

How to manipulate standards

Daniel J. Bernstein

Verizon Communications Inc.

LICENSE: You understand and hereby agree that the audio, video, and text of this presentation are provided “as is”, without warranty of any kind, whether expressed or implied, including, without limitation, the implied warranties of merchantability, fitness for a particular purpose or otherwise. Since you are not a blithering idiot, you also understand that Verizon Communications Inc. and the entire Verizon family of companies are not actually associated in any way with the speaker, have not reviewed the contents of this presentation, and are not responsible for the contents of this presentation. Continuing to read, listen to, or otherwise absorb this information constitutes acceptance of this license. Any court dispute regarding this presentation shall be resolved in the state of Illinois in the United States of America.

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

manipulate standards

. Bernstein

Communications Inc.

You understand and hereby agree
audio, video, and text of this
are provided “as is”, without
any kind, whether expressed
including, without limitation,
warranties of merchantability,
a particular purpose or otherwise.
are not a blithering idiot, you also
that Verizon Communications Inc.
tire Verizon family of companies
ually associated in any way with
, have not reviewed the contents of
ation, and are not responsible for
s of this presentation. Continuing
ten to, or otherwise absorb this
constitutes acceptance of this
y court dispute regarding this
n shall be resolved in the state
n the United States of America.

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

Our core

Delivering

from poi

Alice

e standards

n

cations Inc.

d and hereby agree

d text of this

“as is”, without

ether expressed

hout limitation,

merchantability,

urpose or otherwise.

ering idiot, you also

Communications Inc.

mily of companies

ed in any way with

viewed the contents of

e not responsible for

entation. Continuing

erwise absorb this

acceptance of this

ce regarding this

olved in the state

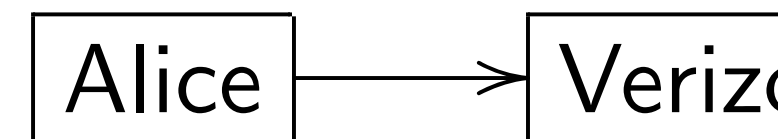
States of America.

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

Our core mission:

Delivering informa

from point A to po



ls

C.

agree

out

ed

n,

ty,

erwise.

ou also

ons Inc.

anies

with

ntents of

ble for

tinuing

this

this

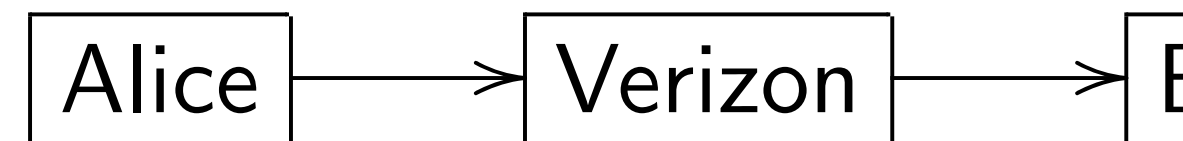
his

cate

erica.

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

Our core mission:
Delivering information
from point A to point B.

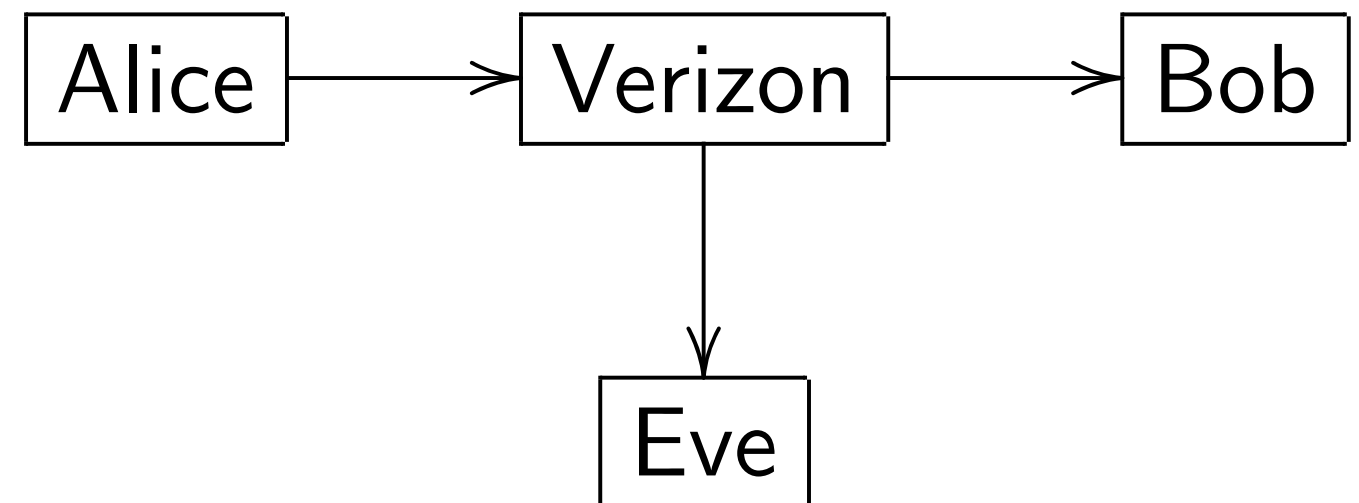


Our core mission:
Delivering information
from point A to point B.



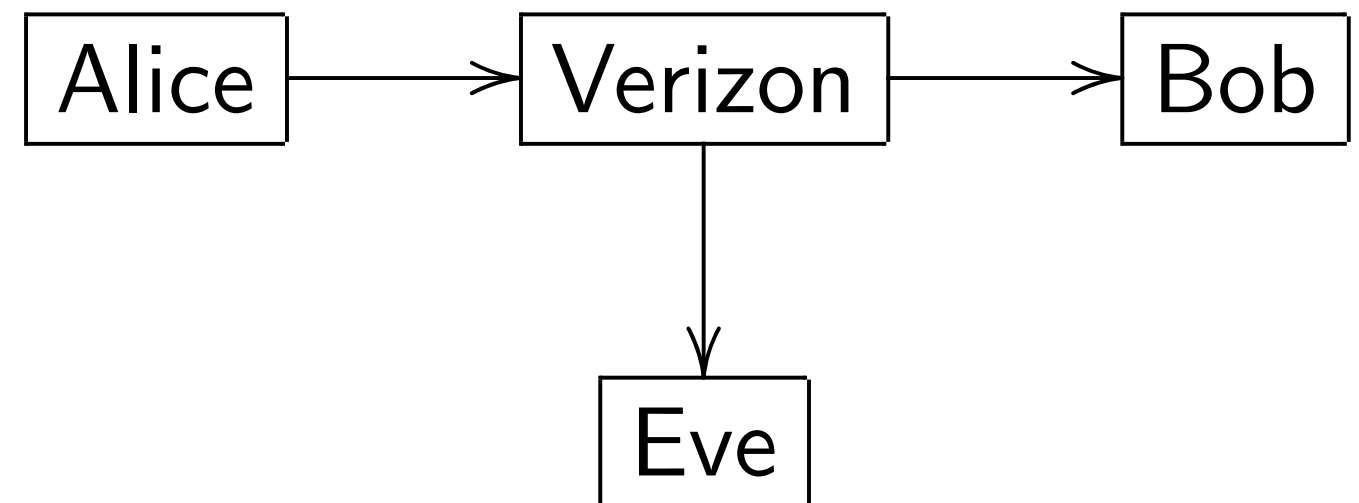
Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...



Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...

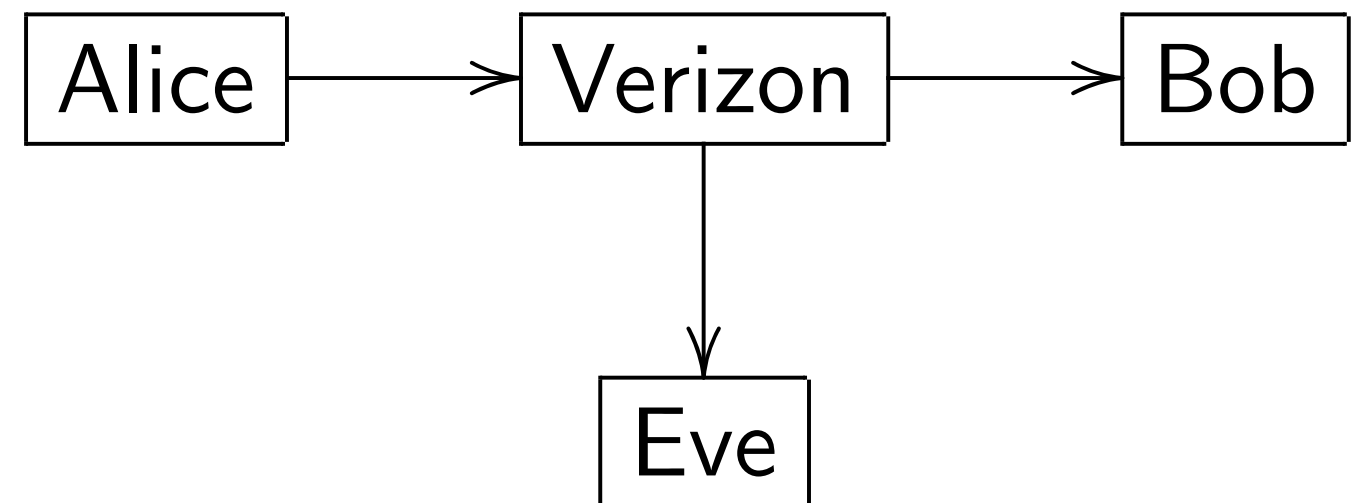


“Can you hear me now? Good.”

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

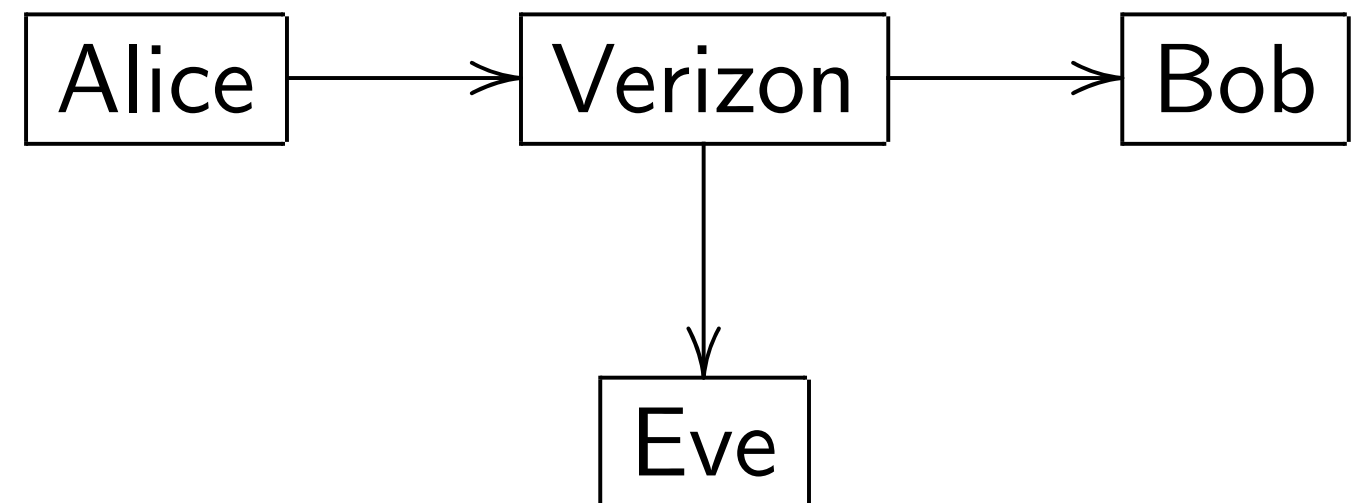
Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”
“Can they hear you now? Good.”

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

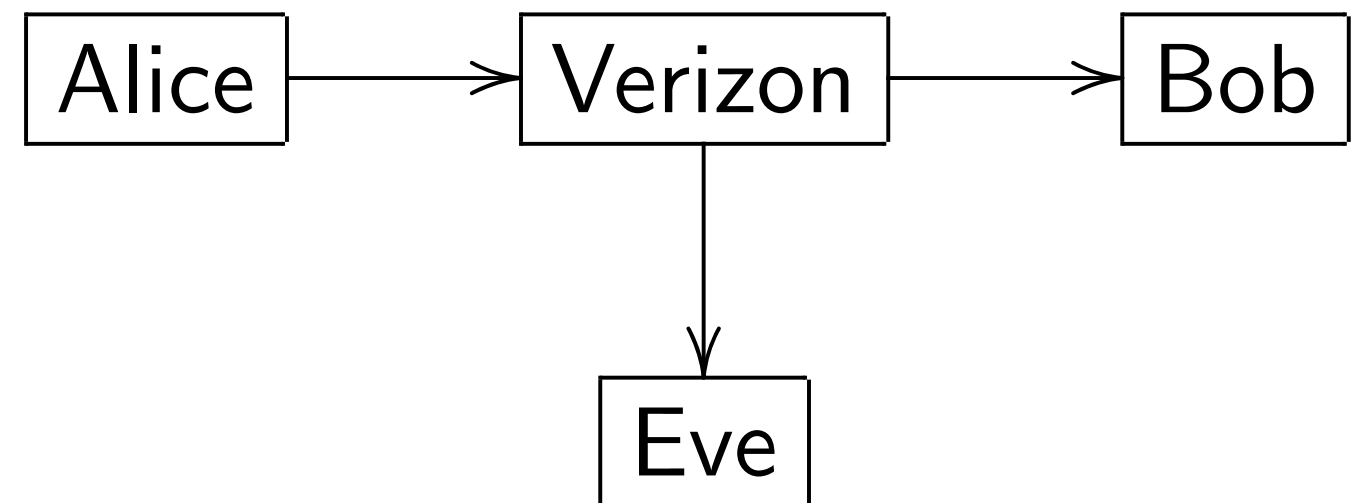
Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”
“Can they hear you now? Good.”
“We never stop working for you.”

