

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

Pulse

The IoT communication protocols

James Stansberry

Entrepreneurship is a fundamental human attribute. We need more of it.

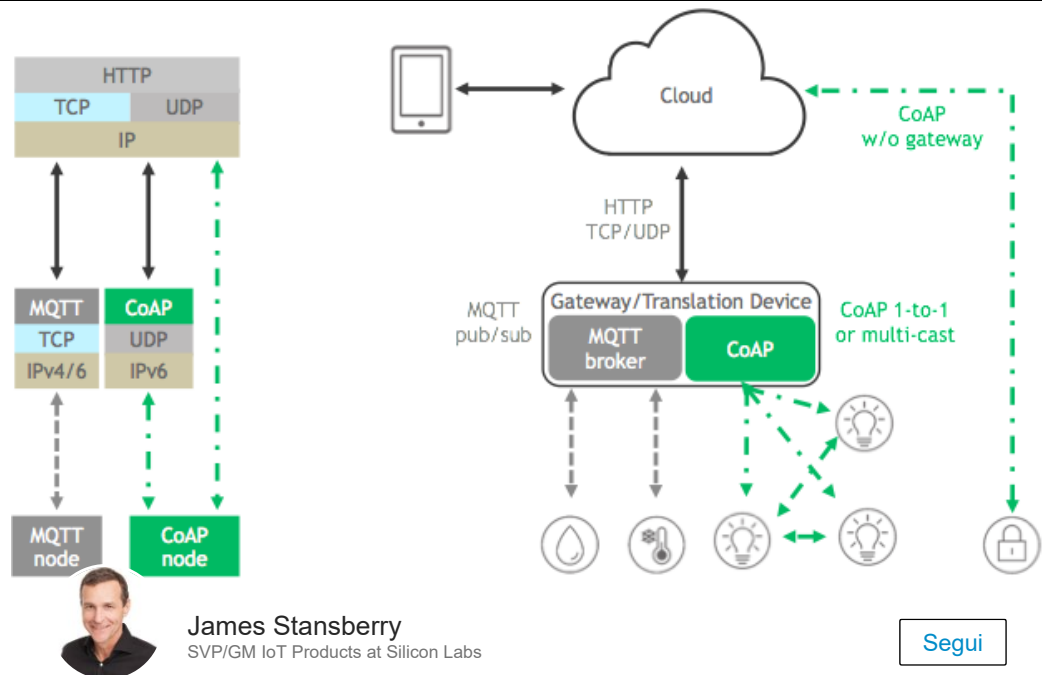
Reid Hoffman

Brexit's Impact on Silicon Valley

Venky Ganesan

What now for Brexit? Time for a rethink?

Angus Jenkinson



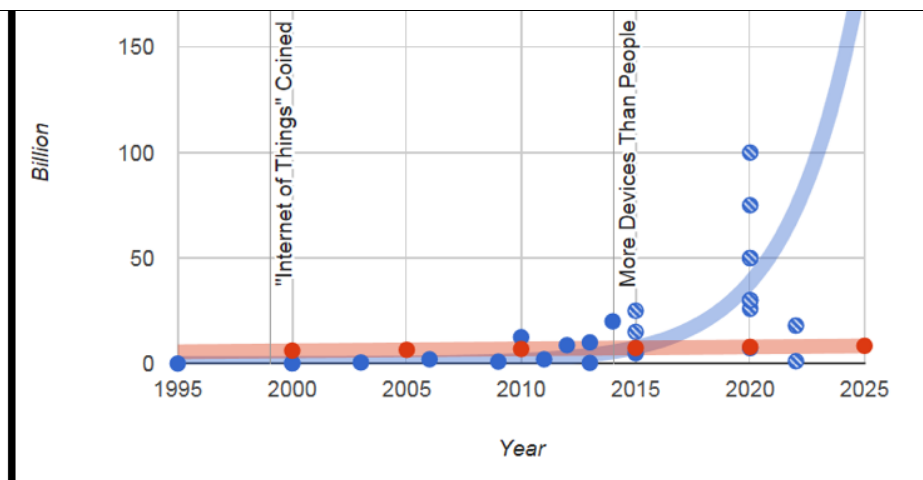
The IoT communication protocols

16 ott 2015 | 6.706 visualizzazioni | 199 volte consigliato | 20 commenti | [in](#) [f](#) [t](#)

Messaging protocols for “lightweight” IoT nodes

A fascinating [article](#) from Philip N. Howard at George Washington University asserts that based on multiple sources, the number of connected devices surpassed the number of people on the planet in 2014. Further, it estimates that by 2020 we will be approaching 50 billion devices on the Internet of Things (IoT).

