rechargeable battery or capacitor (or supercapacitor). An energy harvesting power management IC (EH PMIC) is

needed to handle the energy from the harvesting subsystem, manage the charge supplied to the energy buffer, and power the load when needed, as shown in **Figure 4**. The various energy-harvesting technologies have different electrical characteristics. Thermoelectric harvesters produce continuous DC current at a low voltage and so are low impedance. While solar cells also produce a low DC voltage, the current, and hence impedance, varies with the level of light.

Typical EH PMICs in the market today have a fixed architecture and input voltage range designed to operate with a particular type of harvester. This precludes using an alternative harvester to capture additional ambient energy if one source alone cannot satisfy the system requirement. If several energy sources are needed, therefore, a dedicated EH PMIC is needed for each one. This adds to the system cost, size, and power consumption, and can also complicate the design.

Some EH PMICs can be modified using external circuitry to condition the energy harvester's output. However, to simplify system design, Trameto's

EH PMICs, called OptiJoule, provide inputs that autonomously adapt to various types of connected harvester and maximize the power delivered to the buffer, without requiring external circuitry. Versions are available for single inputs or with up to four inputs. Multi-input versions feature the flexibility to connect similar or different types of harvesters. So, with OptiJoule devices, it is possible to scale the micro energy harvesting capacity, use a single PMIC for multiple applications, and even delay the selection of energy-harvesting technology until later in a product's development if needed.

CONCLUSION

Through developments in optimized radio protocols, low-energy microprocessor design, low power sensors, and the increasing efficiency of micro energy harvesting, ambient energy has become a viable source to help reduce or eliminate reliance on batteries and extend the operating lifetime of IoT endpoints in the field. The latest developments in EH PMICs allow extra flexibility to manage size, cost, and complexity when integrating selected micro energy harvesting technologies.

For more information about Trameto visit: www.embedded.com

PORTFOLIO COMPANY NEWS DOVER



Stopping the Most Common CWE Threats in Embedded Systems

August 17, 2021 | Leslie Barthel

The threat universe for embedded systems is seemingly endless. To try to make sense of it all, we turn to MITRE's CWE database. It's a publicly-available, community-developed list of software and hardware weaknesses. Its purpose is to serve as a common language for security tools and be a baseline for weakness identification, mitigation, and prevention.

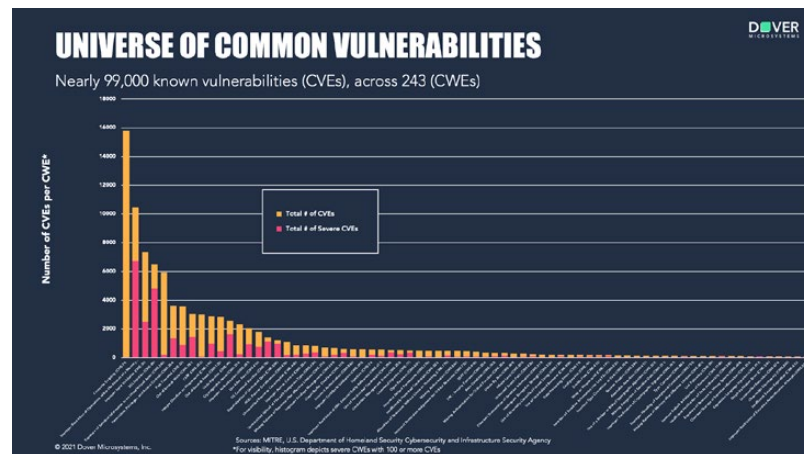
At a high-level, MITRE tracks two main things: Common Vulnerabilities & Exposures (CVEs) and Common Weakness Enumerations (CWEs). CVEs are specific vulnerabilities. You can think of them as specific cyberattacks—whether they are successfully executed or not. CWEs are categories of weaknesses, or types of bugs. When a CVE is added to the database, it must have a one and only one CWE category assigned to it.

What that all means is there could be thousands of CVEs within a single CWE category. For instance, Heartbleed, a famous buffer overflow attack, is recorded as CVE-2014-0160 and it's associated with CWE-787 Out-of-bounds Write. However, that vulnerability is just one of over 3,000 vulnerabilities attributed to CWE-787.

UNDERSTANDING THE UNIVERSE OF COMMON VULNERABILITIES

Now that you know there is this database of vulnerabilities and weaknesses, how do you use that information to understand the specific threats that are relevant to your company's products? And how do you determine the appropriate mitigating defense mechanisms and determine their effectiveness against those specific threats?

That's where Dover's Analytical Framework comes in. We take MITRE's CWE database and label each CWE with an appropriate mitigating defense mechanism, if there is one. Then, solution providers that offer specific defense mechanisms can precisely calculate their level of protection by adding up all the CWEs that are labeled with their corresponding defense mechanism.



For a closer look at MITRE'S histogram visit: info.dovermicrosystems.com

Before jumping into the defense mechanisms, let's look at a helpful depiction of MITRE's universe of vulnerabilities and weaknesses.

Above is a histogram of MITRE'S universe of CWEs and CVEs. The CWEs are shown along the x-axis and CVEs are on the y-axis. In total, there are nearly 99,000 vulnerabilities, across 243 categories. The distribution clearly shows which types of vulnerabilities are most prevalent and, not surprisingly, cross site-scripting, buffer overflows, and SQL injection top the charts.

However, when assessing risk, it's also important to consider severity. Individual CVEs are assigned a severity score, ranging from 0 to 10, with 10 being the most severe. In this graph, pink highlights the number of severe CVEs (those that score ≥ 7). They're severe because the attack comes in over the network, is easy to execute, requires no special privilege, has no workaround, and adversely affects confidentiality, integrity, or availability.

Ultimately, what this tells us is that CWEs with more pink pose a greater threat. Let's consider the top two CWEs, CWE-79 Cross-site Scripting and CWE-119 Improper Restriction

of Operations within the Bounds of a Memory Buffer. Both CWEs have a high number of CVEs associated with them. However, more than two thirds of the vulnerabilities associated with CWE-119 are severe. While in the case of CWE-79, you can hardly see any pink on the bar because the number is so small (only 35 vulnerabilities). This means stopping CWE-119 (buffer overflow) is more important and has bigger impact than stopping CWE-79 (cross-site scripting)

USING DOVER'S ANALYTICAL FRAMEWORK TO IDENTIFY MITIGATING DEFENSE MECHANISMS

In order to make this database of vulnerabilities actionable, we organized them by defense mechanism. Without this organization, it would feel like an insurmountable task to protect against 99,000 individual vulnerabilities or even 243 different types of weaknesses. By grouping the CWEs based on defense mechanisms, it allows you to better identify the appropriate mix of security defenses necessary to protect your system.

The different defense mechanisms include, memory safety, sanitization, web protection, access control, privacy, and cryptography. Memory safety protects against any vulnerabilities related to memory access, including buffer overflows and dangling pointers. Sanitization ensures inputs are validated to protect downstream processing against attacks like SQL injection. Web protection enforces HTML sanitization, as well as processing of URLs and HTTP constructs.

Other mechanisms include access control which authenticates user identity and establishes user permissions, as well as privacy and cryptography which both ensure data privacy. Lastly, there is a small group of CWEs which have no defense mechanism at all. Generally, this represents vulnerabilities that are related to the way

that the software was architected or configured, as well as vulnerabilities that occur as a result of user error. These can only be addressed on a case-by-case basis.

Historically, most cybersecurity defense mechanisms have been implemented in software. However, we all know that a software-only approach doesn't work. That's because all software—including cybersecurity software—is inherently flawed. According to Steve McConnell, author of Code Complete, there are 15 to 50 bugs per thousand lines of source code. And those bugs translate to potentially hundreds of thousands of vulnerabilities that attackers can exploit to take over your system.

For true security, an embedded system needs a defense-in-depth approach that offers multiple layers of defense mechanisms—in particular, hardware-based mechanisms because hardware cannot be subverted or altered over the network.

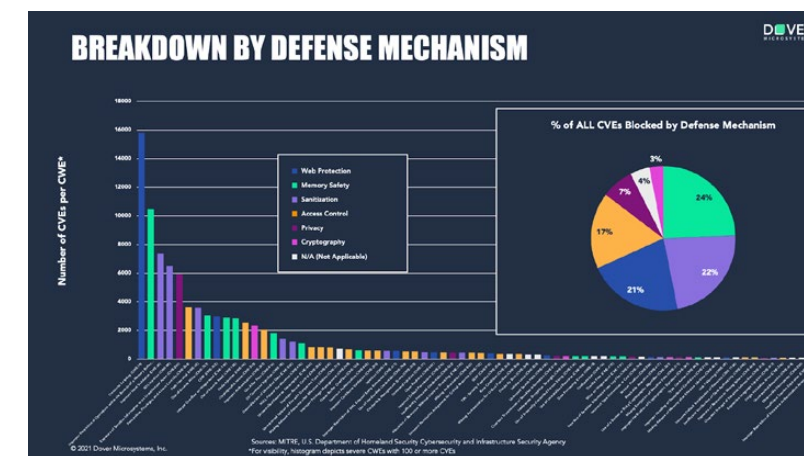
That's where Dover's CoreGuard solution comes in—it's a hardware-based defense mechanism that's specifically designed to stop the exploitation of entire categories of software vulnerabilities.

