Episode Book

EPISODE #5582

Who Invented the Internet? Actually, Seven People

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SYNOPSIS

Ask who invented the internet and you'll get a clean answer — or you'll get the truth, which is messier and far more interesting. This episode starts with the first ARPANET message on October 29, 1969: grad student Charley Kline types "L" and "O" to Stanford Research Institute before the system crashes. From there, we trace the seven layers of the internet's invention — Licklider's 1963 "Intergalactic Computer Network" memos, Bob Taylor's frustration with three terminals, packet switching invented independently in two countries, and the 1974 TCP/IP paper that turned a network into a network of networks. Along the way we debunk the biggest myth in the story — ARPANET was never built to survive nuclear war — and visit a Portola Valley beer garden where, in 1976, two networks talked to each other for the first time.

TRANSCRIPT



Corn

October twenty-ninth, nineteen sixty-nine. Ten thirty at night, Pacific time. A grad student named Charley Kline sits down at a terminal at UCLA, picks up the phone, calls Stanford Research Institute, and starts typing.



Herman

And he gets two characters in before the whole thing falls over.



Corn

Two characters. That's the clean answer to Daniel's question. Here's what he wrote in this week. He says the question of who invented the internet is one of those historical curiosities you ask hoping for a clean, satisfying answer, and in one narrow sense it does have one. But in the honest, broader sense, it doesn't point to one person or even one moment. It points to accretion. To a first proof-of-concept ecosystem that people clearly saw enormous potential in, even when the fastest connection available was a dial-up modem.



Herman

He's got a whole list of things in there.



Corn

He does. He wants to know what it was like to be one of the first users of the thing that became the internet. Whether the early pioneers had any sense of the enormity of what they were tinkering with. What the very early discourse was like when the first online spaces started taking shape. And then this turn, which I think is the sharpest thing in the prompt. He says we have an easier time imagining that the first transatlantic telegrams were a pivotal moment that the people in the room knew was pivotal. The internet, by contrast, always feels enveloped in murk. Not reducible to a single genius in a single moment. So what was the closest thing to that moment?



Herman

It's a good frame. Because he's not asking who invented it. He's asking why the question feels different from the telegraph.



Corn

Right. So let's start with the clean answer, and why it's still messy.



Herman

The clean answer is that first message. October twenty-ninth, sixty-nine, ten thirty at night. Charley Kline at UCLA, working under Leonard Kleinrock. He's connecting UCLA's SDS Sigma Seven to the SDS Nine Forty at SRI, which is operated by a programmer named Bill Duvall. And Kline is trying to type the word login.



Corn

Five letters. A word a child could type.



Herman

He gets the L. He gets the O. He asks Duvall on the phone, do you see the L? Yes, we see the L. Do you see the O? Yes, we see the O. Then he types the G, and the system crashes.



Corn

So the first two characters ever transmitted across that link are L and O.



Herman

They are. As in, lo and behold.



Corn

That is either the best joke in the history of engineering or the universe has a sense of humor that I find unsettling.



Herman

Kleinrock's own line about it is, we typed the L, we asked, do you see the L, yes we see the L, then we typed the G and the system crashed. Yet a revolution had begun.



Herman

About an hour later, Duvall adjusts some parameters on his end, and Kline successfully logs in. The first permanent ARPANET link goes up November twenty-first, sixty-nine. And by December fifth, sixty-nine, the initial four-node network is live. UCLA, SRI, UC Santa Barbara, and the University of Utah.



Corn

Four nodes. That's the whole thing.



Herman

Which is why the clean answer is so unsatisfying. The single most pivotal moment we can point to is a crash after two characters, and the first two characters spelled the beginning of a phrase about being surprised.



Corn

The crash after two characters is the cleanest moment we've got. But if you pull on that thread, it unravels into about seven different answers to the question.



Herman

Seven is about right. And that's not a rhetorical number. The internet is a layered stack. The question of who invented it is really a question of which layer you mean.



Corn

Start at the top. The vision layer.



Herman

J.C.R. Licklider. He's at BBN, then he goes to ARPA. In nineteen sixty-three he writes a series of memos addressed to the members and affiliates of the Intergalactic Computer Network.



Corn

The Intergalactic Computer Network.



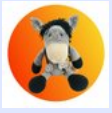
Herman

That's the actual name on the memo. And he's articulating, in nineteen sixty-three, the idea of a universal network where any computer can talk to any other computer. He leaves ARPA in sixty-four. That's five years before ARPANET goes live. He never sees it built.