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×



Philip N. Howard's Study of Connected Devices

In other words, while humans will continue to connect their devices to the web in greater numbers, a bigger explosion will come from “things” connecting to the web that weren’t before, or which didn’t exist, or which now use their connection as more of a core feature.

The question is, how will these billions of things communicate between the end node, the cloud, and the service provider?

This article dives into that subject as it relates to a particular class of devices that are very low cost, battery-powered, and which must operate at least seven years without any manual intervention.

In particular, it looks at two emerging messaging protocols to address the needs of these “lightweight” IoT nodes. The first, MQTT, is very old by today’s standards from way back in 1999. And the second, CoAP, is relatively new but gaining traction.

IoT Communication Protocol Requirements

One definition of IoT is connecting devices to the internet that were not previously connected. A factory owner may connect high-powered lights. A triathlete may connect a battery-powered heart-rate monitor. A home or building automation provider may connect a wireless sensor with no line power source.

But the important thing here is that in all the above cases the “Thing” must communicate through the Internet to be considered an “IoT” node.

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

connection options. As such, its protocols have been considered too heavy to apply wholesale for applications in the emerging IoT.

Layer	Full Internet	Description
Application	HTTP	Defines TCP/IP application protocols and the interface to transport layer services.
Transport	TCP / UDP	Provides communication session management. Defines the level of service and status of the connection.
Internet	IP	Performs IP routing with source and destination address information.

Internet Protocol Suite Overview

There are other aspects of the IoT which also drive modifications to IETF's work. In particular, networks of IoT end nodes will be lossy, and the devices attached to them will be very low power, saddled with constrained resources, and expected to live for years.

The requirements for both the network and its end devices might look like the table below. This new model needs new, lighter weight protocols that don't require the large amount of resources.

MQTT and CoAP address these needs through small message sizes, message management, and lightweight message overhead. We look at each below.

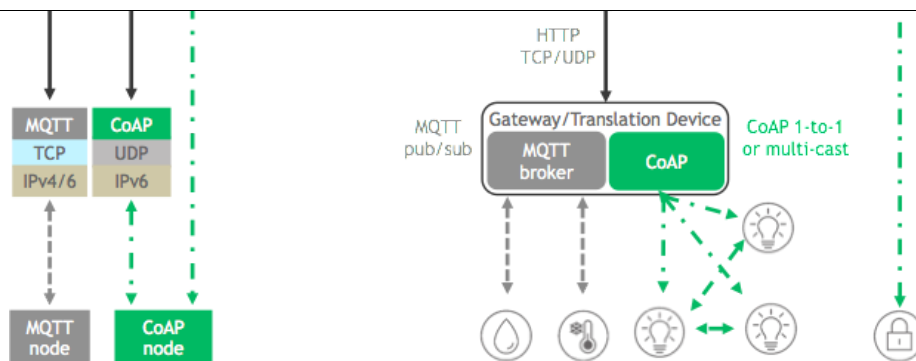
IoT End Network Requirements	Networking Style Impact
Self-Healing / Scalable	Mesh capable
Secure	Scalable to no, low, medium and high security without over burdening clients
End-node Addressability	Device specific addressing scalable to thousands of nodes
Device Requirements	Messaging Protocol Impact
Low Power / Battery-Operated	Lightweight connection, preamble, packet
Limited Memory	Small client footprint, persistent state in case of overflow
Low cost	Ties to memory footprint

Requirements for low-cost, power-constrained devices and associated networks

MQTT and CoAP: Lightweight IoT Communications Protocols

MQTT and CoAP allow for communication from Internet-based resource-rich devices to IoT-based resource-constrained devices. Both CoAP and MQTT implement a lightweight application layer, leaving much of the error correction to message retries, simple reliability strategies, or reliance on more resource rich devices for post-processing of raw end-node data.

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×



Conceptual Diagram of MQTT and CoAP Communication to Cloud / Phone

MQTT Overview

IBM invented Message Queuing Telemetry Transport (MQTT) for [satellite communications with oil field equipment](#). It had reliability and low power at its core and so made good sense to be applied to IoT networks.