HOW DOVER'S COREGUARD® STOPS THE MOST COMMON & SEVERE CWES

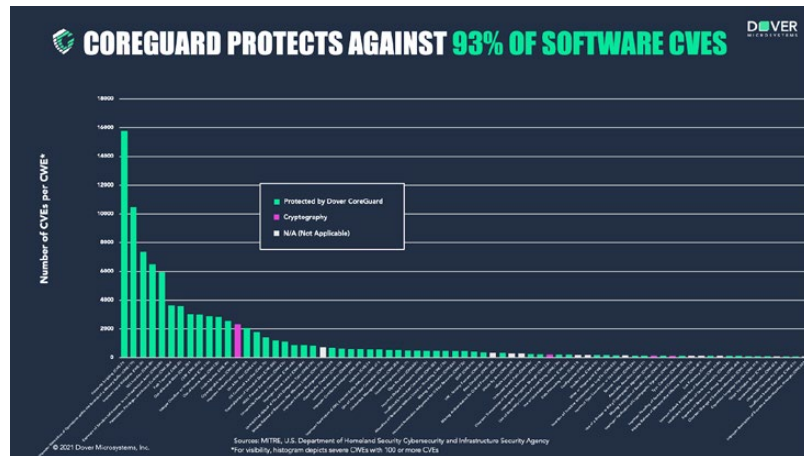
CoreGuard is an oversight system that acts as a bodyguard to embedded systems, watching every instruction executed to ensure it complies with a set of security, safety, and privacy rules. It consists of both hardware and software components. The hardware is our silicon IP that directly integrates with the host processor. Because it resides in hardware, CoreGuard is unassailable by network-based cyberattacks, and it's able to run at hardware speeds, providing real-time protection.

The software portion of the solution is broken up into two parts. The first is a set of rules, called micropolicies. Micropolicies are used to define the security, safety, and privacy properties that should be enforced. CoreGuard comes with a base set of micropolicies which stop the most common and severe types of attacks that plague any system, regardless of industry, including, buffer overflow, stack smashing, and code injection attacks. The second software component is metadata, which is information about every piece of data and every instruction in the application that is executed by the host.

If the host processor attempts to execute an instruction that violates a micropolicy, CoreGuard issues a violation exception back to



For a closer look at MITRE'S histogram visit: info.dovermicrosystems.com



For a closer look at MITRE'S histogram visit: info.dovermicrosystems.com

the host and stops that instruction from executing before any damage can be done.

Returning to that universe of vulnerabilities, let's see how the CoreGuard oversight system stacks up.

Of the nearly 99,000 vulnerabilities, Dover's CoreGuard protects against the exploitation of 93% of them. As you can see, the only remaining defense mechanism is cryptography—which is available from numerous vendors. The rest have no defense mechanism and have to be handled on a case-by-case basis, as I mentioned before.

It's important to note the CVEs on this graph only represent those vulnerabilities we know about and have been tracked by MITRE. That likely represents only a fraction of all bugs in the wild. Luckily, CoreGuard micropolicies are designed to block entire classes of attack and not just specific attacks. That means if there is a new buffer overflow vulnerability, for example, discovered today, tomorrow, or ten years from now, CoreGuard would stop it, no updates necessary.

NOW, LET'S LOOK AT FEW USE CASE EXAMPLES.

CWE-121: STACK-BASED BUFFER OVERFLOW

The first use case that I wanted to highlight is focused on one of the newest additions to the CWE database: CWE-121 Stack-based Buffer Overflow. The exploitation of this type of vulnerability can enable an attacker to execute a Return-oriented Programming (ROP) attack.

Earlier this year, multiple stack-based buffer overflow vulnerabilities were found in the management interface of some of Cisco's wireless routers. This vulnerability could allow an authenticated, remote attacker to execute arbitrary code, or cause an affected device to restart unexpectedly. Ultimately, this could be used to execute a

Denial-of-Service attack, not dissimilar to the Dyn attack of 2016 which brought down major sites, like Netflix and Twitter.

The defense mechanism for a vulnerability like this is CoreGuard's Stack micropolicy, which is a memory safety rule. CoreGuard's Stack micropolicy is designed to protect the control structure of a stack frame from being overwritten. During a ROP attack, the attacker will write more data to a stack buffer than it's designed to hold and overwrite the function's return address with a specific address that points to other code in memory that the program was not intended to execute. By modifying the return address, the attacker can hijack a program to execute system-level commands that delete files, change passwords, or even shut down servers.

With the Stack micropolicy in place, CoreGuard uses metadata, gathered at compile time, to tag a function's code and its data on the stack. It then blocks any instructions that attempt to violate the structure of the stack frame and thus prevents ROP attacks.

CWE-89 SQL INJECTION

The second use case is CWE-89 SQL Injection. In an SQL injection attack, data from outside the system is used to construct a command that is sent to a back-end database or data processing engine. If the incoming data is not sent through a sanitization routine, potentially harmful commands can be sent to the database.

In 2013, the US Office of Personnel Management suffered a cyberattack in which a group of attackers infiltrated the core database servers operated by the OPM. These servers manage the records of all government employees and contain extremely personal information pertaining to security clearances. This information includes things like social security numbers, financial histories, relatives' names, and past residences. The attackers executed multiple breaches, including stealing user credentials for the background check system and installing malware via SQL injection to create a backdoor.

The attackers were in the OPM network for at least 2 years before being discovered. Nearly 22 million people were affected, including 5.6 million of whom also had their fingerprints stolen. The cost in credit monitoring services alone is ongoing and could reach as much as \$1 billion.

The defense mechanism for an attack like this is a high-quality sanitization routine, paired with CoreGuard's Sanitization micropolicy to ensure the routine can never

The different defense mechanisms include, memory safety, sanitization, web protection, access control, privacy, and cryptography.

be bypassed. The micropolicy does this using metadata to taint "trusted" vs. "untrusted" data and follow that through computation.

The micropolicy taints data from the outside world as "untrusted." The rule then says that only a distinguished sanitization function can change the "untrusted" taint to "trusted." Lastly, the rule designates only data which is tainted "trusted" can enter the data processing engine—meaning only data that has gone through the sanitization routine can be processed.

If there is an attempt to exploit a bug that forgot to call sanitization and go straight to the data processing engine, that data will still be tainted as "untrusted" and thus CoreGuard will issue a violation and stop it from executing before any damage is done.

SPEAR PHISHING

For the final use case, I wanted to consider a scenario in which the attacker uses a technique that is unrelated to a vulnerability or type of weakness. It is instead an example of user error—in this case I'm talking about spear phishing. You can't completely stop phishing attacks from happening because no matter how much training you provide, you can't guarantee that someone in your organization will never click on a malicious link.

This is where a defense-in-depth approach comes in. Defense-in-depth means having multiple layers of security which will stop follow-on attacks, if something else fails along the way, like an employee mistakenly clicking on a bad link.

In 2014, an attacker infiltrated a steel manufacturing facility in Germany via a spear phishing email sent to industrial operators. From there, they were able to take over the plant's industrial control system and cause multiple

components to fail. Most notably it caused a furnace to be shut down improperly. This was particularly problematic because a blast furnace must follow a very specific blow down process—or set of steps—to properly and safely shut down. In this case, attackers forced the furnace into an unregulated shutdown which resulted in massive physical damage.

This damage could have been prevented had CoreGuard's Finite State Machine micropolicy been in place. This micropolicy ensures the proper functioning of safety critical finite state machine systems, like a blast furnace. It works by defining the safe states of a system and enforcing only the allowed transitions from one safe state to the next. As a result, CoreGuard can stop attacks that attempt to circumvent the safety protocols of a finite state machine, which in an industrial environment can result in danger to life and catastrophic physical damage.

CoreGuard ensures safety protocols by tracking, through metadata, the current state, as well as each transition routine. If an attacker is looking to cause serious damage, their goal would be to skip over the safe shutdown procedures. CoreGuard prevents this from happening with a simple rule that cross-checks each transition against the current state of the system. If the instruction is trying to jump to an out of order transition, CoreGuard will stop it from executing and issue a violation to the host.

HARDWARE-BASED, DEFENSE-IN-DEPTH IS ESSENTIAL WHEN DESIGNING EMBEDDED SYSTEMS

The cyber threats plaguing today's embedded systems are only going to become more dangerous, costly, and pervasive as time goes on. Trying to address those threats with a software-only security approach is both insufficient and ineffective. For true security, we need to employ hardware-based defense mechanisms because hardware cannot be subverted over the network.

White Papers:

- Securing AI & ML Systems: dmicro.co
- The Cybersecurity Stack: dmicro.co

Other Thought Leadership:

- CoreGuard Cybersecurity Scorecard: dmicro.co
- Securing Embedded Systems Webinar: dmicro.co

To learn more about our analytical framework and the level of protection that our hardware-based **CoreGuard** solution provides, download our [CoreGuard Cybersecurity Scorecard](http://dmicro.co). For more information about **Dover Micro Systems** visit: info.dovermicrosystems.com



SigmaSense Announces New Patents Granted

<https://www.accesswire.com/viewarticle.aspx?id=660005> | August 18, 2021

AUSTIN, TX / ACCESSWIRE / August 16, 2021 / SigmaSense Inc., a global leader in touch sensing performance, announced the issuance of patents #10,963,092, #10,963,093, and #11,061,082, expanding its total patent portfolio to over 70 patents issued and allowed.