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

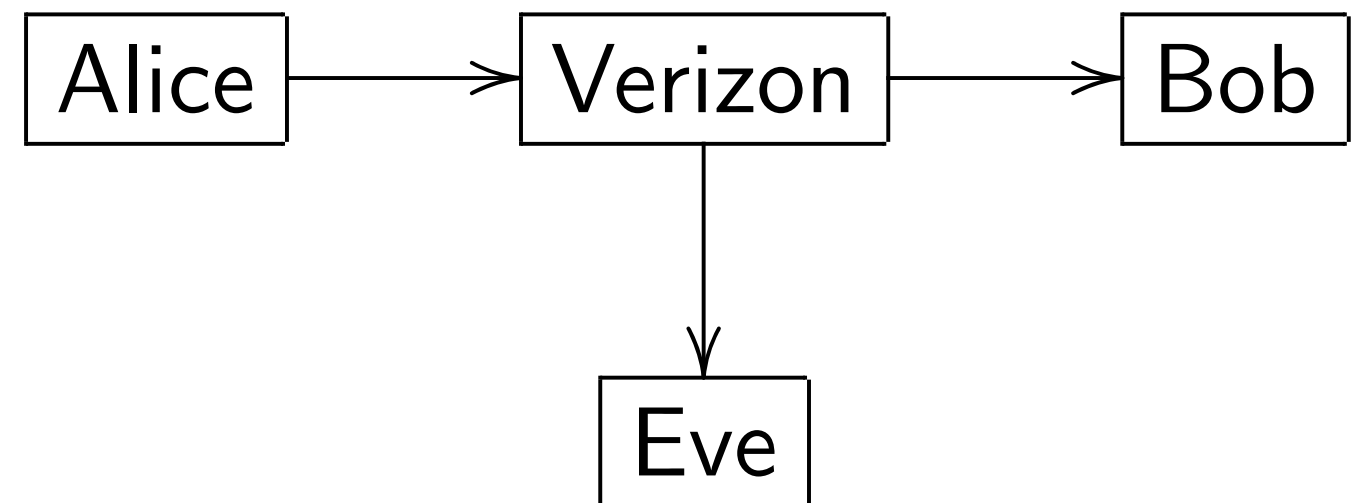
Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”
“Can they hear you now? Good.”
“We never stop working for you.”
“Rule the air.”

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

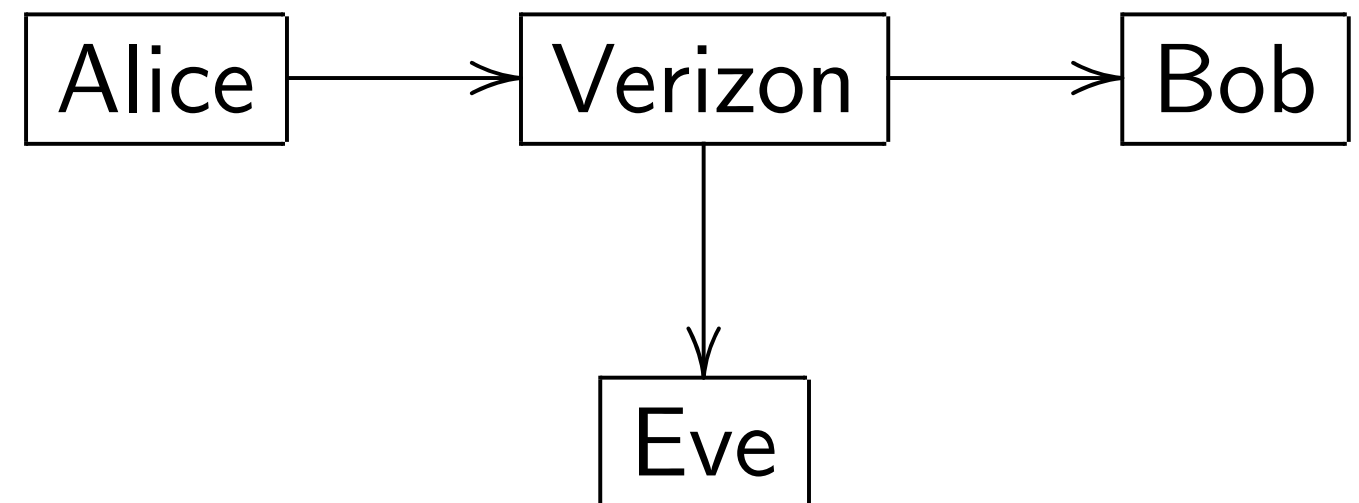
Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”
“Can they hear you now? Good.”
“We never stop working for you.”
“Rule the air.”
“Never settle.”

Verizon is a global leader
delivering innovative
communications and technology
solutions that improve the way
our customers live, work and play.

Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...

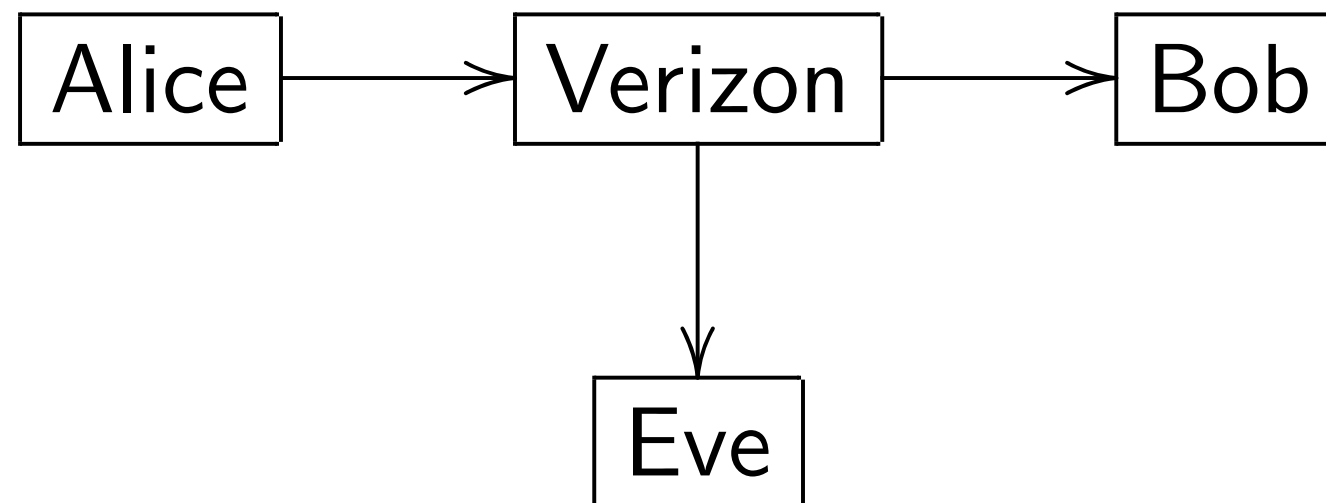


“Can you hear me now? Good.”
“Can they hear you now? Good.”
“We never stop working for you.”
“Rule the air.”
“Never settle.”
“I am the man in the middle.”

is a global leader
g innovative
ications and technology
s that improve the way
omers live, work and play.

Our core mission:

Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”

“Can they hear you now? Good.”

“We never stop working for you.”

“Rule the air.”

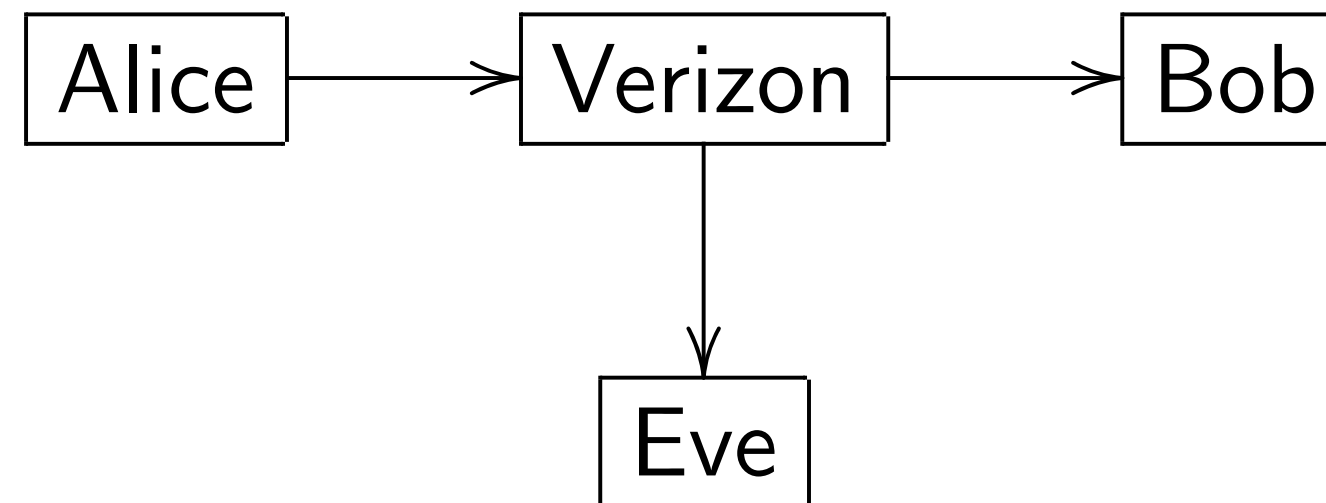
“Never settle.”

“I am the man in the middle.”

Ultimate

leader
ve
nd technology
rove the way
, work and play.

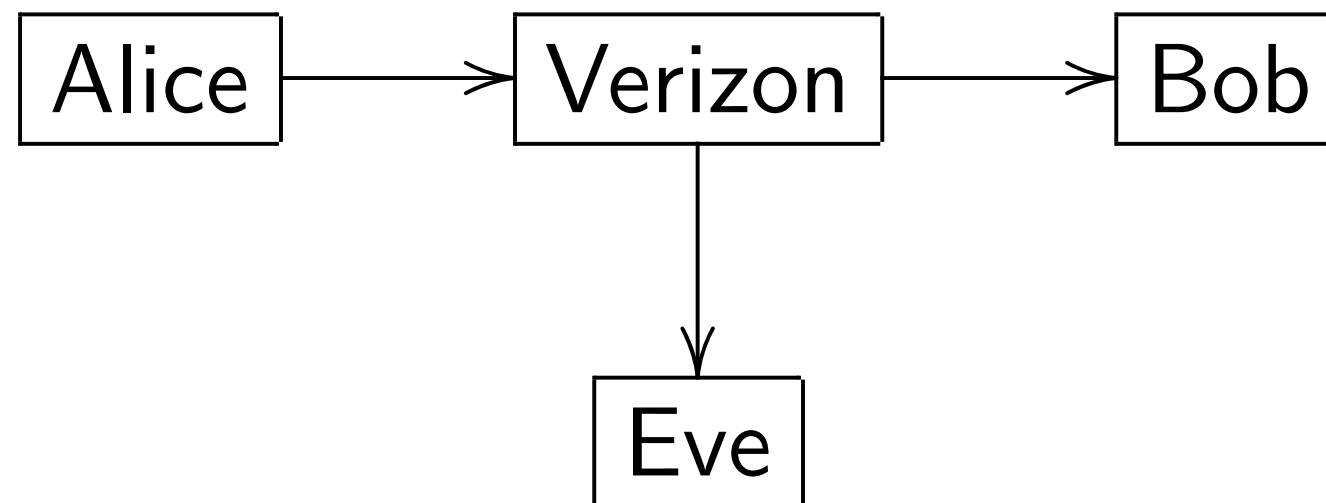
Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”
“Can they hear you now? Good.”
“We never stop working for you.”
“Rule the air.”
“Never settle.”
“I am the man in the middle.”

Ultimate goal: Ma

Our core mission:
Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”

“Can they hear you now? Good.”

“We never stop working for you.”

“Rule the air.”

“Never settle.”