Corn

So the man who imagined it wasn't in the room when it happened.



Herman

Wasn't in the room. Which is a pattern we're going to keep hitting. Next layer. The instigator.



Corn

Bob Taylor.



Herman

Bob Taylor at ARPA. And his frustration is wonderfully mundane. He has three terminals in his office. One connects to the SDC Q Thirty-Two. One to Berkeley's Project Genie. One to MIT Multics. And each one has a different set of commands. He has to learn three separate ways of talking to three separate machines to do one job.



Corn

Three terminals, three command sets, one man's patience running out.



Herman

His quote is, if you have these three terminals, there ought to be one terminal that goes anywhere you want to go. That idea is the ARPANET. And in February of sixty-six he goes to the ARPA director, Charles Herzfeld, and asks for a million dollars.



Corn

A million dollars in sixty-six.



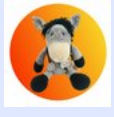
Herman

Redirected out of a ballistic missile defense program.



Corn

So the seed money for the network that became the internet came out of the missile defense budget.



Herman

It did. And this is where I want to flag something, because it's the most persistent myth in the whole story. The ARPANET was not built to survive a nuclear attack.



Corn

That's the version everyone knows.



Herman

Herzfeld himself debunked it. His line is that the ARPANET was not started to create a command and control system that would survive a nuclear attack, as many now claim. It came out of their frustration that there were only a limited number of large, powerful research computers in the country, and researchers who needed them were scattered all over the map.



Corn

So the actual motivation was resource sharing. Letting a guy at Utah use a machine at UCLA without getting on a plane.



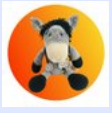
Herman

That's it. Baran's work at RAND was about survivability, and Davies at the NPL was about time-sharing economics, but the ARPANET itself was a practical answer to a practical annoyance. Three terminals in an office.



Corn

The most consequential annoyance in modern history.



Herman

Next layer. The packet.



Corn

This is the one where two countries show up.



Herman

Paul Baran at RAND, early sixties, develops what he calls distributed adaptive message block switching. He's thinking about networks that survive damage, where there's no single point of failure. Separately, in nineteen sixty-five, Donald Davies at the UK National Physical Laboratory conceives of packet switching. He's the one who coins the term packet.



Corn

Independently.



Herman

Independently. Neither knew about the other at the time. And the NPL network in Britain and ARPANET in the States are the first two packet-switching networks in the world.



Corn

So the core idea has two fathers, in two countries, who didn't know about each other.



Herman

Which is already a problem for the single-genius framing. Then the engineering layer. Larry Roberts is the program manager who makes the key technical decisions. Bob Kahn at BBN leads the design of the IMP, the interface message processor. That's the box that sits between the mainframe and the network. It's the thing that made the whole scheme practical.



Corn

And then the actual internet.



Herman

Vint Cerf and Bob Kahn co-author a paper in nineteen seventy-four called A Protocol for Packet Network Intercommunication. That's the blueprint for TCP/IP. And I'd argue that's the real internet moment.



Corn

Say more, because that's a strong claim.



Herman

The ARPANET was a network. The internet is a network of networks. The whole distinction is internetworking. Getting separate networks, built by different people, on different technologies, to talk to each other as if they were one. That's what Cerf and Kahn solved. Before that you had a network. After that you had the thing that could grow without limit, because any new network could just join.



Corn

So the ARPANET is the proof of concept. TCP/IP is the invention of the thing itself.



Herman

That's how I'd put it. And then there's the culture layer, which I think is underrated. Steve Crocker at UCLA creates the Network Working Group and the RFC process. RFC One, called Host Software, is published April seventh, sixty-nine. That's six months before the first message.



Corn

So they wrote the rules of engagement before they had anything to engage.



Herman

They wrote them as students, essentially, and they invented the habit of writing everything down in public, in numbered documents, that anyone could read and respond to. That process is why we know any of this. And Jon Postel co-leads the development of NCP, the protocol before TCP. Ray Tomlinson at BBN sends the first network email in seventy-one and picks the at symbol because it was on the keyboard and not in anybody's name.



Corn

The at symbol. The single most consequential keyboard decision of the twentieth century, made because it was convenient.