SENSOR DRIVE AND SENSE

The recently issued patents cover SigmaSense's core technology, which is pioneering a digital transformation to software defined sensing solutions. As an indicator of the importance of this technology to the sensing industry, the core IP from SigmaSense has already been cited in multiple patents by more than 30 companies. The most recent patents describe the low-power, multi-frequency, analog to digital converters (ADC), which have continuous driving and sensing of analog systems. The unique current and frequency technology provides

continuous and concurrent drive and sense that delivers instantaneous sensing data without the traditional need to measure voltage thresholds. This technology has multiple applications in the world of touch sensing, electric vehicles and medical applications among others.

THIS PROTECTED TECHNOLOGY:

- Enables ultra-low voltage operations, saves power and lowers the noise floor of most sensing systems
- Enables instant access to data for faster report rates using current mode ADCs

- Provides a platform for software-defined sensing where all channels are physically identical but can be software dynamically programmable, including flexibility of dynamic range, precision, frequencies, and gain controls

"We believe we have developed a revolutionary technology that has the capability to disrupt multiple sensing industries," says Rick Seger, CEO of SigmaSense. "We aim to maximize the value of this technology by taking a strategic approach to protecting our growing patent portfolio. These patents are the latest milestones in

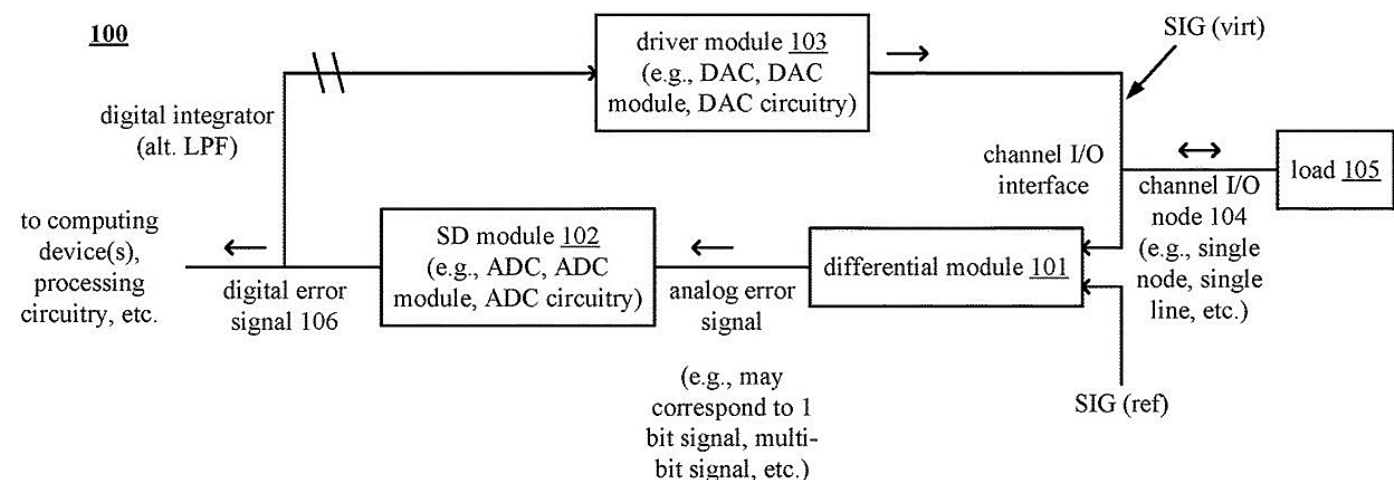


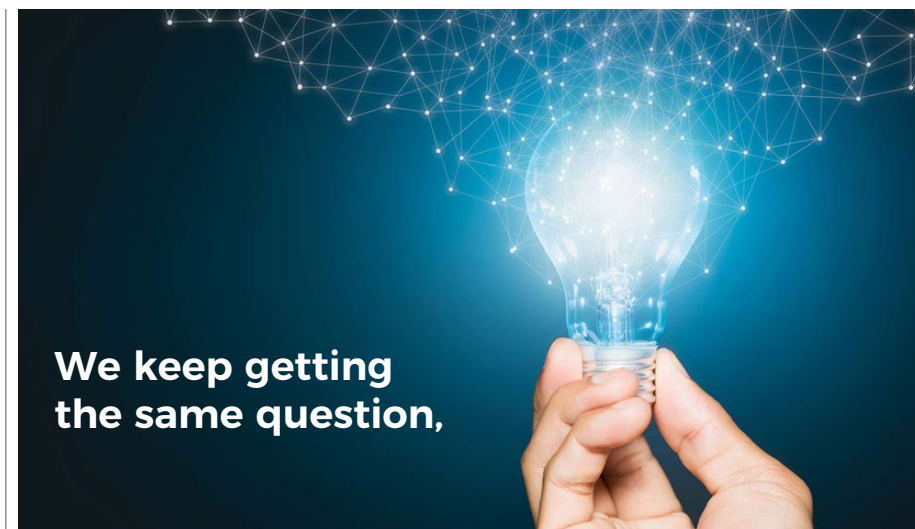
Figure 1

The channel driver circuit simultaneously transmits the channel driving signal to the load at the single node and senses the channel driving signal at the single node.

the growing transformation of sensing systems away from fixed hardware voltage mode ADCs to current mode ADCs with software programmability."

ABOUT SIGMASENSE

SigmaSense, a global leader in touch sensing performance, brings the best user experiences to products ranging from mobile phones and laptops to large monitors and digital signage. SigmaSense is pioneering a comprehensive sensing technology that delivers 100 to 1,000 times improved SNR performance that was previously not possible. SigmaVision™ capacitive imaging technology provides touch, pressure, and object detection to the sensing surface, enabling a new generation of



We keep getting the same question,

“What is the foundational invention that enables the 100-1000X SNR?”

Troy Gray is credited with the initial idea and his story is amazing. He, and our team have reinvented analog sensing to take advantage of digital processing scale, reducing the silicon size, lowering the thermal noise floor and saving power. His idea is leading to some of the greatest inventions in our lifetimes.

We keep getting the same question, “What is the foundational invention that enables the 100-1000X SNR?”. Troy Gray is credited with the initial idea and his story is amazing. He, and our team have reinvented analog sensing to take advantage of digital processing scale, reducing the silicon size, lowering the thermal noise floor and saving power. His idea is leading to some of the greatest inventions in our lifetimes.

In short, Troy envisioned the world's first “concurrent and adaptive sensing transceiver”. The key is concurrent transmit (Tx) and receive (Rx) that is self-referenced, adapts instantly (at the speed of light) and has digital programmability at a single pin. Rather than utilizing voltage thresholds for analog sensing we use an AC approach utilizing multiple frequencies and measuring a change in current (vs. voltage). 40 years of fixed analog ADCs dictating electronic designs is done, no more voltage mode ADCs or slow scanning systems needing “time and energy” to detect a signal above a noise floor.

This foundational concept has massive market impact including the use of polymer conductors, and sensing at a distance (AC). Another beautiful attribute is that it applies to individual channels or massive ADC arrays. Speed and concurrency are the ultimate enablers, allowing us to perform in-line active noise cancelling and digital programmability. It all boils down to a transceiver that has concurrent Tx/Rx, is adaptive to changing environments, and is programmable. From phones to electron microscopes, all our sensing systems will use this faster adaptive sensing... or disappear.

- #10,963,092 - Channel Driver Circuit
- #10,963,093 - Analog Front End Channel Driver Circuit
- #11,061,082 - Single Line Hall effect

perceptive devices that are interactive and engaging. SigmaHover™ provides a superior touchless experience for public displays and any other device that uses touch sensors. Headquartered in Austin, Texas, SigmaSense provides semiconductor products with software, development tools and support. For more information, please visit www.sigmasense.com.

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[lnkd.in](https://www.linkedin.com/company/sigmasense)

PORTFOLIO COMPANY NEWS
SIGMASENSE



SigmaSense Closes \$24M Series B Funding Round

by SigmaSense

Austin, Texas, October 6, 2021 – SigmaSense LLC, a global leader in touch sensing performance, today announced the closing of \$24 million in Series B funding. The Company intends to leverage this funding round to expand its reach in the touch and HMI (Human Machine Interface) markets with significant impact to the \$100+ billion global display market. As part of the capital raise, the Company appointed long-time semiconductor veteran Aurelio Fernandez to its Board of Managers.



Fernandez' experience will help support the rapid scaling of SigmaSense over the next 18 months as the Company deploys its semiconductor and software solutions across a wide range of sensing applications spanning automotive, mobile phones, and laptops to digital signage and kiosks.

"SigmaSense has a breakthrough technology that is on the verge of transforming many sensing markets in the next few years," said Fernandez. "I've seen many jumps in performance over the years, but seeing a real 100-1,000X leap in signal-to-noise ratio will remake and create many new sensing markets in the years to come."