The MQTT standard has since been adopted by the [OASIS](#) open standards society and released as [version 3.1.1](#). It is also supported within the [Eclipse](#) community, as well as by many commercial companies who offer open source stacks and consulting.

MQTT uses a “publish/subscribe” model, and requires a central MQTT broker to manage and route messages among an MQTT network’s nodes. Eclipse describes MQTT as “a many-to-many communication protocol for passing messages between multiple clients through a central broker.”

MQTT uses [TCP](#) for its transport layer, which is characterized as “reliable, ordered and error-checked.”

MQTT Strengths

Publish / Subscribe Model

MQTT’s “pub/sub” model scales well and can be power efficient. Brokers and nodes publish information and others subscribe according to the message content, type, or subject. (These are MQTT standard terms.) Generally the broker subscribes to all messages and then manages information flow to its nodes.

There are several specific benefits to the Pub/Sub model.

Space decoupling

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

This reduces overhead that can accompany TCP sessions and ports, and allows the end nodes to operate independently of one another.

Time decoupling

A node can publish its information regardless of other nodes' states. Other nodes can then receive the published information from the broker when they are active. This allows nodes to remain in sleepy states even when other nodes are publishing messages directly relevant to them.

Synchronization decoupling

A node that in the midst of one operation is not interrupted to receive a published message to which it is subscribed. The message is queued by the broker until the receiving node is finished with its existing operation. This saves operating current and reduces repeated operations by avoiding interruptions of on-going operations or sleepy states.

Security

MQTT uses unencrypted TCP and is not "out-of-the-box" secure. But because it uses TCP it can – and should – use TLS/SSL internet security. TLS is a very secure method for encrypting traffic but is also resource intensive for lightweight clients due to its required handshake and increased packet overhead. For networks where energy is a very high priority and security much less so, encrypting just the packet payload may suffice.

MQTT Quality of Service (QoS) levels

The term "QoS" means other things outside of MQTT. In MQTT, "QoS" levels 0, 1 and 2 describe increasing levels of guaranteed message delivery.

MQTT QoS Level 0 (At most once)

This is commonly known as "Fire and forget" and is a single transmit burst with no guarantee of message arrival. This might be used for highly repetitive message types or non-mission critical messages.

MQTT QoS Level 1 (At least once)

This attempts to guarantee a message is received at least once by the intended recipient. Once a published message is received and understood by the intended recipient, it acknowledges the message with an acknowledgement message (PUBACK) addressed to the publishing node. Until the PUBACK is received by the publisher, it stores the message and retransmits it periodically. This type of message may be useful for a non-critical node shutdown.

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

publisher sends a message announcing it has a QoS level 2 message. Its intended recipient gathers the announcement, decodes it and indicates that it is ready to receive the message. The publisher relays its message. Once the recipient understands the message, it completes the transaction with an acknowledgement. This type of message may be useful for turning on or off lights or alarms in a home.

Last Will and Testament

MQTT provides a “last will and testament (LWT)” message that can be stored in the MQTT broker in case a node is unexpectedly disconnected from the network. This LWT retains the node’s state and purpose, including the types of commands it published and its subscriptions. If the node disappears, the broker notifies all subscribers of the node’s LWT. And if the node returns, the broker notifies it of its prior state. This feature accommodates lossy networks and scalability nicely.

Flexible topic subscriptions

An MQTT node may subscribe to all messages within a given functionality. For example a kitchen “oven node” may subscribe to all messages for “kitchen/oven/+”, with the “+” as a wildcard. This allows for a minimal amount of code (i.e., memory and cost). Another example is if a node in the kitchen is interested in all temperature information regardless of the end node’s functionality. In this case, “kitchen/+ /temp” will collect any message in the kitchen from any node reporting “temp”. There are other equally useful MQTT wildcards for reducing code footprint and therefore memory size and cost.

Issues with MQTT

Central Broker

The use of a central broker can be a drawback for distributed IoT systems. For example, a system may start small with a remote control and window shade, thus requiring no central broker. Then as the system grows, for example adding security sensors, light bulbs, or other window shades, the network naturally grows and expands and may have need of a central broker. However, none of the individual nodes wants to take on the cost and responsibility as it requires resources, software and complexity not core to the end-node function.

In systems that already have a central broker, it can become a single point of failure for the complete network. For example, if the broker is a powered node without a battery back-up, then battery-powered nodes may continue operating during an electrical outage while the broker is off-line, thus rendering the network inoperable.