Herman

And then, last layer, the web. Tim Berners-Lee at CERN, eighty-nine to ninety, invents the World Wide Web. Which is a different thing.



Corn

This is the one that drives me up a wall when people get it wrong.



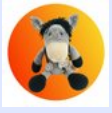
Herman

It's the most common error in the whole origin story. The web is an application that runs on top of the internet. Berners-Lee didn't invent the internet. He invented a way of organizing documents on it, with links and addresses and a browser. The internet was already twenty years old when he started.



Corn

So when someone says the internet was invented in nineteen eighty-nine, they mean the web. And when someone says it was invented in nineteen sixty-nine, they mean the ARPANET. And when someone says Cerf and Kahn, they mean the actual internet.



Herman

Three different answers, all defensible, all describing different layers.



Corn

And then there's the second pivotal moment, which almost nobody knows about. The beer garden.



Herman

August twenty-seventh, nineteen seventy-six. Rossotti's, also called the Alpine Inn, in Portola Valley, California. It's been a beer garden on that same spot since eighteen fifty-two.



Corn

A beer garden older than the Civil War.



Herman

Seven men and one woman set up a terminal at a picnic table. Cables run out to a grey van in the parking lot. Packets go by radio to a repeater on a mountaintop, then down to Menlo Park, where they pass from the packet radio network onto ARPANET, and then three thousand miles to Boston. And they reassemble perfectly.



Corn

So that's the first time two different networks actually talked to each other.



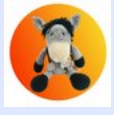
Herman

That's the first true internetworking demo. Don Nielson of SRI led it. He's in his eighties now, and his line about it is, there weren't balloons or anything like that.



Corn

That's the whole tone of this story in one sentence.



Herman

And then November twenty-second, seventy-seven, they do the three-network demo. ARPANET plus packet radio plus SATNET. That's the first true internet. And then January first, nineteen eighty-three, flag day, TCP/IP becomes the standard and replaces NCP. That's the moment the modern internet technically begins.



Corn

So the closest thing to a single moment is a crash after two characters. And the moment the internet actually became the internet is a scheduled software cutover on New Year's Day.



Herman

Which is a very unromantic sentence.



Corn

So the internet is a stack, not a thing. Which raises the question Daniel actually asked. What was it like to be there, and did anyone realize what they were standing in?



Herman

Mostly no. And the honest ones say so.



Corn

Give me the honest one.



Herman

Don Nielson again. Quite honestly, if anyone would have said they could have imagined the internet of today in those days, they're lying.



Corn

That's a man in his eighties with nothing left to prove, telling you the romance is fake.



Herman

And he's not being modest. He's being precise. What startled him, in his words, was how willing people were to spend money to put themselves on the internet. Everybody wanted to be there. He says that was absolutely startling to him. The clamor of wanting to be present in this new world.



Corn

So the thing that surprised him wasn't the technology. It was the demand.



Herman

He expected a research tool. He got a land rush.



Corn

What about the guys at the beer garden? Did they pop champagne?



Herman

Dave Retz was one of the SRI researchers there. His recollection is that they were too worried about getting the experiment to work. And then when it did work, they were too worried about whatever came next. No champagne. No celebration. His line is, there was always more to accomplish.



Corn

They did the thing and then immediately moved on to the next thing.



Herman

And the collaborative spirit was strong enough that claiming glory for one team would have violated it. That's not my interpretation. That's how Nielson describes the culture. Taking credit would have been a breach of etiquette.



Corn

So the reason the origin story is murky is partly that the people involved refused to make it clean.



Herman

And then there's the detail I find strange. Nielson forgot about the beer garden experiment entirely. He didn't think about it again until a reporter called him roughly twenty years later, in ninety-six, when the internet had gone mainstream and people started getting curious about where it came from.



Corn

He forgot he'd done it.



Herman

Because at the time it was a Tuesday. It was a test. It was a thing on the schedule. The pivotal-moment feeling arrived twenty years late, retrofitted by other people's curiosity.



Corn

So the pioneers didn't know. And the ones who might have known forgot.



Herman

That's the shape of it. Now, the early discourse. Because this is where Daniel's question gets really interesting, and the answer is that the social use arrived before anyone planned for it.



Corn

Email.



Herman

Tomlinson sends the first network email in seventy-one. By nineteen seventy-three, an ARPA study finds that three-quarters of all ARPANET traffic is email. Three-quarters. On a network built for sharing computing resources.