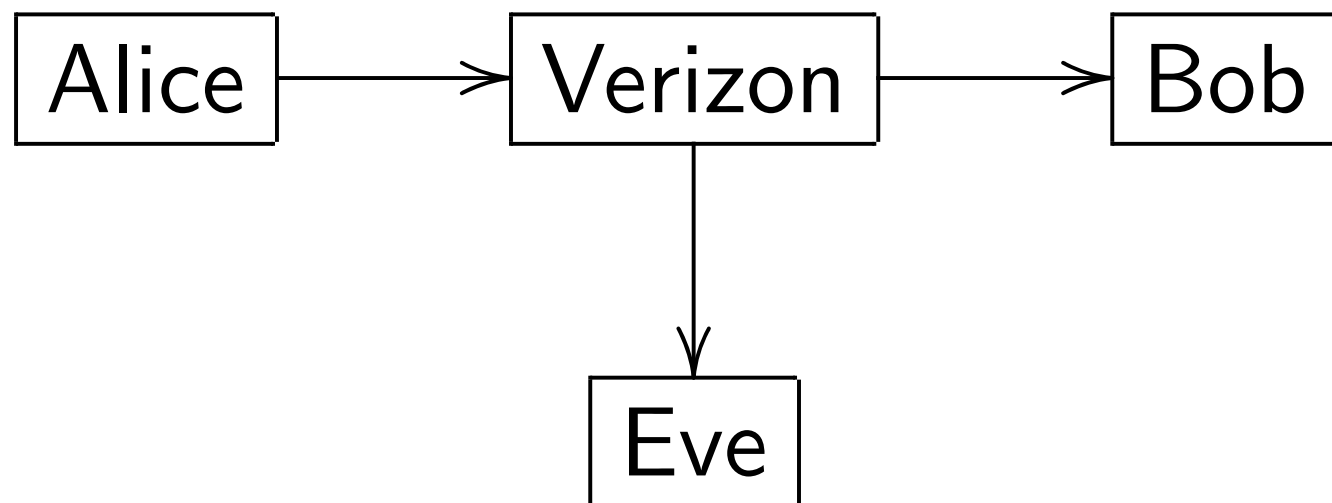
“I am the man in the middle.”

Ultimate goal: Make money

logy
way
d play.

Our core mission:

Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”

“Can they hear you now? Good.”

“We never stop working for you.”

“Rule the air.”

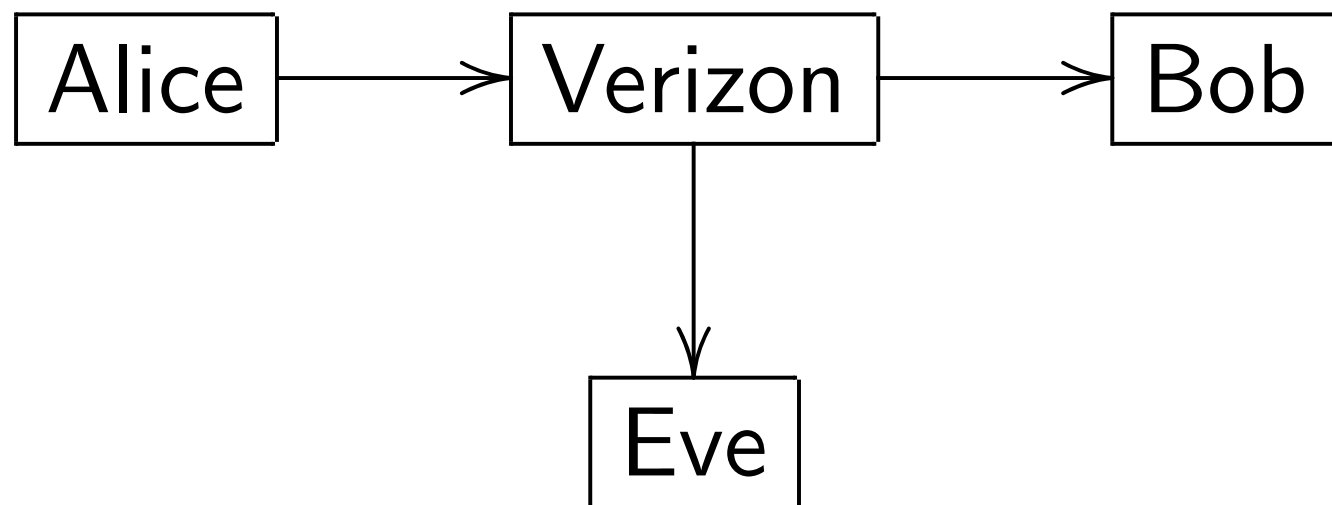
“Never settle.”

“I am the man in the middle.”

Ultimate goal: Make money.

Our core mission:

Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”

“Can they hear you now? Good.”

“We never stop working for you.”

“Rule the air.”

“Never settle.”

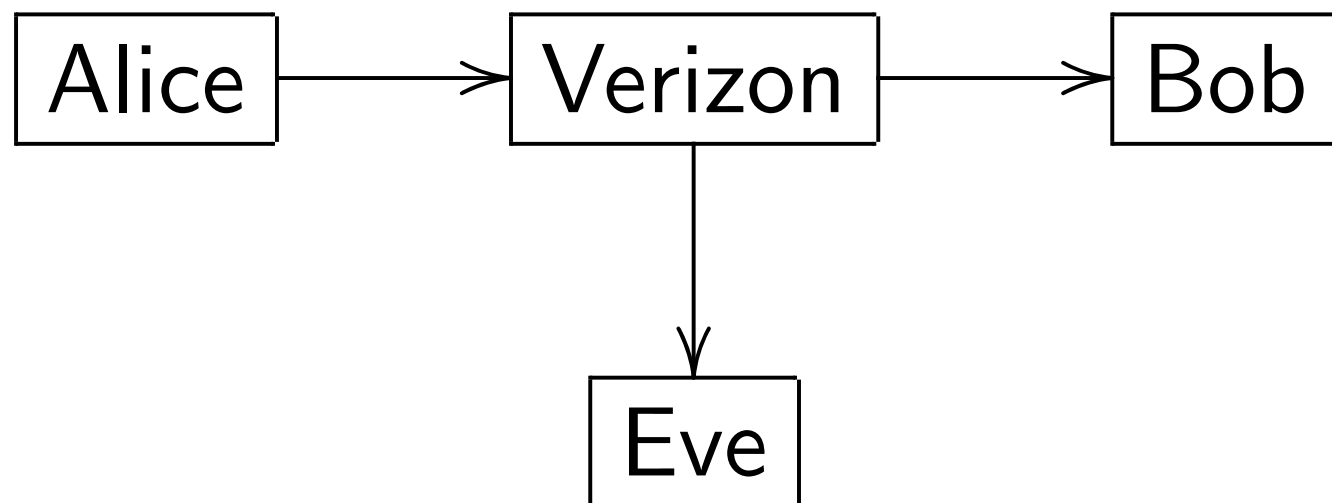
“I am the man in the middle.”

Ultimate goal: Make money.

NSA “pays AT&T, Verizon and Sprint **several hundred million dollars a year** for access to 81% of all international phone calls into the US.”

Our core mission:

Delivering information
from point A to point B,
and also to points C, D, E, ...



“Can you hear me now? Good.”

“Can they hear you now? Good.”

“We never stop working for you.”

“Rule the air.”

“Never settle.”

“I am the man in the middle.”

Ultimate goal: Make money.

NSA “pays AT&T, Verizon and Sprint **several hundred million dollars a year** for access to 81% of all international phone calls into the US.”

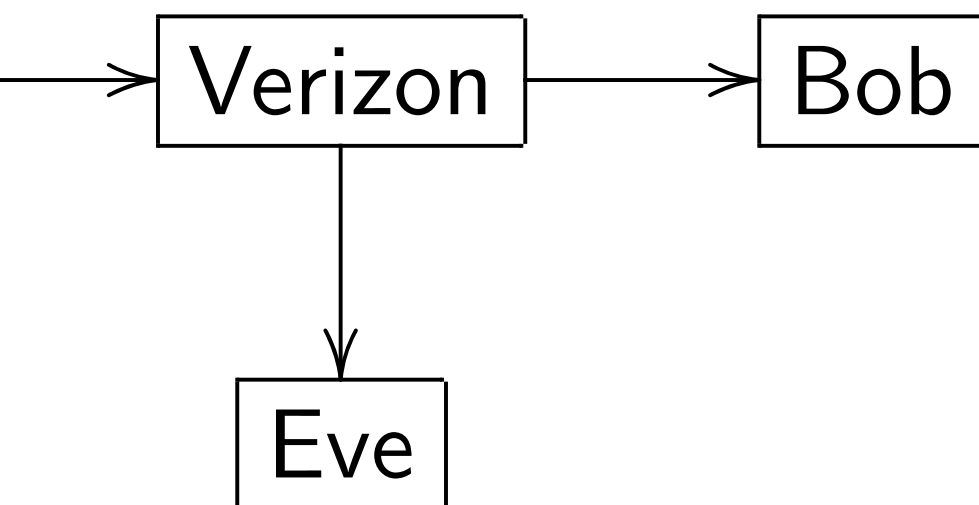
“Precision Market Insights, Verizon’s data marketing arm ... will now **sell its tool to advertisers for mobile ad campaigns that target Verizon’s massive subscriber base** based on demographics, interests and geography.”

the mission:

ing information

point A to point B,

to points C, D, E, ...



u hear me now? Good.”

ey hear you now? Good.”

ver stop working for you.”

he air.”

ettle.”

he man in the middle.”

Ultimate goal: Make money.

NSA “pays AT&T, Verizon and

Sprint **several hundred million**

dollars a year for access to 81%

of all international phone calls

into the US.”

“Precision Market Insights,

Verizon’s data marketing arm ...

will now **sell its tool to advertisers**

for mobile ad campaigns

that target Verizon’s massive

subscriber base based on

demographics, interests and

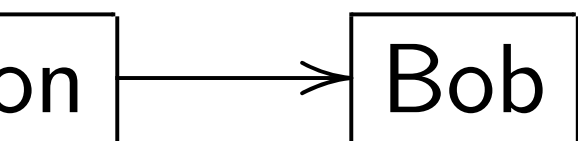
geography.”

Many of

rely on y

to send

tion
oint B,
C, D, E, ...



now? Good.”
u now? Good.”
orking for you.”

the middle.”

Ultimate goal: Make money.

NSA “pays AT&T, Verizon and Sprint **several hundred million dollars a year** for access to 81% of all international phone calls into the US.”

“Precision Market Insights, Verizon’s data marketing arm ... will now **sell its tool to advertisers for mobile ad campaigns that target Verizon’s massive subscriber base** based on demographics, interests and geography.”

Many of our comp
rely on **your brow**
to send data to Ev

Ultimate goal: Make money.

NSA “pays AT&T, Verizon and Sprint **several hundred million dollars a year** for access to 81% of all international phone calls into the US.”

“Precision Market Insights, Verizon’s data marketing arm . . . will now **sell its tool to advertisers for mobile ad campaigns that target Verizon’s massive subscriber base** based on demographics, interests and geography.”

Many of our competitors rely on **your browser** to send data to Eve.

Ultimate goal: Make money.

NSA “pays AT&T, Verizon and Sprint **several hundred million dollars a year** for access to 81% of all international phone calls into the US.”

“Precision Market Insights, Verizon’s data marketing arm . . . will now **sell its tool to advertisers for mobile ad campaigns that target Verizon’s massive subscriber base** based on demographics, interests and geography.”

Many of our competitors rely on **your browser** to send data to Eve.

Ultimate goal: Make money.

NSA “pays AT&T, Verizon and Sprint **several hundred million dollars a year** for access to 81% of all international phone calls into the US.”

“Precision Market Insights, Verizon’s data marketing arm . . . will now **sell its tool to advertisers for mobile ad campaigns that target Verizon’s massive subscriber base** based on demographics, interests and geography.”

Many of our competitors rely on **your browser** to send data to Eve.

“Libert has discovered that the vast majority of health sites, from the for-profit WebMD.com to the government-run CDC.gov, are loaded with tracking elements that are **sending records of your health inquiries to the likes of web giants like Google, Facebook, and Pinterest, and data brokers like Experian and Acxiom.**”

the goal: Make money.

pays AT&T, Verizon and
several hundred million
year for access to 81%
international phone calls
US.”

on Market Insights,
s data marketing arm . . .
sell its tool to advertisers
le ad campaigns
get Verizon’s massive
er base based on
aphics, interests and
hy.”

Many of our competitors
rely on **your browser**
to send data to Eve.

“Libert has discovered that the
vast majority of health sites, from
the for-profit WebMD.com to the
government-run CDC.gov, are
loaded with tracking elements
that are sending records of your
health inquiries to the likes of web
giants like Google, Facebook, and
Pinterest, and data brokers like
Experian and Acxiom.”

We are y
You give
We redi
We moc

ake money.

, Verizon and
dred million

access to 81%
phone calls

Insights,
marketing arm ...
ol to advertisers
paigns
n's massive
sed on
erests and

Many of our competitors
rely on **your browser**
to send data to Eve.

“Libert has discovered that the
vast majority of health sites, from
the for-profit WebMD.com to the
government-run CDC.gov, are
loaded with tracking elements
that are **sending records of your
health inquiries to the likes of web
giants like Google, Facebook, and
Pinterest, and data brokers like
Experian and Acxiom.**”

We are **your network**
You **give us** your
We **redirect it** to
We **modify it** to

Many of our competitors
rely on **your browser**
to send data to Eve.

“Libert has discovered that the
vast majority of health sites, from
the for-profit WebMD.com to the
government-run CDC.gov, are
loaded with tracking elements
that are **sending records of your
health inquiries to the likes of web
giants like Google, Facebook, and
Pinterest, and data brokers like
Experian and Acxiom.**”

We are **your network**.
You **give us** your data.
We **redirect it** to Eve.
We **modify it to help Eve**.