Fernandez has been active in the semiconductor industry, most recently as a startup investor. Earlier in his career, Fernandez helped establish Broadcom as its first VP of Worldwide Sales, the period in which Broadcom expanded from \$35 million to over \$1 billion in sales in three years. Prior to Broadcom, he held sales roles at Exar Corporation,

IC Works, VLSI Technology and Intel. Fernandez holds a Master of Business Administration from Florida Atlantic University and a Bachelor of Science in Electrical Engineering from the University of Florida.

David French, an existing SigmaSense Board member, adds, "I'm excited to have Aurelio join the Board; together, we can use our extensive semiconductor networks to help scale the Company. In my long career at several of the top mixed-signal industry leaders, I haven't seen many breakthroughs of this magnitude. This new funding, combined with the technology, talent, leadership, and IP protection, should position SigmaSense extremely well."

About SigmaSense

SigmaSense, a global leader in touch sensing performance, brings the best

user experiences to products ranging from mobile phones and laptops to large monitors and digital signage. SigmaSense is pioneering a digital transformation sensing technology that delivers software defined sensing with substantially improved SNR performance. SigmaVision® capacitive imaging technology provides touch, pressure, and object detection to the sensing surface, enabling a new generation of perceptive devices that are interactive and engaging. SigmaHover® provides a superior touchless experience for public displays and any other device that uses touch sensors. Headquartered in Austin, Texas, SigmaSense provides semiconductor products with software, development tools, and support.

For more information, please visit www.sigmasense.com. brian.prenoveau@mzgroup.us

TRENDS AND NEWS
ISRAEL'S SEMICONDUCTOR INDUSTRY



While semiconductor players around the world are mainly watching global industry events such as enacting the CHIPS for America act, the on-going US-China trade war, and the world-wide shortage of components, the main thing happening in Israel is the huge increase in design activity, and the quest for talent it is leading to.

It all started in March when Google announced it was "doubling down" on designing and building custom chips as a way to boost the performance of its computing systems, and has appointed Uri Frank, a former Intel Corporate VP, to lead a server chip design team based in Israel.

Amin Vahdat, a Google Fellow and VP of Systems Infrastructure, wrote in a blog post that Frank "will help us build a world-class team in Israel". The hire is part of Google's effort "to meet computing demands from around the world," and computing at Google is at an "important inflection point," he wrote. Whereas once the motherboard was the system in use to integrate computer processing units (CPUs), networking, storage devices and memory from different vendors, this is no longer sufficient, as higher performance and less power usage is needed.

Google has R&D activities in Israel since 2005 focusing on machine learning, artificial intelligence, and natural language processing. The March announcement marks the first expansion to chip design.

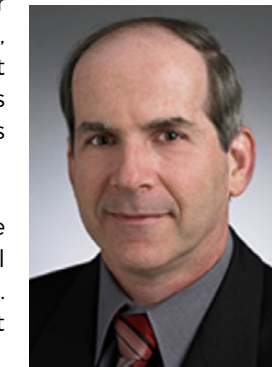
In May, Pat Gelsinger, Intel's new CEO, held a short visit to Israel during which he announced that Intel is investing \$400 million in the Mobileye facility in Jerusalem, as well as \$200 million in a new development campus in Haifa. The cornerstone of the new Haifa campus was laid in September. Moreover, Intel announced it plans to hire 1,400 new employees to the Haifa design center. It is interesting to note that with 14,000 employees Intel is the largest private sector employer in Israel.

Also in May, Israeli newspaper *Ha'aretz* reported that, "Microsoft secretly began developing networking chips at its Israeli research and development center and is gradually expanding the operation".



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The chips Microsoft is developing in Israel are intended primarily to speed up networking at its data centers, which run the company's cloud service Azure. Microsoft, which employs about 2,000 people in an R&D center in Israel already had a team that developed a touchscreen interface for its Surface computers that is based on its acquisition of the startup Intrigue in 2014. The networking chip design is a new activity.

Adding to all this the fact that Apple and Amazon are also continuously increasing their chip design activities in Israel, explains why the headline in one of Israel's business publications in May said, "Amid Global Shortage of Microchips, Israel Emerges as Investment 'Battleground' for Tech Giants".

It is hard to assess yet the full impact of this trend. Over many decades Israel has developed a lot of chip design talent and expertise but such massive hiring clearly creates a short-term imbalance between talent demand and supply. Companies, as well as the Israeli government, are looking for innovative ways to address the talent shortage.

It is important to note that in parallel to this activity among the tech giants, Israeli semiconductor start-ups continue to thrive and attract significant investments. To name a few - in the last few months **Innoviz**, a developer of solid-state Lidar solutions completed a

SPAC merger at a valuation of \$1.4 billion, **NextSilicon** raised \$120 million in June, to complete at total funding round of \$200 million to develop advanced data center computing, **VISIC**, a developer of GaN devices for electric transportation applications raised \$35 million, and earlier this month **Quantum Machines** closed a \$50 million Series B to develop quantum cloud computing solutions. Additionally, **Williot** raised \$200 million in their series C round in July. September 2021 fundings: Speedata \$55m Series A and proteanTecs \$50m Series C.

CHINA REGION NEWSLETTER



Announcing the Formation of the Chengdu Power Semiconductor Technology Institute (PSTI)

Technology Institute – October 2021

When Silicon Power Technology was co-founded by David French, Jesse Parker, Professor Zhang Bo and Silicon Catalyst we localized the Silicon Catalyst incubation business model to focus on the Power Semiconductor industry. Over the past three years we have built up a portfolio of nearly 30 companies, raised more than 100 million RMB in capital for our companies and increased our portfolio value from zero to more than 500 million RMB.



Based on this success, SPT has joined forces with Dr. Simon Zhang to move SPT's focus on Power Semiconductors to a new phase: Chengdu Power Semiconductor Technology Institute (PSTI). PSTI will combine SPT's successful incubation model with Dr. Zhang's rich experience in Power Semiconductor R&D to form a new platform that combines R&D, Incubation and Investment. This new platform will invest in a range of technologies and products for the Power Semiconductor segment, incubate these technologies and products into independent companies and support this effort with an active investment program.

PSTI will operate as an independent company generating revenue from development services, Wafer Dicing Services, FA and Reliability testing services and the eventual equity exit from its portfolio of incubated companies.

With registered capital of 20 million RMB and more than 100 million RMB of support from the Chengdu High Tech District, PSTI intends to become China's leading Power Semiconductor Eco-system centered in Chengdu, Sichuan Province.

PSTI was officially established in August, 2021. It has hired more than twenty employees, half of which are R&D technical personnel. Over the coming three years, PSTI will grow to more than 250 employees, develop new technology and products across the entire Power Semiconductor ecosystem and incubate more than 20 high-quality companies.

SPT has already begun to refocus its incubation services to include a focus on Analog, MEMS, RF, 5G and other related non-power sectors. SPT will continue to utilize the Silicon Catalyst incubation model to develop leading startup companies in these sectors.



Founder Q&A

APD-SEMI

Q: WHO IS APD-SEMI?

A: Ivan Yi, founder of APD-SEMI: APD-SEMI was founded in San Jose, Silicon Valley in 2017 and moved to Chengdu, China in November 2019. The founders are from well-known U.S. semiconductor companies. APD-SEMI focuses on the design, production and sales of high-end PMIC, Type-C, PD fast charging ICs and PD fast charging application solutions.

Q: APD-SEMI HAS BEEN INCUBATED BY SPT FOR 2 YEARS INCLUDING A SUCCESSFUL FINANCING. WHAT ARE THE KEY BENEFITS PROVIDED BY SPT FROM YOUR PERSPECTIVE?

Ivan Yi: We choose SPT because of its professionalism and laser focus on the power segment. SPT not only provided the basic incubation services, but also helped us improve our company's management and technical services. Recently we completed the company's financing with RMB 11M which SPT played a crucial role in the process.



IVAN YI
FOUNDER OF APD-SEMI

with EDA vendors such as Silvaco and Cadence which significantly reduces expenses and increases the viability and development space of new startups.

DANXI

Q: HOW DO YOU FEEL THAT DANXI IS THE FIRST FINANCED AND GRADUATED COMPANY FROM SPT'S INCUBATION?

A: Dr. Luo Peng, founder of DANXI: In June 2020, with the help of SPT, DANXI has completed a RMB 10M angel round of financing, which greatly accelerated DANXI's entry into the field of GaN power semiconductors. SPT has accompanied DANXI from its very startup and has provided us with critical industrial and university resources. This has helped DANXI to successfully develop one of the first high-speed GaN gate driver chips in domestic and further to match with its own enhanced GaN transistor. DANXI has made great progress in becoming one of the most influential new material power device R&D companies in China in the future.

Q: WHAT'S THE RECENT NEWS AND NEXT STEPS OF DANXI?

A: Dr. Luo Peng, founder of DANXI: Our GaN 650V 4*4 fast charging solution won the IC Design Achievement Award in this year, which is a big for us. We are planning to expand into the high-power market, such as industrial and sub-industrial markets. Currently, the use of GaN in PD charging has become more mature, and with the deeply cooperation with our customers, we also optimized the performance and application of GaN. We designed several special drivers to solve the shortcomings in performance and application, and applied for several patents based on these designs.

In the future, DANXI intends to enhance the stability and ease-of-use of GaN to industrial or even automotive level by using the co-encapsulation drive, and to lead the revolutionary breakthrough of GaN material application.