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

the TCP protocol requires that connections be established in a multi-step handshake process before any messages are exchanged. This drives up wake-up and communication times, and reduces battery life over the long run.

Also in TCP it is ideal for two communicating nodes to hold their TCP sockets open for each other continuously with a persistent session, which again may be difficult with energy- and resource-constrained devices.

Wake-up time

Again, using TCP without session persistence can require incremental transmit time for connection establishment. For nodes with periodic, repetitive traffic, this can lead to lower operating life.

CoAP Overview

With the growing importance of the IoT, the [Internet Engineering Task Force \(IETF\)](#) took on lightweight messaging and defined the Constrained Application Protocol ([CoAP](#)). As defined by the IETF, CoAP is for “use with constrained nodes and constrained (e.g., low-power, lossy) networks.” The [Eclipse](#) community also supports CoAP as an open standard, and like MQTT, CoAP is commercially supported and growing rapidly with IoT providers.

CoAP is a client/server protocol and provides a one-to-one “request/report” interaction model with accommodations for multi-cast, although multi-cast is still in early stages of IETF standardization. Unlike MQTT, which has been adapted to IoT needs from a decades-old protocol, the IETF specified CoAP from the outset to support IoT with lightweight messaging for constrained devices operating in a constrained environment. CoAP is designed to interoperate with HTTP and the [RESTful](#) web through simple proxies, making it natively compatible to the Internet.

Strengths of CoAP

Native UDP

CoAP runs over [UDP](#) which is inherently and intentionally less reliable than TCP, depending on repetitive messaging for reliability instead of consistent connections. For example, a temperature sensor may send an update every few seconds even though nothing has changed from one transmission to the next. If a receiving node misses one update, the next will arrive in a few seconds and is likely not much different than the first.

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

Multi-cast Support

A CoAP network is inherently one-to-one; however it allows for one-to-many or many-to-many multi-cast requirements. This is inherent in CoAP because it is built on top of IPv6 which allows for multicast addressing for devices in addition to their normal IPv6 addresses. Note that multicast message delivery to sleeping devices is unreliable or can impact the battery life of the device if it must wake regularly to receive these messages.

Security

CoAP uses DTLS on top of its UDP transport protocol. Like TCP, UDP is unencrypted but can be – and should be – augmented with DTLS.

Resource / Service Discovery

CoAP uses [URI](#) to provide a standard presentation and interaction expectations for network nodes. This allows a degree of autonomy in the message packets since the target node's capabilities are partly understood by its URI details. In other words, a battery-powered sensor node may have one type of URI while a line-powered flow control actuator may have another. Nodes communicating to the battery-powered sensor node might be programmed to expect longer response times, more repetitive information, and limited message types. Nodes communicating to the line-powered flow control actuator might be programmed to expect rich, detailed messages, very rapidly.

Asynchronous Communication

Within the CoAP protocol, most messages are sent and received using the request/report model; however, there are other modes of operation that allow nodes to be somewhat decoupled. For example, CoAP has a simplified “observe” mechanism similar to MQTT's pub/sub that allows nodes to observe others without actively engaging them.

As an example of the “observe” mode, node 1 can observe node 2 for specific transmission types, then any time node 2 publishes a relevant message, node 1 receives it when it awakens and queries another node. It's important to note that one of the network nodes must hold messages for observers. This is similar to MQTT's broker model except that there is no broker requirement in CoAP, and therefore no expectation of being able to hold or queue messages for observers.

There are currently draft additions to the standard which may provide a similar CoAP function to MQTT's pub/sub model over the short-to-medium term. The

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

Issues with CoAP

Standard Maturity

MQTT is currently a more mature and stable standard than CoAP. It's been Silicon Labs' experience that it is easier to get an MQTT network up and running very quickly than a similar one using CoAP. That said, CoAP has tremendous market momentum and is rapidly evolving to provide a standardized foundation with important add-ons in the ratification pipeline now.

It is likely that CoAP will reach a similar level of stability and maturity as MQTT in the very near term. But the standard is evolving for now, which may present some troubles with interoperability.

Message Reliability (QoS level)

CoAP's "reliability" is MQTT's QoS and provides a very simple method of providing a "confirmable" message and a "non-confirmable" message. The confirmable message is acknowledged with an acknowledgement message (ACK) from the intended recipient. This confirms the message is received but stops short of confirming that its contents were decoded correctly or at all. A non-confirmable message is "fire and forget."