Many of our competitors
rely on **your browser**
to send data to Eve.

“Libert has discovered that the
vast majority of health sites, from
the for-profit WebMD.com to the
government-run CDC.gov, are
loaded with tracking elements
that are **sending records of your
health inquiries to the likes of web
giants like Google, Facebook, and
Pinterest, and data brokers like
Experian and Acxiom.**”

We are **your network**.
You **give us** your data.
We **redirect it** to Eve.
We **modify it to help Eve**.

Many of our competitors
rely on **your browser**
to send data to Eve.

“Libert has discovered that the
vast majority of health sites, from
the for-profit WebMD.com to the
government-run CDC.gov, are
loaded with tracking elements
that are **sending records of your
health inquiries to the likes of web
giants like Google, Facebook, and
Pinterest, and data brokers like
Experian and Acxiom.**”

We are **your network**.
You **give us** your data.
We **redirect it** to Eve.
We **modify it to help Eve**.

“In an effort to better serve
advertisers, Verizon Wireless has
been **silently modifying its users’
web traffic on its network to
inject a cookie-like tracker**. This
tracker, included in an HTTP
header called X-UIDH, is sent
to every unencrypted website a
Verizon customer visits from a
mobile device.”

our competitors
your browser
data to Eve.

has discovered that the
majority of health sites, from
for-profit WebMD.com to the
government-run CDC.gov, are
filled with tracking elements
that are sending records of your
inquiries to the likes of web
companies like Google, Facebook, and
Twitter, and data brokers like
Experian and Acxiom.”

We are **your network**.
You **give us** your data.
We **redirect it** to Eve.
We **modify it to help Eve**.

“In an effort to better serve
advertisers, Verizon Wireless has
been **silently modifying its users’
web traffic on its network to
inject a cookie-like tracker**. This
tracker, included in an HTTP
header called X-UIDH, is sent
to every unencrypted website a
Verizon customer visits from a
mobile device.”

“Verizon
marketing
Experian
and Ora
anonymo
the Prec
third-par

competitors
user
ve.

ered that the
health sites, from
MD.com to the
DC.gov, are
ng elements
records of your
the likes of web
Facebook, and
a brokers like
om.”

We are **your network**.
You **give us** your data.
We **redirect it** to Eve.
We **modify it to help Eve**.

“In an effort to better serve
advertisers, Verizon Wireless has
been **silently modifying its users’
web traffic on its network to
inject a cookie-like tracker**. This
tracker, included in an HTTP
header called X-UIDH, is sent
to every unencrypted website a
Verizon customer visits from a
mobile device.”

“Verizon has **partn**
marketing data pro
Experian Marketin
and Oracle’s Blue
anonymous match
the Precision ID id
third-party data.

We are **your network**.

You **give us** your data.

We **redirect it** to Eve.

We **modify it to help Eve**.

“In an effort to better serve advertisers, Verizon Wireless has been **silently modifying its users’ web traffic on its network to inject a cookie-like tracker**. This tracker, included in an HTTP header called X-UIDH, is sent to every unencrypted website a Verizon customer visits from a mobile device.”

“Verizon has **partnerships with marketing data providers like Experian Marketing Services and Oracle’s BlueKai** to enable anonymous matches between the Precision ID identifier and third-party data.

We are **your network**.
You **give us** your data.
We **redirect it** to Eve.
We **modify it to help Eve**.

“In an effort to better serve advertisers, Verizon Wireless has been **silently modifying its users’ web traffic on its network to inject a cookie-like tracker**. This tracker, included in an HTTP header called X-UIDH, is sent to every unencrypted website a Verizon customer visits from a mobile device.”

“Verizon has **partnerships with marketing data providers like Experian Marketing Services and Oracle’s BlueKai** to enable anonymous matches between the Precision ID identifier and third-party data.

We are **your network**.
You **give us** your data.
We **redirect it** to Eve.
We **modify it to help Eve**.

“In an effort to better serve advertisers, Verizon Wireless has been **silently modifying its users’ web traffic on its network to inject a cookie-like tracker**. This tracker, included in an HTTP header called X-UIDH, is sent to every unencrypted website a Verizon customer visits from a mobile device.”

“Verizon has **partnerships with marketing data providers like Experian Marketing Services and Oracle’s BlueKai** to enable anonymous matches between the Precision ID identifier and third-party data. Although there’s deterministic linkage back to the hashed ID, Verizon’s data partners are not able to collect or save the data profiles.”

We are **your network**.
You **give us** your data.
We **redirect it** to Eve.
We **modify it to help Eve**.

“In an effort to better serve advertisers, Verizon Wireless has been **silently modifying its users’ web traffic on its network to inject a cookie-like tracker**. This tracker, included in an HTTP header called X-UIDH, is sent to every unencrypted website a Verizon customer visits from a mobile device.”

“Verizon has **partnerships with marketing data providers like Experian Marketing Services and Oracle’s BlueKai** to enable anonymous matches between the Precision ID identifier and third-party data. Although there’s deterministic linkage back to the hashed ID, Verizon’s data partners are not able to collect or save the data profiles.” . . . “Rather than a universal ID, I think there will probably be **really rich algorithms that can tie multiple IDs together into a rationalized campaign**.”

your network.
Give us your data.
Direct it to Eve.
Identify it to help Eve.

In an effort to better serve its customers, Verizon Wireless has recently modifying its users' traffic on its network to include a cookie-like tracker. This is included in an HTTP header called X-UIDH, is sent to an unencrypted website a customer visits from a mobile device."

"Verizon has partnerships with marketing data providers like Experian Marketing Services and Oracle's BlueKai to enable anonymous matches between the Precision ID identifier and third-party data. Although there's no deterministic linkage back to the hashed ID, Verizon's data partners are not able to collect or save the data profiles." . . . "Rather than a universal ID, I think there will probably be really rich algorithms that can tie multiple IDs together into a rationalized campaign."

Political

"A Congressional report on the multi-billion dollar brokerage industry that collects personal data for marketing is intensifying the debate over privacy and data security."

work.
data.
Eve.
help Eve.
better serve
n Wireless has
fying its users'
network to
e tracker. This
n an HTTP
IDH, is sent
ted website a
visits from a

“Verizon has **partnerships with marketing data providers like Experian Marketing Services and Oracle’s BlueKai** to enable anonymous matches between the Precision ID identifier and third-party data. Although there’s deterministic linkage back to the hashed ID, Verizon’s data partners are not able to collect or save the data profiles.” . . . “Rather than a universal ID, I think there will probably be **really rich algorithms that can tie multiple IDs together into a rationalized campaign.**”

Political backlash?

“**A Congressional** the multibillion-dollar brokerage industry that collect, analyze personal details about for marketing purposes intensifying.”

“Verizon has **partnerships with marketing data providers like Experian Marketing Services and Oracle’s BlueKai** to enable anonymous matches between the Precision ID identifier and third-party data. Although there’s deterministic linkage back to the hashed ID, Verizon’s data partners are not able to collect or save the data profiles.” . . . “Rather than a universal ID, I think there will probably be **really rich algorithms that can tie multiple IDs together into a rationalized campaign.**”

Political backlash?

“**A Congressional probe** into the multibillion-dollar data brokerage industry—companies that collect, analyze, sell or share personal details about consumers for marketing purposes—is intensifying.”

“Verizon has partnerships with marketing data providers like Experian Marketing Services and Oracle’s BlueKai to enable anonymous matches between the Precision ID identifier and third-party data. Although there’s deterministic linkage back to the hashed ID, Verizon’s data partners are not able to collect or save the data profiles.” . . . “Rather than a universal ID, I think there will probably be really rich algorithms that can tie multiple IDs together into a rationalized campaign.”

Political backlash?

“A Congressional probe into the multibillion-dollar data brokerage industry—companies that collect, analyze, sell or share personal details about consumers for marketing purposes—is intensifying.”

“Verizon has **partnerships with marketing data providers like Experian Marketing Services and Oracle’s BlueKai** to enable anonymous matches between the Precision ID identifier and third-party data. Although there’s deterministic linkage back to the hashed ID, Verizon’s data partners are not able to collect or save the data profiles.” . . . “Rather than a universal ID, I think there will probably be **really rich algorithms that can tie multiple IDs together into a rationalized campaign.**”

Political backlash?

“**A Congressional probe** into the multibillion-dollar data brokerage industry—companies that collect, analyze, sell or share personal details about consumers for marketing purposes—is intensifying.”

“Experian, the massive data-broker with far-reaching influence over your ability to get a mortgage, credit-card, or job, sold extensive consumer records to an **identity thieves’ service.**”

has **partnerships with**
ing data providers like
Marketing Services
le's BlueKai to enable
ous matches between
ision ID identifier and
erty data. Although there's
histic linkage back to the
D, Verizon's data partners
able to collect or save the
files." . . . "Rather than
sal ID, I think there will
be **really rich algorithms**
tie multiple IDs together
ationalized campaign."

Political backlash?

"**A Congressional probe** into
the multibillion-dollar data
brokerage industry—companies
that collect, analyze, sell or share
personal details about consumers
for marketing purposes—is
intensifying."

"Experian, the massive data-
broker with far-reaching influence
over your ability to get a
mortgage, credit-card, or job, sold
extensive consumer records to an
identity thieves' service."

Solution
No need

partnerships with
providers like
g Services
Kai to enable
es between
dentifier and
Although there's
ge back to the
n's data partners
lect or save the
"Rather than
hink there will
rich algorithms
le IDs together
campaign."

Political backlash?

"A Congressional probe into the multibillion-dollar data brokerage industry—companies that collect, analyze, sell or share personal details about consumers for marketing purposes—is intensifying."

"Experian, the massive data-broker with far-reaching influence over your ability to get a mortgage, credit-card, or job, sold extensive consumer records to an identity thieves' service."

Solution: **Talk ab**
No need to **protec**

Political backlash?

“A Congressional probe into the multibillion-dollar data brokerage industry—companies that collect, analyze, sell or share personal details about consumers for marketing purposes—is intensifying.”

“Experian, the massive data-broker with far-reaching influence over your ability to get a mortgage, credit-card, or job, sold extensive consumer records to an identity thieves’ service.”

Solution: **Talk about** privacy.
No need to **protect** privacy.

Political backlash?

“A Congressional probe into the multibillion-dollar data brokerage industry—companies that collect, analyze, sell or share personal details about consumers for marketing purposes—is intensifying.”

“Experian, the massive data-broker with far-reaching influence over your ability to get a mortgage, credit-card, or job, sold extensive consumer records to an identity thieves’ service.”

Solution: **Talk about** privacy.

No need to **protect** privacy.

Political backlash?

“A Congressional probe into the multibillion-dollar data brokerage industry—companies that collect, analyze, sell or share personal details about consumers for marketing purposes—is intensifying.”

“Experian, the massive data-broker with far-reaching influence over your ability to get a mortgage, credit-card, or job, sold extensive consumer records to an identity thieves’ service.”

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is not using or selling its first-party subscriber data, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

Political backlash?

“A Congressional probe into the multibillion-dollar data brokerage industry—companies that collect, analyze, sell or share personal details about consumers for marketing purposes—is intensifying.”

“Experian, the massive data-broker with far-reaching influence over your ability to get a mortgage, credit-card, or job, sold extensive consumer records to an identity thieves’ service.”

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is not using or selling its first-party subscriber data, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

“We will never sacrifice our core business and our commitment to privacy because there’s an additional dollar to be made by pumping data out into the ecosystem.”

backlash?

gressional probe into
trillion-dollar data
ge industry—companies
ect, analyze, sell or share
details about consumers
keting purposes—is
ing.”

an, the massive data-
with far-reaching influence
r ability to get a
e, credit-card, or job, sold
e consumer records to an
thieves’ service.”

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is **not using or selling its first-party subscriber data**, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

“We will never sacrifice our core business and our **commitment to privacy** because there’s an additional dollar to be made by pumping data out into the ecosystem.”

Technical

Increasing

Crypto.

probe into
ollar data
—companies
ze, sell or share
out consumers
poses—is

ssive data-
aching influence
o get a
ard, or job, sold
er records to an
ervice.”

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is **not using or selling its first-party subscriber data**, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

“We will never sacrifice our core business and our **commitment to privacy** because there’s an additional dollar to be made by pumping data out into the ecosystem.”

Technical backlash

Increasing problem
Crypto.

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is **not using or selling its first-party subscriber data**, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

“We will never sacrifice our core business and our **commitment to privacy** because there’s an additional dollar to be made by pumping data out into the ecosystem.”

Technical backlash?

Increasing problem for us:
Crypto.

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is **not using or selling its first-party subscriber data**, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

“We will never sacrifice our core business and our **commitment to privacy** because there’s an additional dollar to be made by pumping data out into the ecosystem.”

Technical backlash?

Increasing problem for us:
Crypto.

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is **not using or selling its first-party subscriber data**, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

“We will never sacrifice our core business and our **commitment to privacy** because there’s an additional dollar to be made by pumping data out into the ecosystem.”

Technical backlash?