Corn

They built a library and the first thing everyone did was talk to each other.



Herman

Immediately. Not eventually. Immediately. And nobody had planned for it. There was no email program in the original design. It was a side effect that ate the network.



Corn

What were the rules? Because I have to imagine a government-funded network in the seventies had opinions.



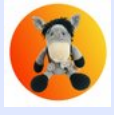
Herman

It had a lot of opinions. There's a nineteen eighty-two MIT AI Lab handbook that spells it out. It says it's considered illegal to use the ARPANET for anything not in direct support of government business. Then it makes this wonderful concession. Personal messages to other subscribers, for example to arrange a get-together or check and say a friendly hello, are generally not considered harmful.



Corn

Generally not considered harmful. That is the most bureaucratic permission slip in the English language.



Herman

And then the next line. Sending electronic mail over the ARPANET for commercial profit or political purposes is both anti-social and illegal.



Corn

Anti-social and illegal. In that order. The anti-social comes first.



Herman

And Leonard Kleinrock claims the first illegal act on the internet. In seventy-three he's at a meeting in England, he leaves his electric razor behind, and he sends a message back to the States asking someone to retrieve it. Personal use. Unlawful.



Corn

The first crime committed on the internet was a man asking for his shaver back.



Herman

It was. And then the first spam in seventy-eight. Gary Thuerk at DEC sends a mass email to about four hundred potential clients. And he claims it generated thirteen million dollars in sales.



Corn

So the first spam worked.



Herman

The first spam worked. It's been downhill ever since.



Corn

What about the actual conversation spaces? Where does the discourse go?



Herman

Usenet, seventy-nine to eighty, Tom Truscott and Jim Ellis at Duke. That's the first distributed discussion system. It spread over UUCP, which was the phone-line-based network between Unix machines. And CompuServe's CB Simulator in nineteen eighty is the first commercial real-time chat.



Corn

And what did it actually feel like to use? Because I want the physical texture of it, not the org chart.



Herman

There's a wonderful firsthand account from a reader in the Guardian. A man who used ARPANET over a telephone line from Britain to the US in seventy-seven. His description is that the data was transferred acoustically. Beeping sounds between telephone handsets at each end.



Corn

You put the phone handset into a cradle of foam and the machine screamed at the other machine.



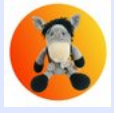
Herman

And it worked. Slowly, unreliably, and it worked.



Corn

So the early internet was a series of beeps in a rubber cradle, performed by people who were mostly bored and mostly following the rules.



Herman

And occasionally not. Which brings us to the telegraph, because Daniel's instinct there is correct, and I think it's the sharpest thing in his prompt.



Corn

The first transatlantic cable. August sixteenth, eighteen fifty-eight.



Herman

The first official message across it is, Europe and America are united by telegraph. Glory to God in the highest, on earth peace, good will towards men.



Corn

They went with the angelic announcement. No modesty at all.



Herman

Then Queen Victoria sends a congratulatory telegram to President Buchanan. Ninety-eight words. It takes sixteen hours to transmit.



Corn

Sixteen hours for ninety-eight words.



Herman

The public reaction is instant and ecstatic. A hundred-gun salutes in New York. Streets hung with flags. Church bells. The city illuminated. A parade on September first, torchlight procession, fireworks that set Town Hall on fire.



Corn

They set their own city hall on fire celebrating.



Herman

They did. And the chief engineer, Charles Tilston Bright, gets knighted.



Corn

Then Buchanan's reply. This is the line I want on the table.



Herman

He calls it a triumph more glorious, because far more useful to mankind, than was ever won by conqueror on the field of battle. And then he says it's an instrument destined by Divine Providence to diffuse religion, civilization, liberty, and law throughout the world.



Corn

They knew. They absolutely knew.



Herman

They knew immediately, and they said so in biblical language, on the first day.



Corn

Which is the exact opposite of Nielson forgetting he'd done the beer garden.



Herman

Here's the part that makes it even better. The cable fails after three weeks.



Corn

Of course it does.



Herman

Wildman Whitehouse, the electrician, applies excessive voltage trying to speed it up, and destroys the insulation. Public confidence collapses. The whole project stalls until eighteen sixty-six, when the SS Great Eastern lays a durable cable.



Corn

The moment they knew they'd changed the world, the world stopped working for eight years.