Summary

The two messaging protocols MQTT and CoAP are emerging as leading lightweight messaging protocols for the booming IoT market. Each has benefits and each has issues. As leaders in mesh networking where lightweight nodes are a necessary aspect of almost every network, Silicon Labs has implemented both protocols, including gateway bridging logic to allow for inter-standard communication.

Further Reading

MQTT

Specification - <http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/os/mqtt-v3.1.1-os.html>

Excellent source for MQTT information – <http://www.hivemq.com/mqtt-essentials-wrap-up/>

CoAP

Specification - <https://tools.ietf.org/html/rfc7252>

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

Specification – <http://mqtt.org/2013/12/mqtt-for-sensor-networks-mqtt-sn>

General coverage of IoT messaging protocols

Excellent white paper on using MQTT, CoAP, and other messaging protocols – <http://www.prismtech.com/sites/default/files/documents/MessagingComparisor>



Autore
James Stansberry

[Segui](#)

[Consiglia](#) [Commenta](#) [in](#) [f](#) [t](#)

199 volte consigliato 20 commenti



Aggiungi il tuo commento

Popolari ▼



Membro di LinkedIn

any other protocols we should be looking at besides MQTT & CoAP?

[Consiglia](#) [Rispondi](#) 8 mesi fa

[Visualizza altro](#)



Reid Hoffman
Entrepreneur. Product Strategist. Investor.

[Segui](#)

Entrepreneurship is a fundamental human attribute.

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). x

It was an honor to speak to hundreds of entrepreneurs from around the world in the plenary session of the 2016 Global Entrepreneurship Summit, hosted by The White House and the State Department at Stanford University. This post is the extended version of my remarks.

Part I: Why is entrepreneurship important to society?

"All humans were born entrepreneurs."

That's a quote from Muhammad Yunus, the founder of Grameen Bank. It's a quote I like so much I opened my first book with it, *The Start-up of You*.

It's a quote that resonates here in Silicon Valley -- because it positions entrepreneurship as a fundamental human attribute, a part of our DNA.

Entrepreneurs have always been crucial to human progress and well-being, but that's especially true now. As we've moved from the Industrial Age to the Information Age and now to the Networked Age, dynamism has replaced stability. Businesses come and go faster than ever. Entire industries are replaced by new ones in shorter and shorter time frames. Adaptability is crucial in this new era. At their core, this what both *The Start-up of You* and my second book, *The Alliance*, are about. How do individuals and companies cultivate an adaptability mindset to succeed and thrive in the Networked Age?

Overall, the net impacts of our accelerating culture are positive. But the speed and dynamism of the Networked Age creates turmoil too. People are uncertain about their jobs moving forward – whether it's competition from other countries, increasing automation, or just the continuous effort needed to maintain a set of skills and expertise that employers demand.

Entrepreneurship represents our best path forward. Entrepreneurs create the products and services that lead to new industries, new jobs, new opportunities. A society where entrepreneurship is flourishing is a society where workers have many opportunities to pursue meaning and livelihoods and governments have a revenue base that can support a wide range of services and infrastructure.

Not every entrepreneur cares as much about his employees as Hamdi Ulukaya, the Turkish immigrant who founded Chobani yogurt in 2005 and [recently distributed a significant portion of his company's stock to its 2000 employees](#). Not every entrepreneur is as socially committed as Celtel founder [Mo Ibrahim](#), who has worked so hard to improve governance in Africa.

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

We should value entrepreneurs in all their different incarnations. They're the ones who refuse to accept that the way things are today is the ways thing should always be.

In general, people crave stability and the familiar. That means the societies we create often up enshrining the past. In contrast, entrepreneurs are always seeking new possibilities and cultivating new opportunities. What could be done differently than the way things are done now? How do we push the world forward in ways that create new value and make the world better? Entrepreneurs dream up crazy, often controversial ideas that challenge the status quo and improve human prosperity and wellbeing. They push for change and progress. And it's this adaptation that helps us not just to survive in the face of changing conditions –it helps us flourish.

Part II: What do entrepreneurs need to survive and thrive?

I often say that starting a company is like jumping off a cliff and assembling an aircraft on the way down.