Increasing problem for us:

Crypto. This “**breaks network management, content distribution and network services**”; creates “congestion” and “latency”;

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is **not using or selling its first-party subscriber data**, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

“We will never sacrifice our core business and our **commitment to privacy** because there’s an additional dollar to be made by pumping data out into the ecosystem.”

Technical backlash?

Increasing problem for us:

Crypto. This “**breaks network management, content distribution and network services**”; creates “congestion” and “latency”; “limits the ability of network providers to protect customers from web attacks”;

Solution: **Talk about** privacy.

No need to **protect** privacy.

“Verizon said it is **not using or selling its first-party subscriber data**, but rather deploying partnerships with third-party data providers to target Verizon’s massive consumer base.”

“We will never sacrifice our core business and our **commitment to privacy** because there’s an additional dollar to be made by pumping data out into the ecosystem.”

Technical backlash?

Increasing problem for us:

Crypto. This “**breaks network management, content distribution and network services**”; creates “congestion” and “latency”; “limits the ability of network providers to protect customers from web attacks”; breaks “UIDH (unique client identifier) insertion” and “data collection for analytics”; breaks “value-add services that are based on access to header and payload content from individual sessions”; etc.

: **Talk about** privacy.

to **protect** privacy.

n said it is **not using** or

s **first-party** subscriber

t rather deploying

ships with third-party

viders to target Verizon's

consumer base."

I never sacrifice our core

and our **commitment**

cy because there's an

al dollar to be made

ping data out into the

m."

Technical backlash?

Increasing problem for us:

Crypto. This "**breaks network management, content distribution and network services**"; creates

"congestion" and "latency";

"limits the ability of network

providers to protect customers

from web attacks"; breaks

"UIDH (unique client identifier)

insertion" and "data collection

for analytics"; breaks "value-add

services that are based on access

to header and payload content

from individual sessions"; etc.

Best case

No crypto

out privacy.

ct privacy.

not using or

ty subscriber

employing

third-party

target Verizon's

base."

sacrifice our core

commitment

e there's an

o be made

out into the

Technical backlash?

Increasing problem for us:

Crypto. This “breaks network management, content distribution and network services”; creates “congestion” and “latency”; “limits the ability of network providers to protect customers from web attacks”; breaks “UIDH (unique client identifier) insertion” and “data collection for analytics”; breaks “value-add services that are based on access to header and payload content from individual sessions”; etc.

Best case for us:

No crypto. **Lobby**

Technical backlash?

Increasing problem for us:

Crypto. This “breaks network management, content distribution and network services”; creates “congestion” and “latency”; “limits the ability of network providers to protect customers from web attacks”; breaks “UIDH (unique client identifier) insertion” and “data collection for analytics”; breaks “value-add services that are based on access to header and payload content from individual sessions”; etc.

Best case for us:

No crypto. Lobby for this!

Technical backlash?

Increasing problem for us:

Crypto. This “breaks network management, content distribution and network services”; creates “congestion” and “latency”; “limits the ability of network providers to protect customers from web attacks”; breaks “UIDH (unique client identifier) insertion” and “data collection for analytics”; breaks “value-add services that are based on access to header and payload content from individual sessions”; etc.

Best case for us:

No crypto. Lobby for this!

Technical backlash?

Increasing problem for us:

Crypto. This “breaks network management, content distribution and network services”; creates “congestion” and “latency”; “limits the ability of network providers to protect customers from web attacks”; breaks “UIDH (unique client identifier) insertion” and “data collection for analytics”; breaks “value-add services that are based on access to header and payload content from individual sessions”; etc.

Best case for us:

No crypto. Lobby for this!

Almost as good for us:

“Opportunistic encryption” without authentication.

“Stops passive eavesdropping” but **we aren’t passive.**

Technical backlash?

Increasing problem for us:

Crypto. This “breaks network management, content distribution and network services”; creates “congestion” and “latency”; “limits the ability of network providers to protect customers from web attacks”; breaks “UIDH (unique client identifier) insertion” and “data collection for analytics”; breaks “value-add services that are based on access to header and payload content from individual sessions”; etc.

Best case for us:

No crypto. Lobby for this!

Almost as good for us:

“Opportunistic encryption” without authentication.

“Stops passive eavesdropping” but **we aren’t passive.**

Almost as good for us:

Signatures on some data.

We can still see everything.

Can also censor quite selectively.

Can’t modify signed data but can track in many other ways.

al backlash?

ng problem for us:

This “breaks network
ment, content distribution
work services”; creates
tion” and “latency”;
he ability of network
s to protect customers
b attacks”; breaks
(unique client identifier)
” and “data collection
ytics”; breaks “value-add
that are based on access
er and payload content
individual sessions”; etc.

Best case for us:

No crypto. Lobby for this!

Almost as good for us:

“Opportunistic encryption”
without authentication.

“Stops passive eavesdropping”
but **we aren’t passive**.

Almost as good for us:

Signatures on some data.

We can still see everything.

Can also censor quite selectively.

Can’t modify signed data but
can track in many other ways.

More tro

authenti

But we s

adequate

n?

n for us:

breaks network

content distribution

ices"; creates

"latency";

of network

ct customers

; breaks

ent identifier)

ata collection

aks "value-add

ased on access

load content

ssions"; etc.

Best case for us:

No crypto. [Lobby for this!](#)

Almost as good for us:

["Opportunistic encryption"](#)

without authentication.

"Stops passive eavesdropping"

but **we aren't passive**.

Almost as good for us:

[Signatures on some data.](#)

We can still see everything.

Can also censor quite selectively.

Can't modify signed data but

can track in many other ways.

More troublesome

authenticated encr

But we still see m

adequate for most

Best case for us:

No crypto. [Lobby for this!](#)

Almost as good for us:

[“Opportunistic encryption”](#)

without authentication.

“Stops passive eavesdropping”

but **we aren’t passive.**

Almost as good for us:

[Signatures on some data.](#)

We can still see everything.

Can also censor quite selectively.

Can’t modify signed data but

can track in many other ways.

More troublesome: End-to-end
authenticated encryption.

But we still see metadata—
adequate for most surveillance

Best case for us:

No crypto. [Lobby for this!](#)

Almost as good for us:

[“Opportunistic encryption”](#)

without authentication.

“Stops passive eavesdropping”
but **we aren’t passive.**

Almost as good for us:

[Signatures on some data.](#)

We can still see everything.

Can also censor quite selectively.

Can’t modify signed data but
can track in many other ways.

More troublesome: End-to-end
authenticated encryption.

But we still see metadata—
adequate for most surveillance.

Best case for us:

No crypto. [Lobby for this!](#)

Almost as good for us:

[“Opportunistic encryption”](#)

without authentication.

“Stops passive eavesdropping”
but **we aren’t passive**.

Almost as good for us:

[Signatures on some data.](#)

We can still see everything.

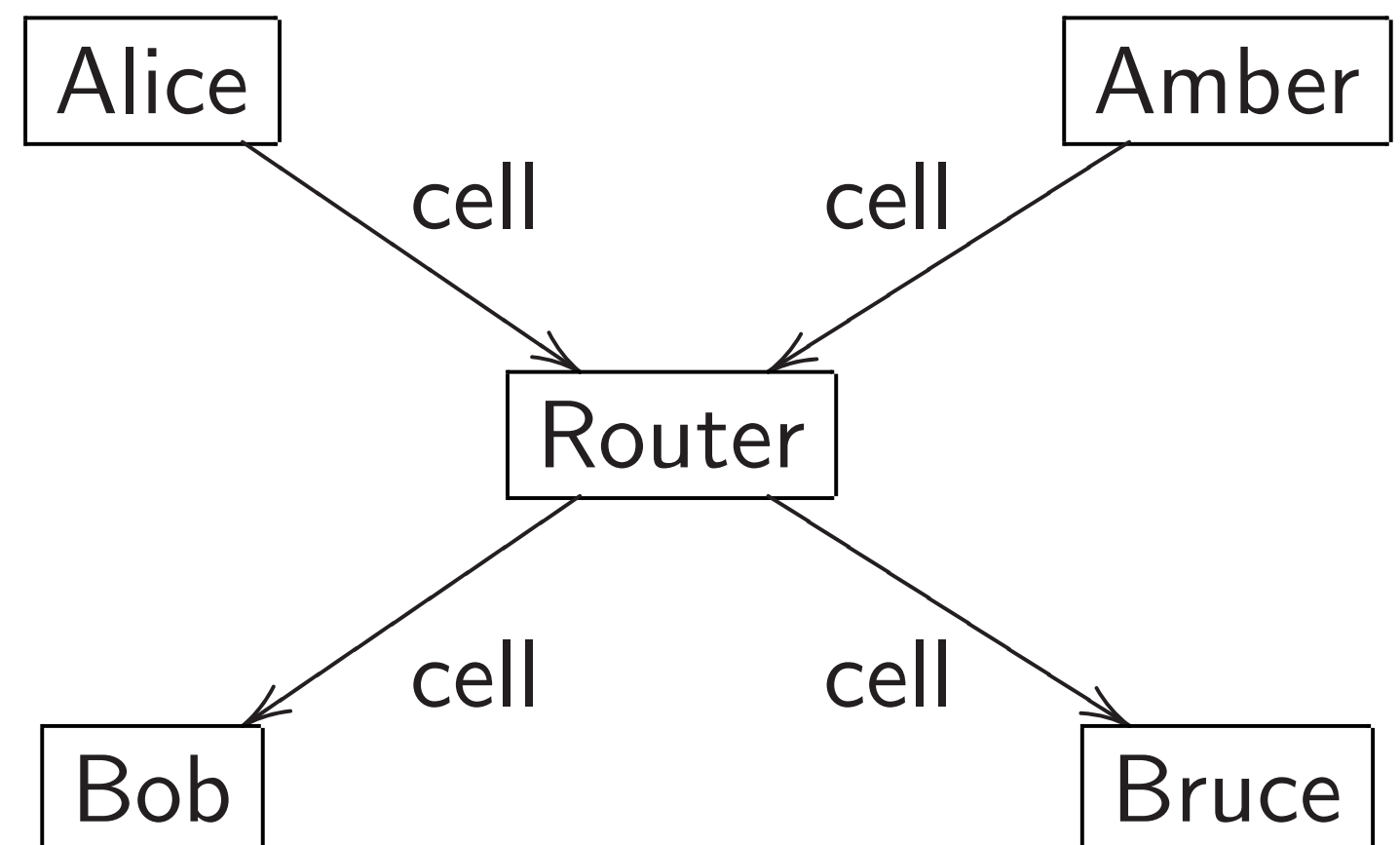
Can also censor quite selectively.

Can’t modify signed data but
can track in many other ways.

More troublesome: End-to-end
authenticated encryption.

But we still see metadata—
adequate for most surveillance.

Nightmare scenario: Scrambling
unidentifiable encrypted cells—
[Tor](#) has multiple layers of this:



is good for us:

to. Lobby for this!

is good for us:

"unistic encryption"

authentication.

"passive eavesdropping"

aren't passive.

is good for us:

res on some data.

still see everything.

o censor quite selectively.

odify signed data but

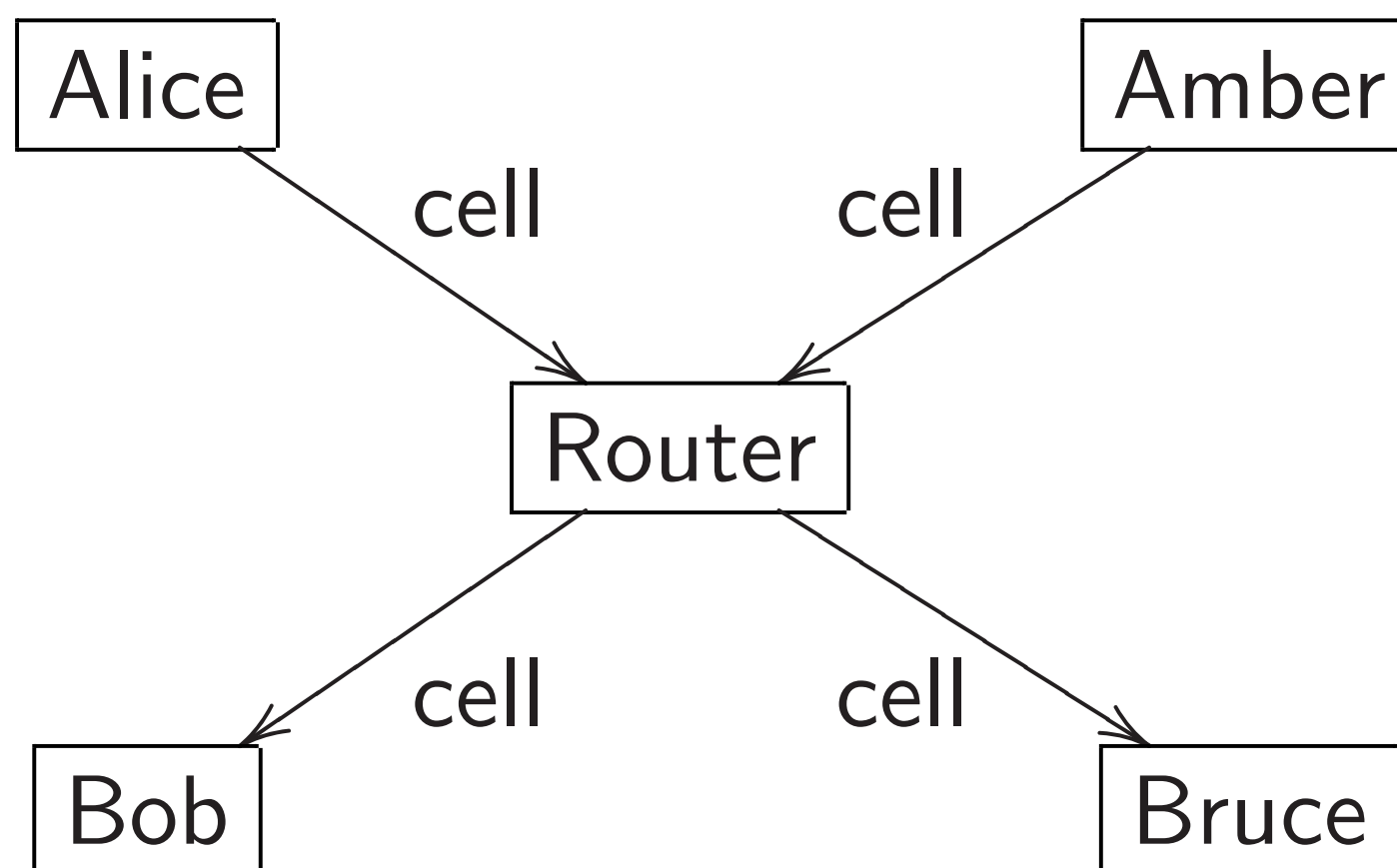
k in many other ways.