DR. LOU PENG
FOUNDER OF DANXI



JACK TAI
FOUNDER OF NOVUSEM

NOVUSEM

Q: WHY DID NOVUSEM CHOSE TO PARTNER WITH SPT?

A: Jack Tai, founder of Novusem: In addition to the services SPT provided, what's more important is a visionary leader with successful experience and lots of connections in the semiconductor industry. Jesse, as the CEO of SPT and an American with over 25 years living in China, has a very deep understanding of the operations of large international companies, the success of semiconductor companies in Silicon Valley and local industrial and economic environment. He can help the startups go through the difficult time by combining resources from China, Hong Kong, Taiwan and the United States. SPT not only assists us in connecting with foundries such as CSMC, but also establishes strategic partnerships

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PRAXIS CENTER
for Venture Development

Silicon Catalyst and Cornell University Are Expanding Opportunities for Startups Like Geegah

Mike Gianfagna, SemiWiki

June 24, 2021-SemiWiki has covered many aspects of Silicon Catalyst, from their business model to notable industry events and profiles of promising startups. You can get some perspective on the breadth and depth of Silicon Catalyst here. In this post, I'll explore an aspect of the broader collaboration the organization is engaging in. It is well-known that Silicon Catalyst maintains a substantial network of product and service providers as well as a large network of advisors. All this is intended to help promising young semiconductor-based startups to take their idea to the next level. There is another aspect of the innovation pipeline, however. It's the journey from a great idea to proof that it's possible to implement. Through added collaboration, Silicon Catalyst is addressing this phase as well. Their work is having measurable impact for promising young companies. Read on to see how Silicon Catalyst and Cornell University are expanding opportunities for startups like Geegah.

The Next Big Thing begins with an idea - perhaps not even an idea but a dream. I am a firm believer that the dreamers among us are the

ones who will change the world. As an idea progresses to a commercial implementation, there are many hurdles to cross. For a semiconductor startup a lot of these hurdles have to do with access to technology, services, infrastructure, and design tools. These are all areas where Silicon Catalyst brings a lot to the party.

Let's get back to that dream of an idea. If someone is dreaming of a new application for semiconductor technology, the first step needs to be a reality check. Can the idea be implemented with current materials and fabrication techniques? Or perhaps something over the next horizon will be required. Answers to these questions often require fundamental research, but ultimately the new idea needs to address real world problems to build a viable business. This is an expanding area of Silicon Catalyst's ecosystem, working with university partners to find the next great innovation for the semiconductor industry. More on this in a moment.

EXPANDED COLLABORATION

I had the opportunity to speak with

several folks that are part of the expanded Silicon Catalyst ecosystem. Some represent the university research point of view and others the licensing of that research. Still others ensure the many moving parts of these relationships continue to work smoothly. And of course, there's the growing list of startups who are the primary beneficiaries of all this work.

Collaboration between Silicon Catalyst and universities isn't new. There is an ongoing program that connects universities with the Silicon Catalyst ecosystem and you can learn about it here. One of the folks I spoke with is Laura Swan. Laura manages the university program at Silicon Catalyst. One of the key benefits of this program is to connect Silicon Catalyst's large advisor network with research work at partner universities. Universities must focus on the viability of their research from a commercial standpoint and the Silicon Catalyst advisor network is full of folks who can help with market discovery and validation of the innovations. This organization can help search for early-adopters and build a foundation for ultimate business success. This is one of many win/win scenarios that are part of this story.



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Laura is an investor with Sand Hill Angels and is a founding partner of The Batchery a tech incubator in Berkeley California. Laura started her career in networking before the explosion of the internet, she worked in several networking startups that delivered the very first switches and routers. Laura has a thorough understanding of the engineering development process (functional specification, system/architecture design, development, testing, and deployment) based on over a decade of software/firmware development experience. She moved into engineering Program Management where she used her engineering development experience to manage products from cradle to grave (early engineering specification through alpha and beta testing).

CORNELL UNIVERSITY'S PRAXIS CENTER FOR VENTURE DEVELOPMENT

Cornell University is a member of the Silicon Catalyst University Program. Recall I mentioned that semiconductor startups often require fundamental research to establish the efficacy of an idea. This kind of research requires materials and physics expertise as well as the environment and equipment to experiment with new materials to see what happens when you build it. Cornell brings a lot to the table here - they operate a semiconductor research fab, the Cornell NanoScale Science and Technology Facility, or CNF.



ALICE LI
**EXECUTIVE
DIRECTOR, CTL**

The organization at Cornell that has developed a partnership with Silicon Catalyst is the Cornell Praxis Center for Venture Development. This is Cornell's on-campus incubator for engineering, digital and physical science startups. The program is run by Robert Scharf and Bob is one of the folks I got a chance to speak with. One of the first things Bob pointed out was the proximity of Cornell's fab facility - it's in the same building as the Praxis Center, so access to equipment and know-how couldn't be easier. Bob described a process whereby startup companies are evaluated for admission to the Praxis Center. This in many ways is similar to what Silicon Catalyst does, as part of their comprehensive applicant screening process.

Bob explained that entrants to Praxis can be very early in the maturation process - one click past "will it work?" if you will. Early results and fundamental research are focus areas for Cornell,

and many other universities as well. Bob went on explain that, as startups mature, they can physically grow to a size that is hard to accommodate on campus at the Praxis Center. This is where Silicon Catalyst has formed a seamless fit for the startup as they continue their journey.

Before I discuss a promising new startup that is benefiting from all this collaboration, I'll finish the picture for Praxis. To do this I spoke with Alice Li, the executive director of Cornell's Center for Technology Licensing (CTL). As you will see if you visit its website, CTL supports inventors, industry, entrepreneurs and academia. Regarding entrepreneurs, their stated goal is this:

WE WORK TO CREATE SUCCESSFUL TRANSITIONS FROM INNOVATION TO NEW ENTERPRISE

Licensing technology developed at Cornell turns out to be a two-way street. Certainly, startups benefit from access to cutting-edge research to create the foundation of a new enterprise.

Cornell also benefits from the "grounding" that occurs when one attempts to apply fundamental research in a commercial setting. Alice explained that this process provides an important reality check for advanced research. After all, the goal of this work is to impact the world in a positive way and understanding what is relevant to that goal is a very important ingredient. Yet another win/win was discovered during my discussions with Alice.



ROBERT SCHARF
**ACADEMIC
ADMINISTRATIVE
DIRECTOR**

GEEGAH - A PROMISING STARTUP AND BENEFICIARY

To complete the story, I spoke with Amit Lal. He is the Robert M. Scharf 1977 Professor of Electrical and Computer Engineering at Cornell. He's also the director of the SonicMEMS Laboratory there, which focuses on micromachining technologies for making ultrasonic transducers for ultrasonic applications.



Professor Lal made an important breakthrough. He and his students came up with a way of post-processing a CMOS layer with piezoelectric films to create ultrasonic waves to deliver high-resolution, precision imaging. The resultant small, gigahertz-frequency waves have many potential applications—from chip security to acoustic storage of computer memory, ultrasonic imaging, and ultrasonic analog computing.

Amit and his student Justin Kuo have created a new company, Geegah, to commercialize the technology. There are many potential applications. We discussed a couple. First is chip security. Consider the reverse engineering liability associated with a chip that has metal interconnect. Now consider the same device that implements on-chip communication with ultrasonic waves. There are no signal paths to observe (or copy), making chip copying difficult, if not impossible.

The imaging capability has significant applications as well. One that caught my attention has to do with agriculture. It turns out there are very small worms, called nematodes that eat plant roots. Sensing their presence, so they can be controlled is virtually impossible with today's technology - it's difficult to "see" inside of soil. The sensors being developed by Geegah can do this

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quite accurately, however. The implications on the worldwide food supply / agriscience markets are significant and can make farmer's lives more predictable. Similar to the problem of not being able to see nematodes in soil is the problem of not being able to see viruses in one's breath. Geegah is now extending the technology to enable imaging of viruses. This capability is not only needed for COVID-like viruses, but for many other body infections as well.



AMIT LAL
PROFESSOR,
ELECTRICAL
AND COMPUTER
ENGINEERING

the guidance of Professor Lal. The company is now also a member of the Silicon Catalyst incubator. The combined resources of both Praxis and Silicon Catalyst should have a significant and positive impact on the trajectory of this promising new startup. Geegah has access to the Cornell cleanroom to extend the technology to commercial levels, while it also has access to an extended network of silicon commercialization experts via Silicon Catalyst.

generation of semiconductor solutions to benefit our industry and ultimately our lives. The Cornell Praxis and CTL collaboration with Silicon Catalyst and Geegah provides a great example of this value. Laura Swan and her team are looking to further expand university collaboration and would welcome contact with other academic institutions and researchers to learn more. Post docs in search of a path to commercialization should consider applying to the Silicon Catalyst Incubator, as the deadline for the next application review cycle is July 2, 2021.

So, there's the summary of how Silicon Catalyst and Cornell University are expanding opportunities for startups like Geegah. Another win/win for each of these organizations and potentially a big win for our industry.