The idea behind this analogy is that every new business effectively exists as the walking dead at launch. That's your default state: You don't have any customers. You're burning capital. The clock is ticking and you're falling fast. Until you have revenue on a solid trajectory to exceed costs, your business's natural result is a crash.

So what do entrepreneurs need in order to fly?

Networks. Networks of capital. Networks of talent and expertise. Networks of customers and product distribution.

The networks that entrepreneurs can access have never been stronger, and that's why there's never been a better time for entrepreneurship.

For most of my career, I've developed networks that help entrepreneurs in one way or another. Obviously, there's [LinkedIn](#). There's [Kiva.org](#), where I'm a board member, which has helped more than 2 million micro-entrepreneurs obtain capital from a global network of more than 1.5 million lenders.

I'm also on the board of [Endeavor](#), another organization that identifies and supports high-growth start-ups around the world -- because it's these high-

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

Endeavor's impact is about to get even bigger. This week, it's announcing Catalyst II, a co-investment fund that will support high-growth companies across Latin, America, the Middle East, Africa, and Southeast Asia.

Endeavor has already proven the model has impact. Catalyst II is the successor of Catalyst I, a \$20 million fund whose 35 portfolio companies have already created 10,000 jobs. And Catalyst II is going to be five times as big – a \$100 million fund, which I myself am supporting with an investment of \$10 million.

Organizations like Kiva and Endeavor steer entrepreneurs into the networks that help start-ups take flight. LinkedIn, in turn, is a platform where many of these key networks actually reside.

LinkedIn has always functioned as a trust-and-identity platform that individuals use to be the entrepreneurs of their own careers. But for entrepreneurs developing their own businesses, it's a central network facilitator as well.

These days, even small businesses are often global businesses. A shop-owner in Kenya might be selling to a very small, localized market, but she gets financing from Kiva.org. A graphic designer located in Ohio might use Etsy and various global shippers to sell her letterpress greeting cards to the world.

At LinkedIn, we see the shift to a global, increasingly connected mindset first-hand. Three out of four new members are international ones. Organizations in more than 200 countries have created company profiles. LinkedIn's vision is to create economic opportunity for every member of the global workforce – and to achieve this vision, we're building the world's first [Economic Graph](#), to digitally map the global economy and connect talent with opportunity at a massive scale. In fact, today LinkedIn is providing data from its Economic Graph to over 40 of the White House Tech Hire cities in the US, which are designed to increase the number of individuals leveraging bootcamps and accelerators to develop in-demand tech skills.

In the evolving world of global connectedness, entrepreneurs aren't confined to their own local markets or even countries to find the specific expertise, capital, and customers they need to make their businesses grow.

In the end, the Networked Age doesn't just make connectedness easier – it turns connectedness into a key strategic edge that every individual must cultivate. Because as the world accelerates, as competition increases, the people who are

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

It's entrepreneurs like yourselves who must embrace this fact most fully. And that's why we're giving every GES entrepreneur a one-year free LinkedIn Premium Account, so you can continue to build your networks of talent, investors, and customers in the most productive way possible.

Part III: What role does government play?

Another key platform for entrepreneurship – and one we often completely overlook in this context – is government.

Here in the land of disruptive innovation, we tend to be big believers in the invisible hand and the power of self-organizing systems.

A summit on entrepreneurship, sponsored by the federal government, is not something you'd necessarily expect to pack an auditorium that's a just a short drone flight to Sand Hill Road. In these parts, the government is often portrayed as working at cross-purposes with entrepreneurship, a force that ends up impeding innovation.

There's serious truth in that. Political systems evolve in ways that favor incumbents over upstarts. And entrepreneurs are always the upstarts. They create the future that challenges the established order.

But to suggest that the government is fundamentally at odds with entrepreneurship is a classic mistake. Because entrepreneurship doesn't just magically happen. Entrepreneurs need a platform on which to innovate and build new businesses. And government creates that platform.

Think about it. For great entrepreneurship to happen at scale, you need a talented workforce. That means an educated workforce. And for education at scale, where the majority of society receives in-depth instruction over the course of years, you need the resources of government. Governments can also support entrepreneurship by establishing — through policy — social safety nets that enable citizens to take entrepreneurial risk.

For great entrepreneurship to happen at scale, you also need reliable sources of capital. You need rule of law, and specific laws for the protection of property and the formation of businesses.

More generally, you need a culture of trust and predictability. Even under ideal scenarios, entrepreneurship is a risky endeavor. So if you've got a culture where

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

institutions and trustworthy citizens.