More troublesome: End-to-end
authenticated encryption.

But we still see metadata—
adequate for most surveillance.

Nightmare scenario: Scrambling
unidentifiable encrypted cells—

Tor has multiple layers of this:



Can we

for this!

or us:

“encryption”

ation.

vesdropping”

ssive.

or us:

the data.

everything.

quite selectively.

ed data but

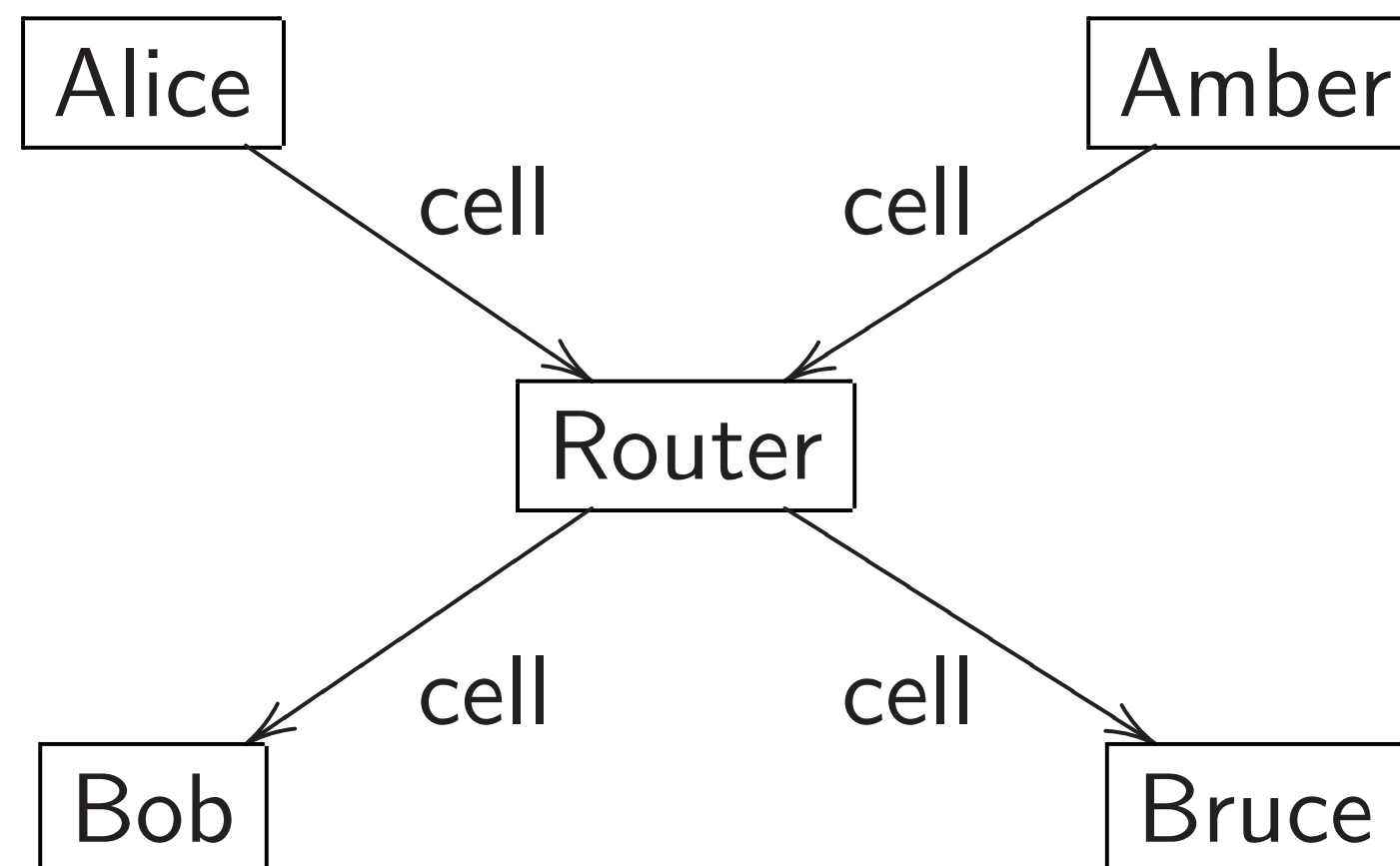
other ways.

More troublesome: End-to-end
authenticated encryption.

But we still see metadata—
adequate for most surveillance.

Nightmare scenario: Scrambling
unidentifiable encrypted cells—

[Tor](#) has multiple layers of this:



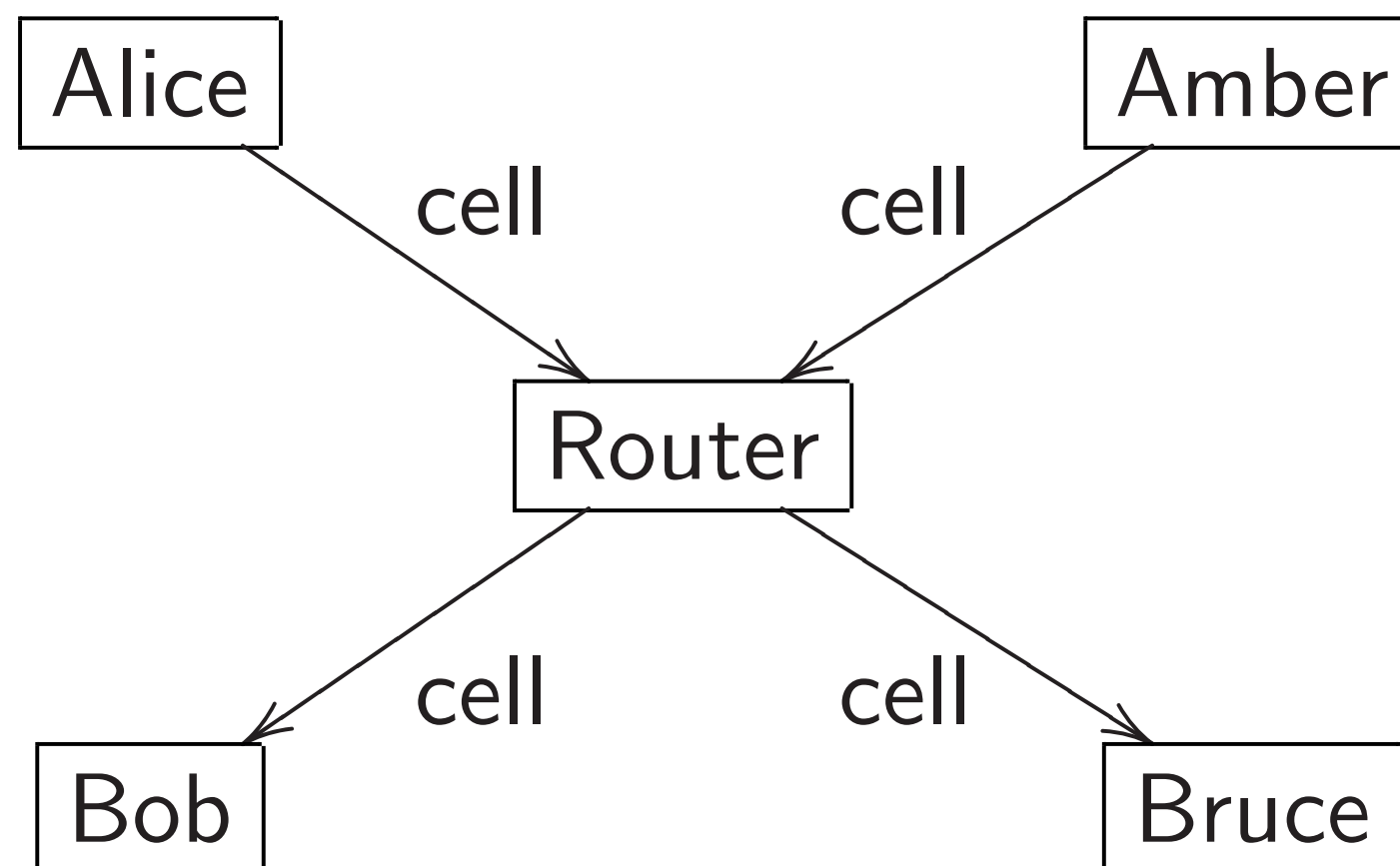
Can we [ban crypto](#)

More troublesome: End-to-end authenticated encryption.

But we still see metadata—adequate for most surveillance.

Nightmare scenario: Scrambling unidentifiable encrypted cells—

[Tor](#) has multiple layers of this:



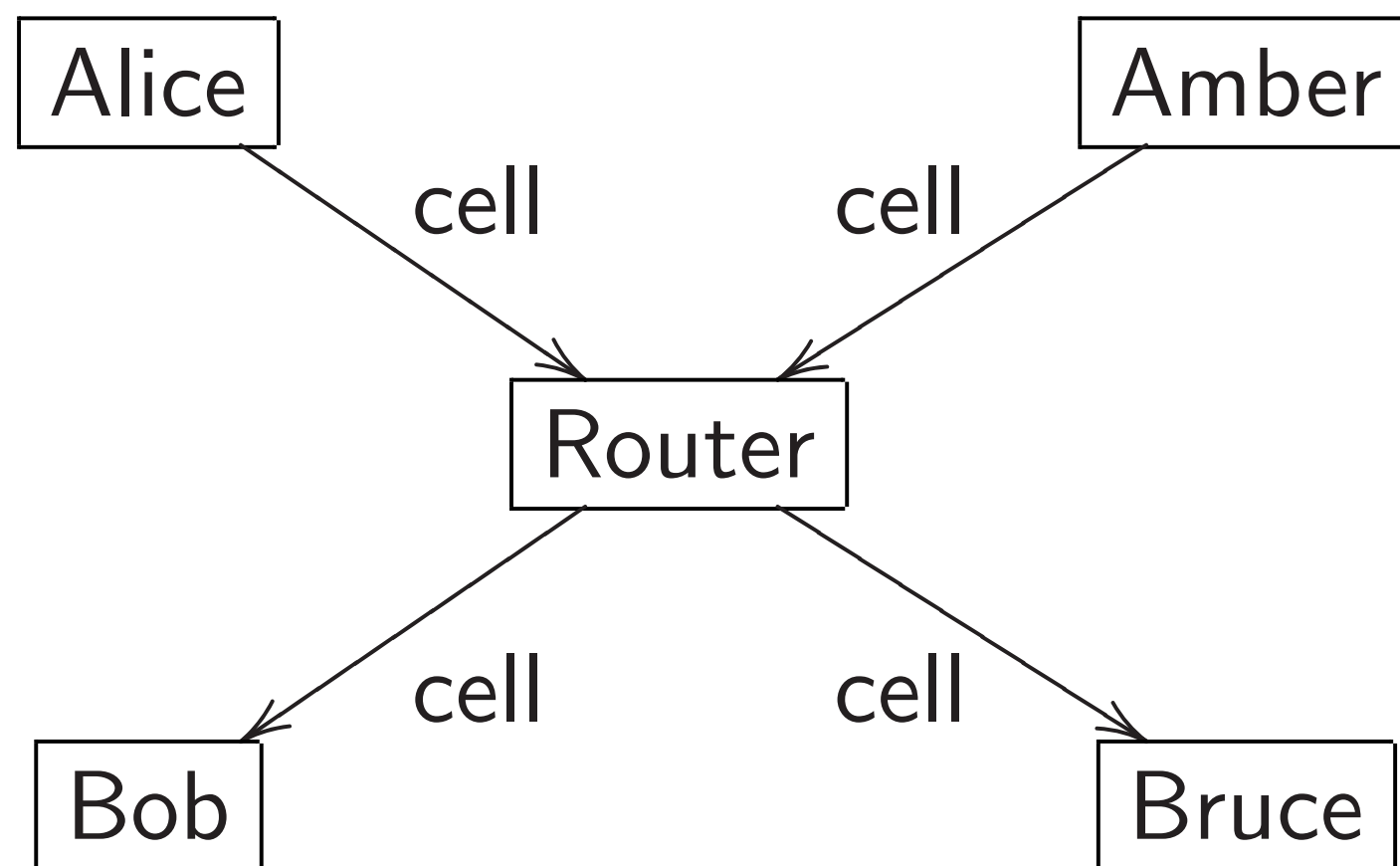
Can we [ban crypto](#)?