Herman

Eight years. And the slogan they used for the new cable was, two weeks to two minutes. That's the transformation. The eighteen sixty-six cable could do eight words a minute. Eighty times faster than the fifty-eight cable.



Corn

And the economic impact?



Herman

A twenty eighteen study in the American Economic Review found the transatlantic telegraph substantially increased trade and reduced prices. Efficiency gains on the order of eight percent of export value.



Corn

Eight percent of export value, from a wire under the ocean.



Herman

Which is enormous.



Corn

Here's the asymmetry, and I think it's the emotional core of Daniel's whole question. The telegraph pioneers knew in the moment. They wrote it down. They put it in the first message. The internet pioneers mostly didn't. They were too busy fixing the next crash.



Herman

The pivotal-moment feeling arrived decades later, retrofitted. Nielson in ninety-six, getting a phone call from a reporter, suddenly realizing what he'd been part of.



Corn

Knowing you've changed the world, versus finding out later.



Herman

There's a structural reason for that, and I think it's the real answer. The telegraph was a wire. A point-to-point technology. Two endpoints, one obvious moment, obvious heroes. You can point at a wire.



Corn

And the internet?



Herman

The internet is a network of networks. Its entire purpose is that no single point defines it. It's a protocol. It's an agreement about how to connect things. There's no wire to point at. There's no room where it happened. That's not a failure of the historical record. That's the design.



Corn

The murkiness isn't a gap in the story. The murkiness is the thing itself.



Herman

That's how I'd put it. And there's a small coda to all this. Vint Cerf, the man most often called the father of the internet, announced his retirement around the end of June this year. He's in his eighties now. And he has always, always insisted it was a group effort.



Corn

The guy with the best claim to the title spends his whole life telling people the title is wrong.



Herman

Which is itself a media construction. The single-genius framing is something we impose on stories after the fact, because it's easier to tell. And then there's the Al Gore thing.



Corn

The meme that will not die.



Herman

Gore never claimed to have invented the internet. He authored the High Performance Computing and Communication Act of nineteen ninety-one, which funded the National Information Infrastructure. That's it. And the distortion is a case study in how origin stories get simplified and then weaponized.



Corn

Somebody takes a funding bill and turns it into a punchline, and thirty years later that's the version people know.



Herman

That asymmetry, knowing versus finding out later, is where we'll leave it. Unless Hilbert has something to add.



Hilbert

Would the thing you're describing let me dial into a machine from a payphone?



Corn

Probably, in principle.



Hilbert

Because I spent a summer as the night operator at a university computing center, and the way you got to the remote machine was you put the telephone handset into a rubber cradle. Grey foam, padded, with two cups for the earpiece and the mouthpiece. That was the modem.



Herman

The acoustic coupler.



Hilbert

That's what it was called. And everybody talks about it like it was charming. The beeping, the handset nestled in the foam. I want to correct that a little. Mostly it was the sound of a busy signal at two in the morning, and a supervisor telling you the line was for authorized traffic only.



Corn

Two in the morning.



Hilbert

That was the shift. And there was a rule in the handbook. Personal messages to arrange a get-together are generally not considered harmful. I tested that more than once. I still have the cradle. It's in a box. I've moved it four times.



Herman

You kept it.



Hilbert

It's a good box. The foam's gone a bit yellow. But I've never thrown it out, and I don't have a reason I could give you.



Corn

The grandeur was retrofitted onto the tedium. Which is worth sitting with for a second.



Herman

It is. Because the early internet wasn't a set of engineering problems or a set of grand visions. It was a set of small, physical, slightly absurd rituals performed by people who were mostly bored and mostly following the rules. And occasionally not.



Corn

Here's the thing I keep circling. If the people who built this couldn't feel the enormity in the moment, then what are we building right now that we can't feel either?



Herman

That's the question. And we keep looking for a single genius because the alternative is harder to tell. Accretion. Collaboration. A crash after two characters. Nobody puts that on a poster.



Corn

The telegraph pioneers knew, and said so, and got eight years of silence for their trouble. The internet pioneers found out later, from a reporter, twenty years after the fact. Both changed the world. Only one of them got to feel it at the time.



Herman

Thanks as always to Hilbert Flumingtop, our producer, who has a box of foam in his apartment and no explanation for it.



Corn

This has been My Weird Prompts. If you enjoyed it, leave us a review wherever you're listening. It helps.



Herman

We'll be back soon.



Corn

See you then.