Put all these things together, and you've got a platform that entrepreneurs can build on. What government does, in other words, is give the invisible hand a stable and potentially productive space in which to operate.

And there is a bit of a virtuous cycle, as entrepreneurship ends up playing key roles in governance and diplomacy. Commerce, after all, is what provides the revenues that pay for social services and public infrastructure.

It also creates stability and security on a global level. When I created LinkedIn in 2003, I had a deep conviction about how it could transform individual lives and careers, but I hadn't fully considered what impact it might have on the level of global relations. Over time, though, I've come to recognize the impact that increasing individual economic connectivity can have on improving global stability.

When individuals use entrepreneurship to create deeper connections with each other, greater communication and greater understanding follow. And when these connections have an economic component, prosperity follows too. New webs of mutual interdependence, collaboration, and innovation form, with both national and global impact.

Recognizing this, President Obama organized the first [Global Entrepreneurial Summit](#) in 2010. He understands the positive synergy that can exist between government and entrepreneurship – how their own mutual interdependence ends up creating benefits for both. And events like this Summit serve as important recognition of this fact. So I want to thank him for his efforts in this regard – and I also want to let him know that the offer for a LinkedIn Premium account extends to him as well – because I hear he's contemplating a career shift.

Part IV: What can you learn from Silicon Valley during your time here?

Today, advances in technology are increasing both the speed and the force of what economist Joseph Schumpeter once called "the perennial gale of creative destruction."

In the face of this gale, many people's reflex is to want seek shelter, slow things down, protect the status quo, and effectively lock in the past. But when you do that, you're locking in stagnation. You're not innovating or moving forward in

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

and how to ensure that a broad base of our citizens continues to have access to jobs that allow for a secure, autonomous, and fruitful life.

The way to do that is to harness dynamism and change, not reject it. We need to encourage innovation and bold new technologies and industries – everything from [Airbnb](#) to [self-driving cars](#).

Of course, as we move forward, we must be conscious of the forces at work, and steer toward compassion and grace. How do we use the new technologies at our disposal to increase individual autonomy and empowerment? How do we smooth the transitions and dislocations that arise out of creative destruction?

As you might expect by now, my answer is networks. [Networks](#) create resilience by giving people faster access to more resources and more opportunities.

Think about how Silicon Valley functions. Over the last few decades, it has experienced booms and busts, all kinds of economic turmoil and disruption. Over the long term, though, Silicon Valley keeps growing stronger and more productive.

And that's because it has mastered the art of leveraging networks. Networks of talent that grow out of Stanford University and UC Berkeley, the companies that already exist here, and aspiring entrepreneurs from across the planet. Networks of capital from the venture capital firms clustered on Sand Hill Road. Networks of open-source technology and resources.

Ultimately, the Valley's connectedness makes it both incredibly generative and incredibly resilient.

Now, as long as you've watched even just one episode of HBO's hit TV series *Silicon Valley*, then you know that the actual Silicon Valley is also incredibly generative when it comes to self-regard and smugness. Nowhere else, not even Hollywood, do people throw themselves million-dollar parties for democratizing pizza delivery.

But if we sometimes get too full of ourselves, or oversell our vision of the future, the same impulses that can lead to hubris also lead to breakthrough technologies and companies that do in fact change the world. To be a successful entrepreneur, you have to think boldly. You have to be unreasonably confident. You have to believe in your ability to create a future that most other people think is impossible, foolish, or crazy.

! Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

only just beginning.

We're still just starting to understand what it means — on cultural, political, and economic levels — to have instant access to almost anyone in the world. To have all of humanity so tightly connected, in webs of knowledge, cooperation, competition, and sometimes outright conflict.

In the end, that's what this summit is about: How do we use our new connectedness to create a world that is more harmonious, more secure, more abundant with opportunities for people to live productive and rewarding lives?


All across the planet, for the foreseeable future, entrepreneurs are going to be pursuing different answers to that question. I look forward to learning from you all.


In primo piano in [Editor's Picks](#), [Entrepreneurship](#), [Technology](#), [Law & Government](#)




Autore
Reid Hoffman

[Segui](#)

 Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

 Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×

 Questo sito Web utilizza i cookie per migliorare il servizio e presentare annunci pubblicitari personalizzati. Usando il sito accetti questo utilizzo. Vedi la nostra [Informativa sui cookie](#). ×