More troublesome: End-to-end authenticated encryption.

But we still see metadata—adequate for most surveillance.

Nightmare scenario: Scrambling unidentifiable encrypted cells—

Tor has multiple layers of this:



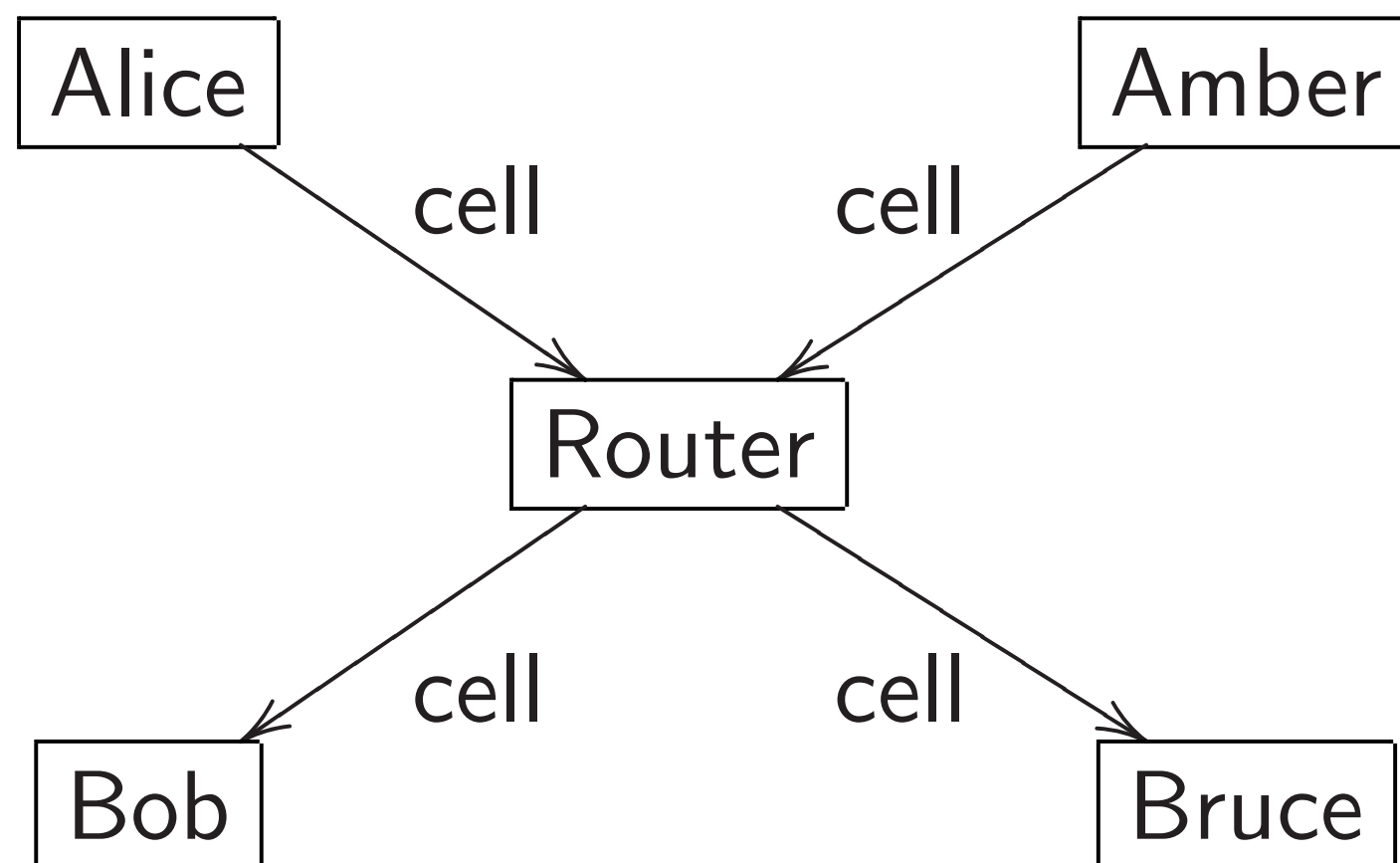
Can we **ban crypto**?

More troublesome: End-to-end authenticated encryption.

But we still see metadata—adequate for most surveillance.

Nightmare scenario: Scrambling unidentifiable encrypted cells—

Tor has multiple layers of this:



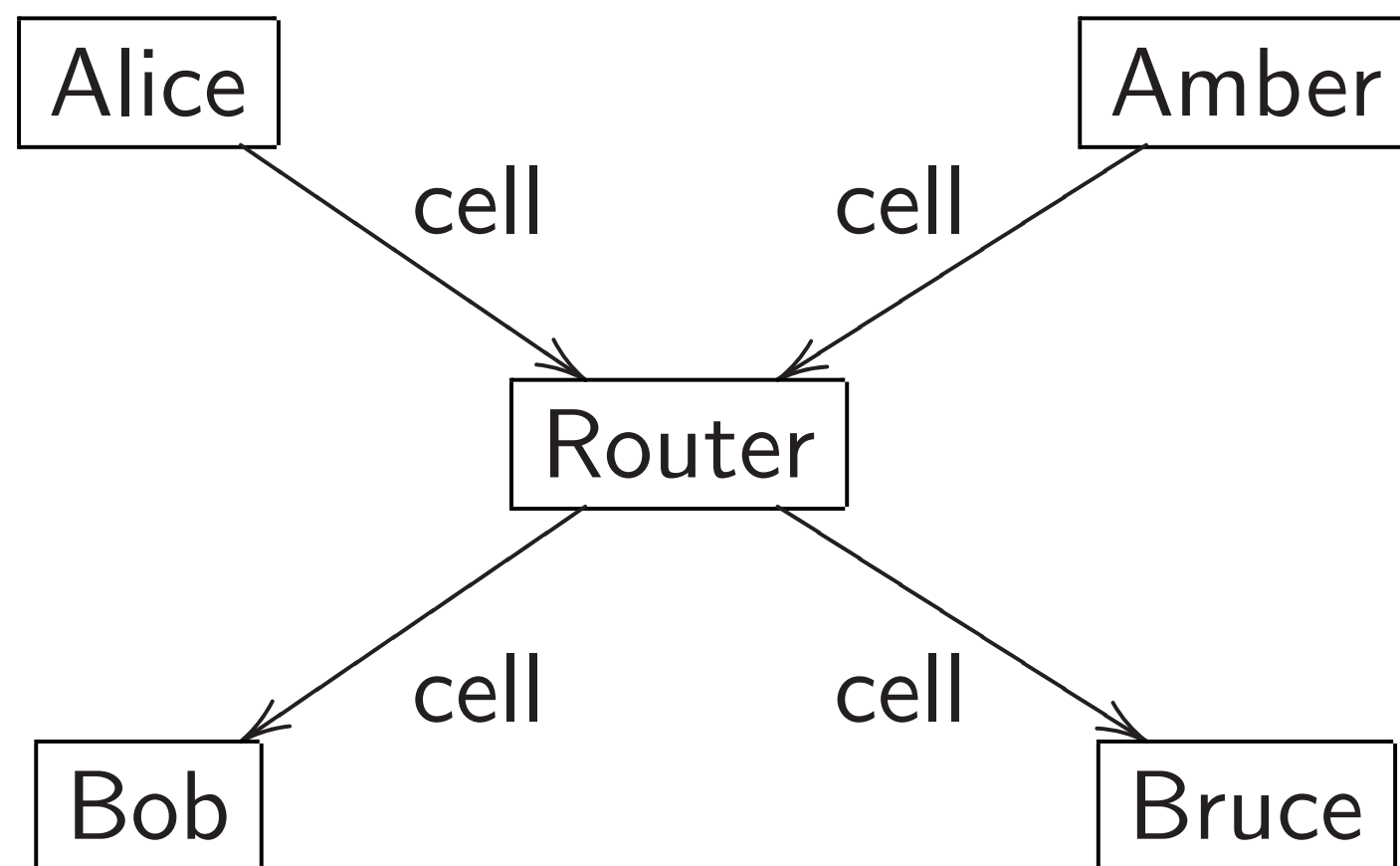
Can we **ban crypto**? If not, can we divert effort into opportunistic encryption, or into pure authentication?

More troublesome: End-to-end authenticated encryption.

But we still see metadata—adequate for most surveillance.

Nightmare scenario: Scrambling unidentifiable encrypted cells—

[Tor](#) has multiple layers of this:



Can we [ban crypto](#)? If not, can we divert effort into opportunistic encryption, or into pure authentication?

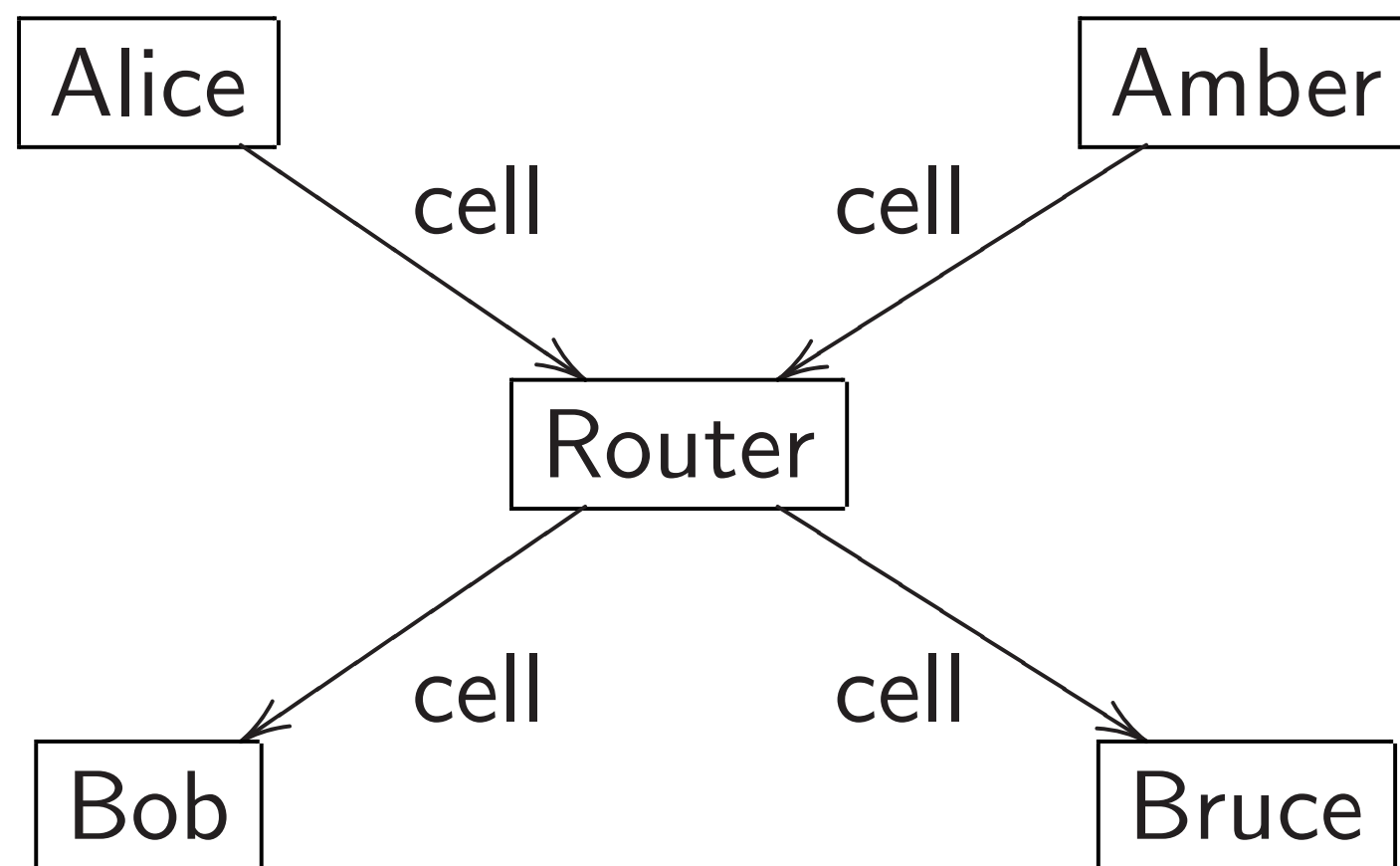
Can we promote standards that expose most data, or that **trust our proxies**?

More troublesome: End-to-end authenticated encryption.

But we still see metadata—adequate for most surveillance.

Nightmare scenario: Scrambling unidentifiable encrypted cells—

[Tor](#) has multiple layers of this:



Can we [ban crypto](#)? If not, can we divert effort into opportunistic encryption, or into pure authentication?

