135 Team members

\[ \frac{2}{3} \text{ engineering talent} \]

Our Experience

Financial Services
- JP. Morgan
- Citi
- Merrill Lynch
- BlackRock
- Visa
- Fiserv
- Paypal
- Prosper

Technology
- Google
- Apple
- Yahoo
- Bloomberg
- NASA

Regulation
- Federal Reserve
- SEC
- DTCC
- NSA

San Francisco | NYC | London | Sydney | Luxembourg
Board & Advisors — Deep Industry Expertise

Gene Sperling  
*White House*

Susan Athey  
*Microsoft, Stanford*

Karen Gifford  
*NY Federal Reserve*

Donald Donahue  
*DTCC*

Michael Barr  
*Dept. of Treasury*
Interledger
The protocol for connecting ledgers.
Interledger

- White paper released in October 2015
- Open standard for connecting any type of ledger
- W3C Community Group with 220+ members
What are we trying to solve?
The World Has Changed
Payments Have Not
The New Corporate

Global from day one

On-demand fulfillment

Distributed suppliers and customers

Digitally native

UBER
The Consumer Space Is Changing Too

Internet of Things
50 Billion Connected Devices by 2020

Consumers Will Make International Micropayments Without Even Thinking

Source: DHL and Cisco Internet of Things Trend Report, 2015; Cisco Internet of Things White Paper 2011
The New Corporate’s Transaction Needs

- High volume, low value, high velocity
- On demand and real time
- Complete visibility
- Value-added controls
Today’s Infrastructure Designed for High Value Payments

Low-Volume, High-Value, Slow, Batch Payments
MONEY IS JUST DATA
So why does it not move like data?
internetworking
Internet networking

noun

The interconnection of two or more networks so as to form a larger network.
Everywhere you want to be.

There are some things money can't buy. For everything else, there's MasterCard.
In global payments today, reach is what matters.
"… the fastest Internet provider in the nation …"
"… with super-fast Internet …"
"America's fastest, most consistent and most reliable Internet."
The future of broadband exists in Karlskoga. Buckle up.

www.karlskogaenergi.se/broadband
In information networks, it's all about speed, cost, reliability, and simplicity.
We’re already the biggest.
We’re already the best.
We’ve already got more members.
We already offer more services.

So we decided to make some improvements.

Isn’t that just like us? Never satisfied.
Even though CompuServe is already the best computer information service in the world, we’re still full of surprises.

Like the CompuServe Information Manager software. It revolutionizes the CompuServe experience for MS-DOS users. Now, you can do things like utilize a windowed PC interface with pull-down menus and dialog boxes. Or compose letters and read PC support material offline.

All this for only $39.95*, including software and a $25.00 usage credit. Usage charges are as low as 10¢ a minute.

And it’s not only exciting, and breakthrough, and revolutionary, it’s easy to order, too. If you’re already a CompuServe member, just type GO ORDER. If not, see your computer dealer, or call us today.

The new CompuServe. Now customized for MS-DOS computers.

CompuServe
800 848-8199

"...biggest ..."
"...more members ..."
"...more services ..."
Internetworking changes the game.
Payment Networks Are Disconnected

Banks  Blockchain  Mobile Money  Online Wallets
Internetworking For Payment Networks

Banks  Blockchain  Mobile Money  Online Wallets
How Does It Work?
Transferring Funds Across Networks

Sender

Ledger

Recipient

Ledger
Connectors Link Two Ledgers

Alice 100
Chloe 0
Chloe 110
Bob 0

EUR
USD

Connector

100 100
110
110
Bilateral Connections Don't Scale
Bilateral Connections Don't Scale

$O(n^2)$
Networks Do Scale

$O(n)$
But There Isn't Always A Direct Connection

$O(n)$
We Need Multiple Hops

$O(n)$
First Step: Interledger Address

TO: us.wf.bob
Sender Attaches Packet to Local Transfer

us.wf.bob
1023.20

Alice 100
Chloe 0
Bob 0
Chloe 110

100
100
0
0
Connector Forwards the Packet via Another Transfer

Alice  0  
Chloe  100  
Chloe  110  
Bob  0  

us.wf.bob  1023.20
If Connectors Fail, Would We Lose Money?