In conclusion, fundamental university-based research continues to be a valuable resource to drive the next

Geegah was born out of the fundamental research at Cornell under

Semiwiki Webinar: "Silicon IP", with CEOs from Dover, Espre, and Spark



Silicon Catalyst and Semiwiki Panel Session • MAY 6, 2021

"Silicon IP for Early-Stage Semi Companies"

MODERATOR:



Daniel Nenni
Founder



General Theme:

A discussion around the requirements & challenges of investigation and ultimate selection of IP for early-stage chip companies, discussing both the technical and business aspects of securing IP for your designs.

Audio: semiwiki.com/podcast

PANELISTS:



Jothy Rosenberg
Founder & CEO



Dr. John Terry, PhD.
Founder & CEO



Topics Discussed:

What have been some of the biggest challenges for your startup? And how did you overcome these challenges? What have been the major challenges in development/production? And how did you overcome them?



Fares Mubarak
CEO



Silicon Catalyst Announces Six Newly Admitted Companies to Semiconductor Incubator

Silicon Valley, California - April 26, 2021

Silicon Catalyst, the world's only incubator focused exclusively on semiconductor solutions, announces the admission of six companies into the semiconductor industry's highly acclaimed incubation program.

THE NEWLY ADMITTED COMPANIES INCLUDE:

AlphaICs

- Next-generation AI Processor

Lelantos

- Revolutionizing the world of gas sensing

Oculi

- Image sensor products with true edge processing

Salience Labs

- Next generation photonic computing solutions

Sonical

- A computer in every ear

Visual Dawn

- Soft contact lens based Augmented Reality Platform

The mission of Silicon Catalyst is to help semiconductor startups succeed. The ecosystem that Silicon Catalyst has created lowers the capital expenses associated with the design and fabrication of silicon-based IC's, Sensors, and MEMS devices by providing tools and services from a comprehensive network of In-Kind Partners (IKPs). The Portfolio Companies in the incubator utilize IKP tools and services including design tools, simulation software, design services, foundry PDK access and MPW runs, test program development, tester access, and banking and legal

services. The world-class Silicon Catalyst network of advisors and investors further facilitates their journey from idea through prototype toward volume production.

"As we approach our seventh year of operations, we're extremely pleased to welcome these companies to our incubator. We received more applications in our recent screening cycle than ever before, and these six companies in particular Impressed us with the quality of their technical innovations and the diversity of their target markets," stated Nick Kepler, COO of Silicon Catalyst. "Additionally, their geographical distribution spans from the US to the UK, and also includes our first company based in India. Our Partners and ecosystem members are looking forward to contributing to the business success of our six newest companies."



Pradeep Vajram - CEO
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AlphaICs, a fabless semiconductor company, designs and develops the best-in-class Artificial Intelligence (AI) Co-processors for delivering high-performance AI compute on edge devices. AlphaICs edge solutions include inference with learning. AlphaICs solutions are targeted toward mid-performance applications with power requirement greater than 3 watts and lower than 50 watts.

The company has developed a next-generation AI Processor, called Real AI Processor (RAP™), based on a proprietary architecture. The RAP™ architecture makes use of a specialized Instruction Set Architecture (ISA), designed for accelerating AI workloads. RAP™ is highly scalable and can be scaled for mobile devices to datacenter solutions.



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Lelantos is revolutionizing the world of gas sensing by developing a new generation of IoT compatible gas sensors targeted to high value monitoring applications in threat detection, industrial safety, environmental and air quality monitoring as well as medical diagnostics. Current gas sensors are based on optical and resistive technologies and suffer from inherent weaknesses such as bulky size, high power consumption and high cost. As such, they prohibit the effective monitoring in IoT oriented use cases that require large scale, pervasive sensing to be provided by autonomous, portable, battery operated sensors with wireless connectivity. In contrast, Lelantos sensors based on CMOS integrated piezoelectric resonator arrays can achieve up to 1000 times more compact size, lower power consumption and lower cost than currently utilized systems. As a foundationally superior sensing technology, Lelantos is enabling the

widespread adoption of gas sensing in IoT applications and the disruption of the market providing a true chemical sensor for the Internet of Things.



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Oculi makes the SPU™ Sensing and Processing Unit, a complete edge vision system on a chip, that overcomes power, bandwidth and latency constraints. The Oculi SPU is a high performance, edge processing, low latency, low bandwidth, high speed sensor, and is an ideal solution to scale an intelligent network over a wide area for use cases in traffic monitoring, analytics and tolling. Oculi is deployed on a US public highway and partnering with various companies to deliver innovative solutions to market.



SALIENCE
LABS

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Salience Labs is building a hybrid photonic-electronic chip for AI. We have designed a massively parallel, ultra-high throughput Photonic Tensor Processing Unit. Photonics allows data to be modulated at up to 100 GHz, and allows for high levels

of parallelization using multiplexing. We integrate this photonic unit into a SoC architecture designed to exploit its high throughput for AI inference. Salience Labs technology is based on decades of research collaboration between Oxford University and University of Münster, Germany.



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Sonical is revolutionizing the way we hear. In the same way you use apps on your phone, Sonical is putting apps in your ears. To make this possible we are designing and building the world's first ear computer that has the capabilities and performance for next generation ear worn products. To make our intuitive platform accessible we are creating EarOS to unlock thousands of existing and new developers. Our ear worn solutions will enable everyone to have a personalized hearing experience and to control how they hear the world using AI and advanced audio processing.



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"Soft Contact Lens Based Augmented Reality Platform"

Visual Dawn is developing a contact lens based AR hardware platform that relies upon the same hydrogel

material used for corrective vision contact and sets the gold-standard for comfort. Our system is enabled by a biocompatible battery. Our biocompatible battery leverages a proprietary chemistry that eliminates the need for toxic electrolyte solution and electrode materials. Further, our chemistry is stable and doesn't exhibit the same catastrophic failure modes seen in lithium based consumer batteries, namely fire and explosion. Our lens is designed to be disposable, with an 8-hour useful battery life.

About Silicon Catalyst

Silicon Catalyst is the world's only incubator focused exclusively on accelerating solutions in silicon (including IP, MEMS & sensors), building a coalition of in-kind and strategic partners to dramatically reduce the cost and complexity of development. More than 400 startup companies have engaged with Silicon Catalyst since April 2015, with a total of 37 startup and early-stage companies admitted to the incubator. With a world-class network of mentors to advise startups, Silicon Catalyst is helping new semiconductor companies address the challenges in moving from idea to realization. The incubator/accelerator supplies startups with a path to design tools, silicon devices, networking, access to funding, banking and marketing acumen to successfully launch and grow their companies' novel technology solutions. The Silicon Catalyst Angels was established in July 2019 as a separate organization to provide access to seed and Series A funding for Silicon Catalyst portfolio companies.

More information is available at www.siliconcatalystangels.com.

Entrepreneurial teams developing innovative semiconductor or MEMS products are encouraged to contact Silicon Catalyst to learn more about the comprehensive selection of products and services available to companies in the Incubator. The application deadline for our newly instituted "Fast Track" screening and review process is November 29, 2021. More detailed information about the application process is available at www.siliconcatalyst.com/application.

Call for Fast Track Applicants
Deadline: Jan. 10, 2022

Startups start here.

it's about what's next.®



it starts with startups.



APPLY NOW FOR OUR "FAST TRACK" PATH

Silicon Catalyst's Incubator Application Deadline - January 10, 2022

Silicon Catalyst is the world's only incubator focused on semiconductor solutions, including MEMS, sensors and intellectual property. We accelerate startups from idea through prototype, and onto a path to volume production.

We have evaluated over 600 startups worldwide and have admitted 42 exciting companies. Silicon Power Technology, our Chengdu Joint Venture, has admitted 29 additional startups in China. Our companies participate in a 24-month customized incubation program. Each is guided closely by a Silicon Catalyst partner.

Silicon Catalyst's ecosystem provides everything our startups need to design, fabricate, and market semiconductor solutions:

- **In-Kind Partners** (TSMC, Synopsys, Arm, ST Micro and over 40 more) – provide each startup several millions of dollars' worth of goods and services including EDA tools, IP, PDKs, prototypes, design and test services, packaging and business solutions.
- **Strategic Partners** (TI, ON Semi, Soitec, Bosch, Cirrus Logic, Arm, ST Micro and Matrix Capital) – participate in the selection process and actively look for opportunities to partner with our startups.
- **Investors** – a large group of over 300 VCs, Angels, Angel groups, Corporate VCs, and Family Offices fund each journey. Silicon Catalyst Angels, created from our ecosystem also funds our companies. More than \$90M has been invested in our startups in the past six months.
- **Advisors** – a valuable network of over 190 industry experts that we match to the specific needs of each startup.
- **Universities, Industry Organizations, Incubators, and Government Agencies** – We nurture dozens of key relationships for the benefit of our portfolio companies. Our companies have received over \$80M in grants.

Silicon Catalyst's mission is to help semiconductor startups succeed.

Join us in driving innovation!

Apply now.



www.siliconcatalyst.com





ANDES TECHNOLOGY IN-KIND PARTNER PROFILE



Andes Technology Corp. Brings Its Broad Family of RISC-V CPU IP to the Silicon Catalyst Semiconductor Incubator

September 8, 2021 | Hsinchu, Taiwan, and Silicon Valley, CA

Andes Technology Corporation (TWSE: 6533), a leading supplier of high efficiency, low-power 32/64-bit RISC-V processor cores and Founding Premier member of RISC-V International, today announced that it has joined Silicon Catalyst's In-Kind Partner program. Andes Technology will make available a wide range of its RISC-V processors to startups participating in the Silicon Catalyst incubator program. These include all Andes RISC-V offerings between the smallest N22 to its multicore 5-stage pipeline 25 and 27 families with P extension, floating point, L2 cache controller and memory management unit. Incubator startups will also have access to Andes' AE250 Pre-integrated AHB platform, AE350 Pre-integrated AXI platform, and AndeSight Eclipse-based Integrated Development Environment.

"Andes has been helping a steady stream of new design starts to incorporate our wide range of RISC-V AndesCore™ processors," said Dr. Charlie Su, President and CTO of Andes Technology. "Silicon start-ups such as those in the Silicon Catalyst incubator program are ideal examples of the new ventures. Many have great products on papers but need the IP and tools to lift their design from the page and implement it in silicon. The Silicon Catalyst incubator and Andes provide them the perfect environment and high efficiency RISC-V CPU IPs to achieve this goal. We are delighted to be part of this endeavor."

"We applaud Andes' initiative in expanding the reach and visibility of the RISC-V ISA," said Calista Redmond, CEO of RISC-V International. "As an open computing platform, the continued growth and adoption of RISC-V depends on a broad ecosystem of hardware

and software tools and IP. Andes contributing its silicon-proven RISC-V IP to the Silicon Catalyst incubator will help make it easier for emerging startups to build the next generation of semiconductor applications with RISC-V."

The mission of Silicon Catalyst is to lower the capital expenses associated with the design and fabrication of silicon-based IC's, sensors, and MEMS devices. For over seven years, the Silicon Catalyst partner ecosystem has enabled early-stage companies to build complex silicon chips at a fraction of the typical cost. Silicon Catalyst has created a unique ecosystem to provide critical support to semiconductor hardware start-ups, including tools and services from a comprehensive network of In-Kind Partners (IKPs). The Portfolio Companies in the incubator utilize IKP tools and services including design tools, simulation software, design services, foundry PDK access and MPW runs, test program development, tester access, and banking and legal services. Additionally, the startups can tap into the world-class Silicon Catalyst network of advisors and investors.

"Adding a tier one RISC-V IP supplier such as Andes Technology; with its broad range of IP, hardware design tools, and integrated software development environment; broadens the selection of design IP and tools our incubator companies have to create with," said Paul Pickering, Managing Partner at Silicon Catalyst. "Andes' success with startups in the emerging 5G and AI chip markets demonstrates their understanding of nurturing new ventures building products for markets that are just beginning to field large numbers of new silicon designs. We are pleased to have them join the Silicon

Catalyst incubator and look forward to seeing new designs containing their IP."

ABOUT ANDES TECHNOLOGY
Sixteen years in business and a Founding Premier member of RISC-V International, Andes is a leading supplier of high-performance/low-power 32/64-bit embedded processor IP solutions, and a main force to take RISC-V mainstream. Andes' fifth-generation architecture AndeStar™ adopted the RISC-V as the base. Its V5 RISC-V CPU families range from tiny 32-bit cores to advanced 64-bit cores with DSP, FPU, Vector, Linux, superscalar, and/or multicore capabilities. The annual volume of Andes-Embedded SoCs has exceeded 2 billion since 2020 and continues to rise. To the end of 2020, the cumulative volume of Andes-Embedded™ SoCs has surpassed 7 billion.

For more information, please visit www.andestech.com. Follow Andes on LinkedIn, Twitter, Facebook, and YouTube!

About RISC-V AndesCore™
Andes Technology's comprehensive CPU includes entry-level, mid-range, high-end, extensible and security families to address the full range of embedded electronics products, especially for connected, smart and green applications. From 2017, Andes expands its product line to RISC-V processors and provides a total solution in V5 family cores, including N22, N25F/NX25F, D25F, A25/AX25, A25MP/AX25MP, A27/AX27/NX27V, A45/D45/N45, AX45/DX45/NX45 and A45MP/AX45MP.

For more information about Andes Technology products, please visit www.andestech.com.



AGILE ANALOG IN-KIND PARTNER PROFILE



Helping semi start-ups implement analogue circuit designs

Agile Analog has announced that it has joined the technology ecosystem of semiconductor start-up incubator Silicon Catalyst (siliconcatalyst.com) as it's latest in-kind partner.

June 1, 2021 - Agile Analog has announced that it has joined the technology ecosystem of semiconductor start-up incubator Silicon Catalyst (siliconcatalyst.com) as its latest in-kind partner. The partner status of Agile Analog means that portfolio start-ups in the Silicon Catalyst network can take advantage of Agile Analog's analogue IP technology, and draw on its expertise in the rapid implementation of effective analog semiconductor circuit designs.

Silicon Catalyst portfolio companies will also benefit from Agile Analog's participation in its global series of events, and from the opportunity to meet key engineering and commercial executives at the company.

John Hartley, Chief Commercial Officer at Agile Analog, said: "We look forward to helping the Silicon Catalyst portfolio companies succeed in realising their vision for innovative semiconductor products. Now, as an in-kind partner, Agile Analog can work hand-in-hand with portfolio companies to quickly generate application-optimised analogue IP using our programmatic, systematic and repeatable methodology."

The Silicon Catalyst incubator provides an expert partner to advise each semiconductor start-up in its portfolio, guiding their early development as they move from product idea to prototype to volume production.

These partners help start-ups to take advantage of the incubator's ecosystem of in-kind and strategic partners, investors, advisors, academic experts, government agencies and industry organisations.

Agile Analog will provide highly configurable analogue IP to portfolio companies with which they can implement building block functions such as security monitoring, power management, sensing and signal processing. The Agile Analog process for generating application-optimised IP is compatible with almost any foundry, process and node, including FinFET nodes.

The design flexibility embedded in Agile Analog's technology is ideal for the start-up companies which Silicon Catalyst supports. Start-ups' prototypes commonly go through multiple design iterations before reaching final production: the powerful configuration capabilities in the Agile Analog technology enable new versions of analogue IP to be optimised for each successive set of customer specifications, and rapidly compiled for any supported process and node.

About Agile Analog:
At Agile Analog we have brought together a team of industry veterans from the analog, IP and design automation worlds to revolutionise the way Analog IP is developed and delivered. Based in Cambridge, UK,



JOHN HARTLEY
CHIEF COMMERCIAL OFFICER,
AGILE ANALOG

we are growing quickly to become one of the world's leading Analog IP companies. Using our innovative core technology, we are able to design analog circuits faster, to a higher quality, and on any semiconductor process. We are widening market access to Analog IP in a way that will greatly increase our customers' opportunities to take innovative chip designs to market. As part of a dynamic industry, we are disrupting methodologies that have been unchanged for generations.

For more information about Agile Analog products, please visit www.agileanalog.com.

IMEC International Research & Development and Innovation Hub

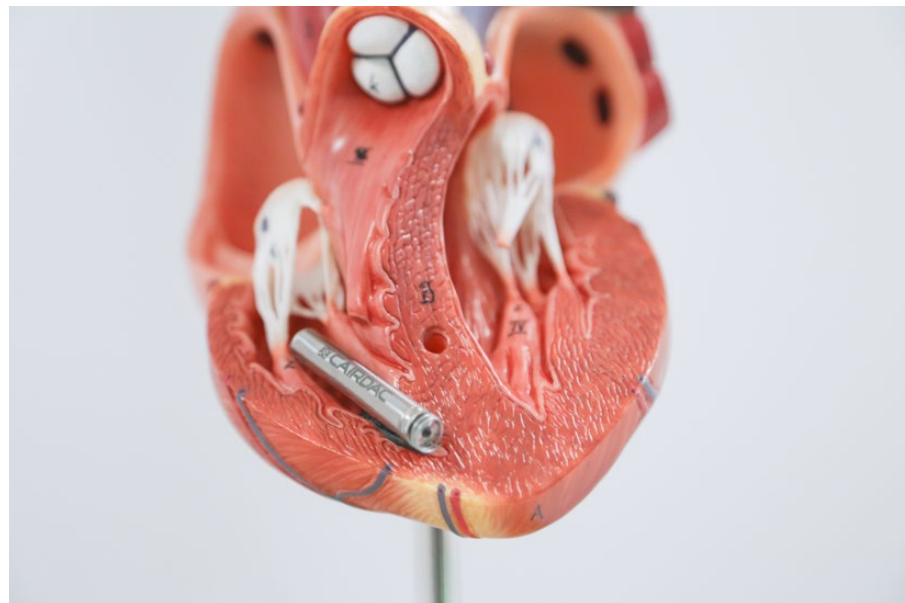


Why the world's leading semiconductor R&D hub is the perfect partner for deep-tech startups

Within the semiconductor industry, imec is a household name. Since its inception in 1984, it has rapidly become the place where just about all the major players conduct their pre-competitive research into the next generations of IC technologies. Therefore, you might be surprised to learn that imec is increasingly looking towards startups to play a key role in its mission of radical innovation. Especially for deep-tech startups who need access to an innovation ecosystem, advanced infrastructure, expertise, and connections, imec should be on the top of their list of potential partners.