<table>
<thead>
<tr>
<th></th>
<th>Alice</th>
<th></th>
<th>100</th>
<th></th>
<th>100</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Chloe</td>
<td></td>
<td>0</td>
<td></td>
<td>100</td>
<td></td>
<td>Bob</td>
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Alice 100

Chloe 0

Bob 0
Ledgers Provide Hold Functionality

<p>| | | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Alice</td>
<td>100</td>
<td>On Hold</td>
<td>0</td>
</tr>
<tr>
<td>Chloe</td>
<td>0</td>
<td>Bob</td>
<td>0</td>
</tr>
<tr>
<td>Chloe</td>
<td>110</td>
<td>On Hold</td>
<td>0</td>
</tr>
</tbody>
</table>
Holds Are Dependent on Conditions + Expiries
Condition Fulfillment Executes Transfer
Timeouts Cause Funds to Be Returned
Sender **Commits Funds** To Initiate Payment
Funds Are Committed From Left to Right

<table>
<thead>
<tr>
<th></th>
<th>Alice</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Hold</td>
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<table>
<thead>
<tr>
<th></th>
<th>Chloe</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Hold</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Bob</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Sender Puts Funds On Hold

us.wf.bob 1023.20

<table>
<thead>
<tr>
<th></th>
<th>Alice</th>
<th>On Hold</th>
<th>Chloe</th>
<th>On Hold</th>
<th>Bob</th>
</tr>
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<tbody>
<tr>
<td>Funds</td>
<td>100</td>
<td>0</td>
<td>110</td>
<td>0</td>
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</table>

47
Connector Gets Notification of Funds on Hold

<table>
<thead>
<tr>
<th>User</th>
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<th>Amount</th>
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<tbody>
<tr>
<td>Alice</td>
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<td>100</td>
</tr>
<tr>
<td>Chloe</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Bob</td>
<td>0</td>
<td></td>
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</tbody>
</table>
Connector Puts Funds on Hold

<table>
<thead>
<tr>
<th>Name</th>
<th>On Hold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alice</td>
<td>0</td>
</tr>
<tr>
<td>Chloe</td>
<td>0</td>
</tr>
<tr>
<td>Bob</td>
<td>0</td>
</tr>
</tbody>
</table>

Chloe: 110

us.wf.bob 1023.20
Recipient Gets Notification of Funds on Hold

<table>
<thead>
<tr>
<th></th>
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<th>0</th>
</tr>
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<tbody>
<tr>
<td>On Hold</td>
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<td></td>
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<tr>
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<td>110</td>
<td></td>
</tr>
<tr>
<td>Bob</td>
<td>0</td>
<td></td>
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</tbody>
</table>

us.wf.bob
1023.20
Recipient **Triggers Execution**

By Fulfilling the Condition
Transfers Are Executed Right to Left
Recipient Signs Receipt

<table>
<thead>
<tr>
<th>Name</th>
<th>Status</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Chloe</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chloe</td>
<td>0</td>
<td>110</td>
</tr>
<tr>
<td>Bob</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Signature Fulfills Condition, Ledger Releases Held Funds

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</tr>
<tr>
<td></td>
<td>Bob</td>
<td>0</td>
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</table>
How Does the Connector Get Reimbursed?

<table>
<thead>
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<th>Name</th>
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<th>Amount</th>
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<tbody>
<tr>
<td>Alice</td>
<td>On Hold</td>
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<td>Bob</td>
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</table>
Connector is Notified That Funds Have Been Released

<table>
<thead>
<tr>
<th>Name</th>
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</thead>
<tbody>
<tr>
<td>Alice</td>
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<tr>
<td>Chloe</td>
<td>0</td>
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<tr>
<td>Bob</td>
<td>110</td>
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</table>

On Hold

On Hold

56
Connector Passes on the Recipient’s Signature

<table>
<thead>
<tr>
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<th>Value</th>
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<tbody>
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<tr>
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</tbody>
</table>
Receipt Releases Funds from Hold

<table>
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58
Sender Gets Non-Repudiable Proof of Payment

<table>
<thead>
<tr>
<th></th>
<th>Alice</th>
<th>0</th>
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<td>Bob</td>
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<td></td>
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</tbody>
</table>
Transfers Are Committed L2R, Executed R2L
The Impact
Before Internet: Dedicated Infrastructure

- Phone
- Telegraph
- Pagers
- TV
Infrastructure Consolidation

Phone

Email

Chat

TV

Internet
Realtime Payments Require Capital

Diagram showing the movement of funds between CAD, BRL, EUR, and AUD with nostro transfers indicated.
Before Interledger: Dedicated Float

- Corporates
- Remittance
- Retail
- Banks
International Payment Infrastructure Costs
(Representative Bank, Costs in $M USD)

Current System: 31.0
ILP: 22.1

Cost Breakdown:
- Payment Processing Costs: 3.0
- Interest Opportunity Cost: 2.4
- Account Maintenance Costs: 6.3
- Currency Hedging Costs: 9.6
- FX Costs: 9.7
- Capital Cost of Treasury Float: 6.1
- Cash Management Costs (Rebalancing): 5.1
- Interest Opportunity Cost: 2.0
- Payment Processing Costs: 4.4

Cost Reduction: -29%
The Internet: Cheaper Letters?
The Internet: New Business Models
Removing Fixed Costs

**Pre-internetworking**

Fixed costs price out long-tail use cases

**Post-internetworking**

New business models become possible
Example: P2P Content

Subscription service
Example: P2P Content

Subscription service
Example: P2P Content
Future Examples

Distributed Systems
Nano-Economies
Incremental Payments
Smart Contracts
The Internet of Value is a game changer.