Embracing a better life. Imec's motto reveals that its mission goes beyond keeping up with Moore's law - making ICs smaller, faster, and less power-hungry. Imec wants to positively impact people's lives by facilitating digital transformations of domains like healthcare and life sciences, food and agriculture, transport, and energy. To enable such advanced solutions, imec - building on its core semiconductor expertise - created a portfolio of **mature technology platforms** such as integrated photonics, microfluidics, on-chip imaging, and many more. Because of its expertise, infrastructure, and unique position between academia and industry, imec can combine these technologies into complex systems that are compatible with current manufacturing standards.

Startups have become one of the main drivers of the so-called fourth disruptive innovation wave. So it makes sense that imec sees a **significant role for startups** towards achieving its mission of transformation through technology. In the past, it has already created successful spinoff companies to valorize its innovations, such as miDiagnostics. And it supported start-



The French startup CAIRDAC used the ASIC services of imec.IC-link to develop its autonomous pacemaker that harvests the heart's kinetic energy.
Full story: imeciclink.com/cairdac.

and scale-ups such as SCANTINEL PHOTONICS, Spectricity, and Evonetix. Today, it is further intensifying its collaborations with the startup community.

For startups who need silicon technology, this presents a massive opportunity. Imec's combination of infrastructure and expertise,

both in-house and with partners, complemented with its strong ties to a vast ecosystem of universities, companies, and organizations such as Silicon Catalyst, make it an ideal partner for companies who want to **de-risk their investments**. Let us take a look at the different ways in which they can benefit from partnering with imec.

At the heart of imec's infrastructure lies the world's most advanced 300mm cleanroom for research purposes

ASIC DESIGN, PROTOTYPING, AND MANUFACTURING

Using an application-specific IC (ASIC) can be a strong market differentiator for startups. It allows them to lower the cost per unit, integrate many functions in a small form factor, and protect their IP. However, developing an ASIC is not a straightforward undertaking. The design phase requires specific skills, tools, and IP. Moreover, fabrication at leading foundries is often impossible without a manufacturable prototype. Imec.IC-link, a division of imec, functions as a **one-stop shop for ASIC development**. Startups can make their lives considerably easier by taking advantage of imec.IC-link's expertise, and its partnerships with leading foundries, assembly & test houses, design tool vendors as well as design and IP companies. To develop prototypes, they can sign up for multi-project wafer (MPW) runs, sharing

photo masking and processing costs with other customers. Next to prototype fabrication, imec.IC-link also provides customers with a direct route to volume production. Customers can choose what best suits their business, from just buying processed wafers to fully outsourcing the ASIC supply chain and purchasing fully qualified, tested, and assembled ASICs.

DISRUPTIVE RESEARCH

At the heart of imec's infrastructure lies **the world's most advanced 300mm cleanroom for research purposes** - surrounded by numerous state-of-the-art (bio)labs. Here, imec's top researchers shape the future. It is clear that companies can reap enormous competitive benefits from tapping into this research. And startups specifically can leverage the infrastructure for their early prototype development - either complete

projects or post-processing on wafers from a foundry.

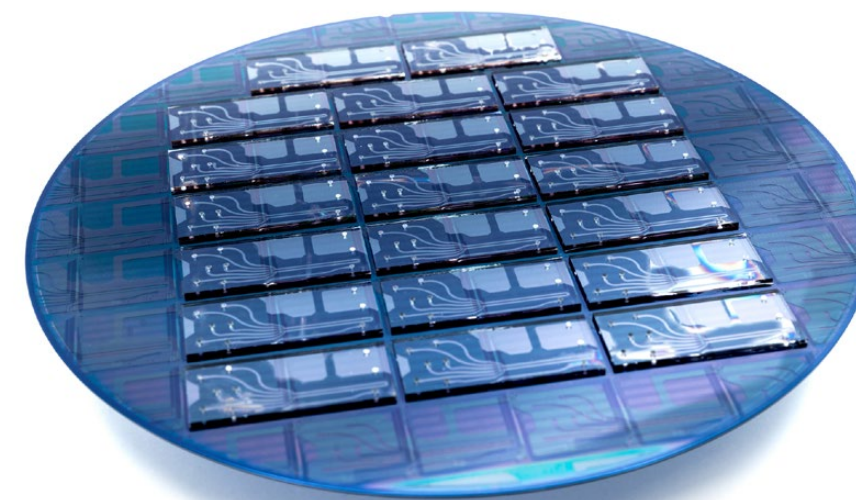
CUSTOM DEVELOPMENT AND LOW-VOLUME MANUFACTURING

Fundamental research is only one way to achieve breakthrough innovations. Another is the convergence of advanced technologies with semiconductor processing, such as GaN-on-IC, MEMS-based ultrasound transducers, and flat optics. Imec's **mature technology platforms** allow startups to explore these possibilities in a way that ensures the manufacturability of their solution. Specifically, in its 200-mm cleanroom, imec supports the development of a process, the realization of a prototype (sometimes also in MPW mode), and even low-volume production. For high-volume production, the process can be easily transferred to one of imec's foundry partners.

FUNDING AND VENTURING

Of course, startups need more than just access to technology. They also require business insights, talent, and, last but not least, capital. Here, imec can offer **privileged access to the deep-tech ecosystem and venture builders**. Its venturing teams help startups make the suitable technology-market match, get them in touch with possible investors and collaborators, and even consider offering direct support through imec's investment funds imecistart.com and imecexpand.com.

Imec is headquartered in Belgium and has offices around the globe. For more info or to get in touch, visit imec-int.com/startups.



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Imec's microfluidic cell sorting technology is used by Sarcura, an early-stage technology startup, to develop a chip-based prototype of a cytometer for automated cell separation, bringing gene and cell therapy to the next level.
Full story: imec-int.com/sarcura.

SILICON CATALYST ANGELS INVESTING IN THE INNOVATION



Funding and Fostering the Innovations, Technologies, and Companies that will Improve our Lives

Silicon Catalyst Angels was spawned from Silicon Catalyst, the world's only incubator focused exclusively on accelerating solutions in silicon.

What makes Silicon Catalyst Angels unique is not only our visibility into an exclusive deal flow pipeline, but our membership is comprised of seasoned semiconductor veterans who bring with them a wealth of knowledge along with their ability to invest. Driven by passion and a desire to 'give back', our members understand the hardware space thanks to a lifetime of engagement in the industry. When you couple our members enthusiasm, knowledge, and broad network of connections with companies that have been vetted and admitted to Silicon Catalyst, you have a formula that is to date, non-existent within the investment community.

After launching our group in July 2019, we're pleased to announce that our members have made investments in 10 companies, 9 of which are from the Silicon Catalyst Incubator/Accelerator. The total investment amount by the members now stands at ~\$1.5 million.

Interested in joining?
Interested in pitching?

Please contact Laura Swan, VP of Business Operations.
laura@siliconcatalystangels.com
siliconcatalystangels.com



Board members, Raul Camposano, Amos Ben-Meir & Michael Joehren



Enabling the next phase of Moore's Law through optical connectivity
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Si Strategic Ecosystem Partners



Si In-Kind Ecosystem Partners





SILICON STARTUP SOLUTIONS

About Us

Silicon Catalyst is the world's only incubator focused on semiconductor solutions, including MEMS, sensors and intellectual property. We accelerate startups from idea through prototype, and onto a path to volume production.

We have evaluated over 600 startups worldwide and have admitted 42 exciting companies. Silicon Power Technology, our Chengdu Joint Venture, has admitted 29 additional startups in China.

Our companies participate in a 24-month customized incubation program. Each is guided closely by a Silicon Catalyst partner.

Silicon Catalyst's ecosystem provides everything our startups need to design, fabricate, and market semiconductor solutions:

- **In-Kind Partners** (TSMC, Synopsys, Arm, ST Micro and over 40 more) – provide each startup several millions of dollars' worth of goods and services including EDA tools, IP, PDKs, prototypes, design and test services, packaging and business solutions.
- **Strategic Partners** (TI, ON Semi, Soitec, Bosch, Cirrus Logic, Arm, ST Micro and Matrix Capital) – participate in the selection process and actively look for opportunities to partner with our startups.
- **Investors** – A large group of over 300 VCs, Angels, Angel groups, Corporate VCs, and Family Offices fund each journey. Silicon Catalyst Angels, created from our ecosystem also funds our companies. More than \$90M has been invested in our startups in the past six months.
- **Advisors** – A valuable network of over 190 industry experts that we match to the specific needs of each startup.
- **Universities, Industry Organizations, Incubators, and Government Agencies** – We nurture dozens of key relationships for the benefit of our portfolio companies. Our companies have received over \$80M in grants.

Silicon Catalyst's mission is to help semiconductor startups succeed. Join us in driving innovation!

Silicon Catalyst Angels was formed to foster the startup companies admitted into the Silicon Catalyst incubator. Comprised of seasoned semiconductor veterans who bring with them a wealth of knowledge along with their ability to invest they are driven by passion and a desire to 'give back'. Our members understand the hardware space thanks to a lifetime of engagement in the industry. When you couple our members enthusiasm, knowledge, and broad network of connections with companies that have been vetted and admitted to Silicon Catalyst, you have a formula that is to date, non existent within the investment community.

A VALUABLE RESOURCE FOR THE SEMICONDUCTOR STARTUP COMMUNITY



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