Can we promote standards that expose most data, or that **trust our proxies**?

Very often crypto protocols and implementations have weaknesses.

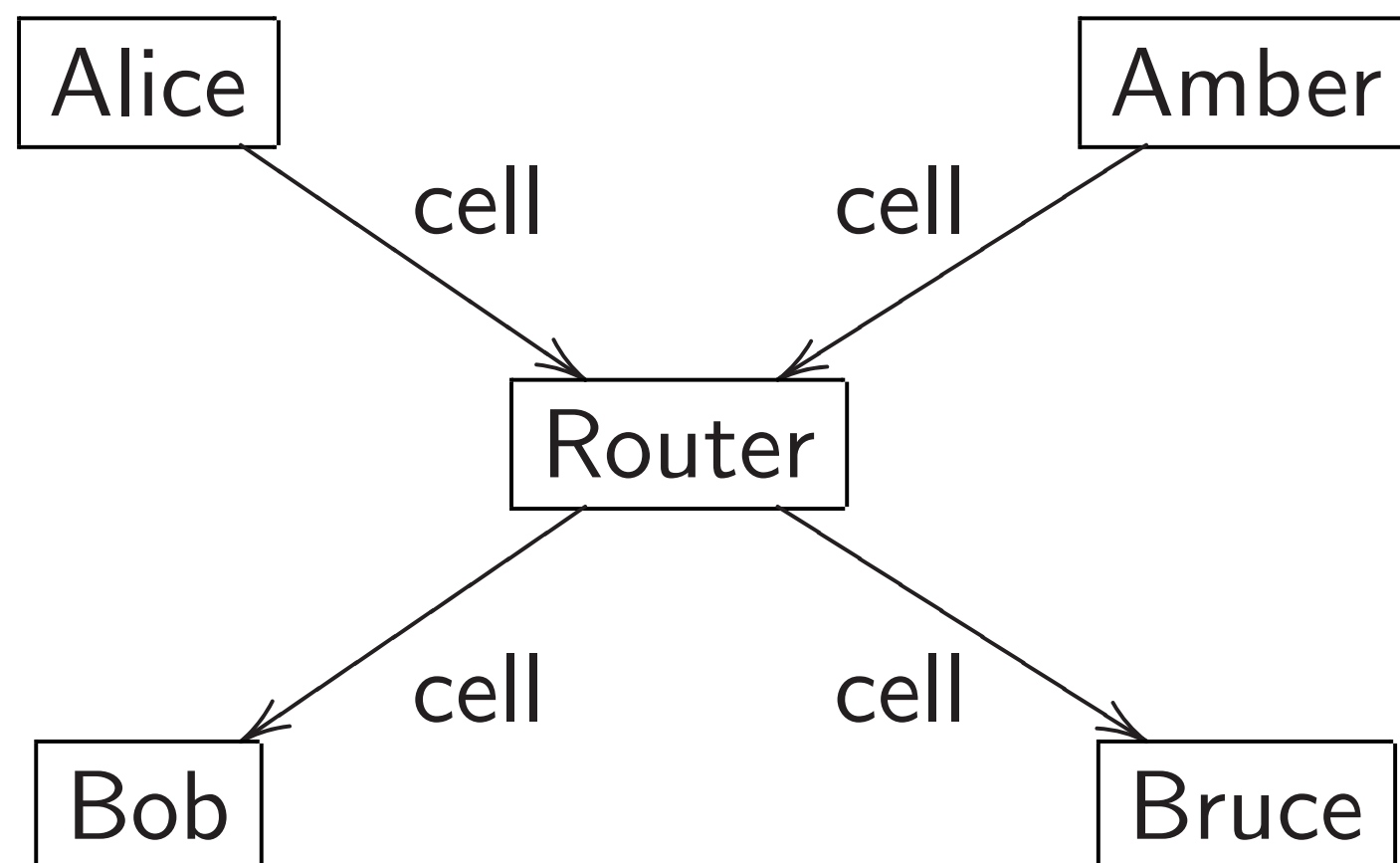
Can we promote weak crypto?

More troublesome: End-to-end authenticated encryption.

But we still see metadata—adequate for most surveillance.

Nightmare scenario: Scrambling unidentifiable encrypted cells—

[Tor](#) has multiple layers of this:



Can we [ban crypto](#)? If not, can we divert effort into opportunistic encryption, or into pure authentication?

Can we promote standards that expose most data, or that **trust our proxies**?

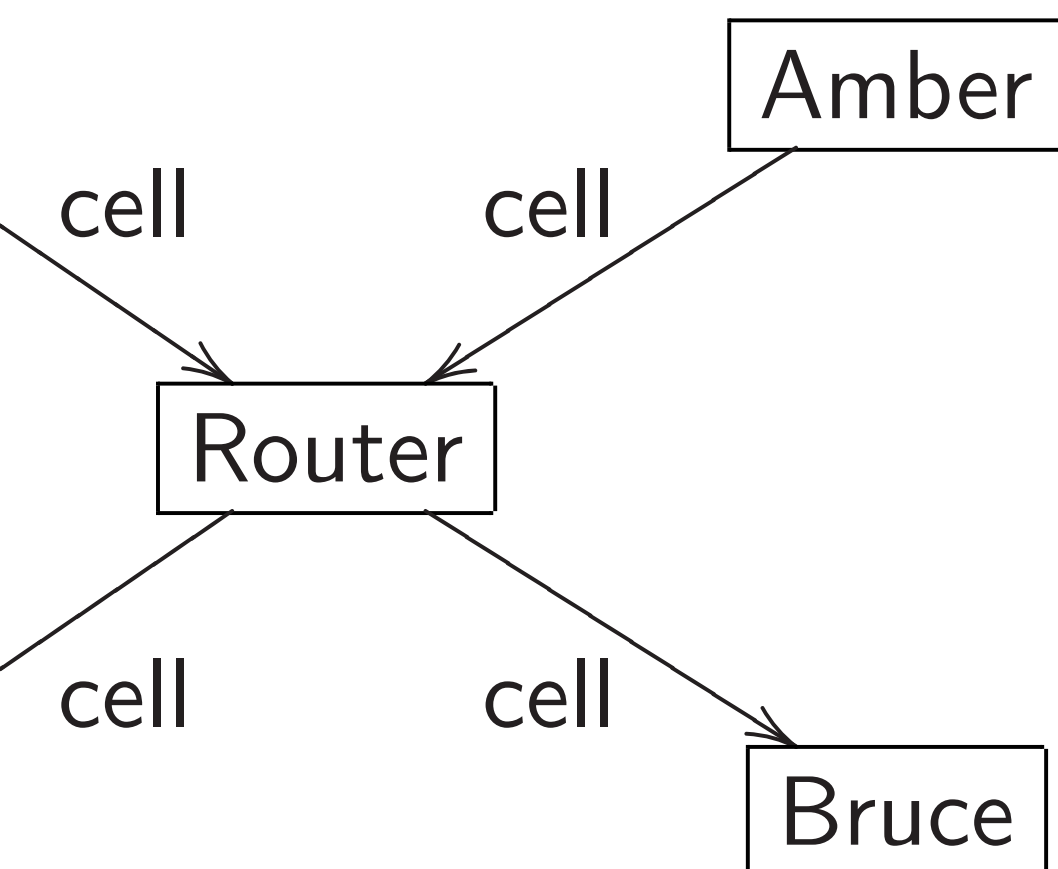
Very often crypto protocols and implementations have weaknesses.

Can we promote weak crypto?

We've started working with experts in crypto sabotage.

oublesome: End-to-end
cated encryption.
still see metadata—
e for most surveillance.

are scenario: Scrambling
fiable encrypted cells—
multiple layers of this:



Can we **ban crypto**? If not,
can we divert effort into
opportunistic encryption,
or into pure authentication?

Can we promote standards
that expose most data, or
that **trust our proxies**?

Very often crypto protocols and
implementations have weaknesses.

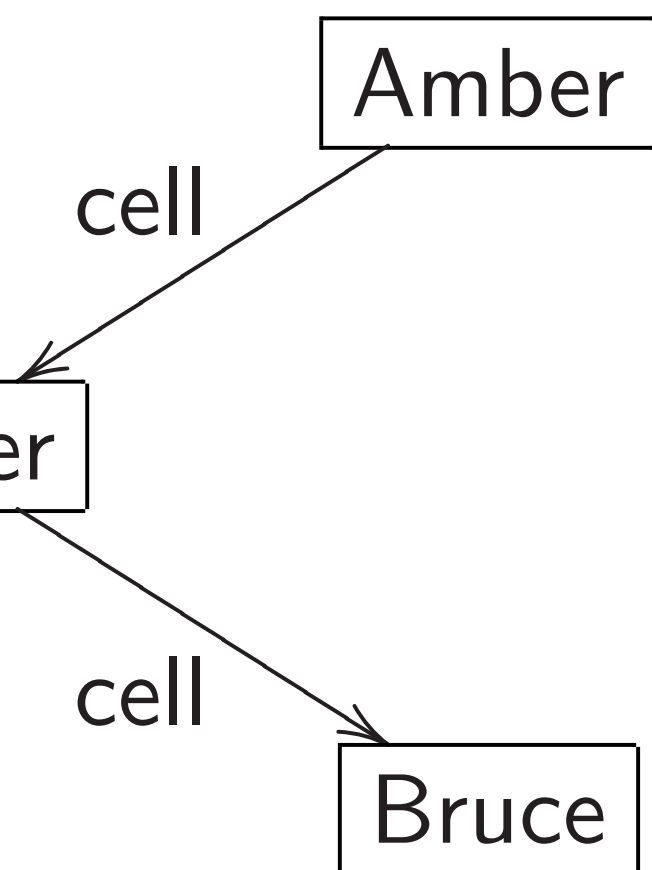
Can we promote weak crypto?

We've started working with
experts in crypto sabotage.

Emphasi
'heart' o
simple a
pseudo-r

: End-to-end
ryption.
etadata—
surveillance.

o: Scrambling
rypted cells—
ayers of this:



Can we **ban crypto**? If not,
can we divert effort into
opportunistic encryption,
or into pure authentication?

Can we promote standards
that expose most data, or
that **trust our proxies**?

Very often crypto protocols and
implementations have weaknesses.

Can we promote weak crypto?

We've started working with
experts in crypto sabotage.

Emphasize perform
'heart' of RC4 is it
simple and extrem
pseudo-random ge

end

ce.

oling

s—

is:

amber

Bruce

Can we **ban crypto**? If not,
can we divert effort into
opportunistic encryption,
or into pure authentication?

Can we promote standards
that expose most data, or
that **trust our proxies**?

Very often crypto protocols and
implementations have weaknesses.

Can we promote weak crypto?

We've started working with
experts in crypto sabotage.

Emphasize performance: “The
‘heart’ of RC4 is its **exceptionally
simple and extremely efficient
pseudo-random generator.**”

Can we **ban crypto**? If not,
can we divert effort into
opportunistic encryption,
or into pure authentication?

Can we promote standards
that expose most data, or
that **trust our proxies**?

Very often crypto protocols and
implementations have weaknesses.

Can we promote weak crypto?

We've started working with
experts in crypto sabotage.

Emphasize performance: “The
‘heart’ of RC4 is its **exceptionally
simple and extremely efficient
pseudo-random generator.**”

Can we **ban crypto**? If not,
can we divert effort into
opportunistic encryption,
or into pure authentication?

Can we promote standards
that expose most data, or
that **trust our proxies**?

Very often crypto protocols and
implementations have weaknesses.

Can we promote weak crypto?

We've started working with
experts in crypto sabotage.

Emphasize performance: “The
‘heart’ of RC4 is its **exceptionally
simple and extremely efficient
pseudo-random generator.**”

Bamboozle people: Dual EC is
“**the only DRBG mechanism in
this Recommendation whose
security is related to a hard
problem** in number theory.”

Can we **ban crypto**? If not,
can we divert effort into
opportunistic encryption,
or into pure authentication?

Can we promote standards
that expose most data, or
that **trust our proxies**?

Very often crypto protocols and
implementations have weaknesses.

Can we promote weak crypto?

We've started working with
experts in crypto sabotage.

Emphasize performance: “The
‘heart’ of RC4 is its **exceptionally
simple and extremely efficient
pseudo-random generator.**”

Bamboozle people: Dual EC is
“**the only DRBG mechanism in
this Recommendation whose
security is related to a hard
problem** in number theory.”

Make crypto protocols
**so complicated that
nobody will get them right.**
Standards committees rarely
fight against complications.

ban crypto? If not,
divert effort into
stochastic encryption,
secure authentication?

promote standards
lose most data, or
st our proxies?

en crypto protocols and
ntations have weaknesses.

promote weak crypto?

tarted working with
in crypto sabotage.

Emphasize performance: “The
‘heart’ of RC4 is its **exceptionally
simple and extremely efficient
pseudo-random generator.**”

Bamboozle people: Dual EC is
“**the only DRBG mechanism in
this Recommendation whose
security is related to a hard
problem** in number theory.”

Make crypto protocols
**so complicated that
nobody will get them right.**
Standards committees rarely
fight against complications.

Sabotage

*How to
manipulate
a white*

Daniel J
Tung Ch
Chitchan
Andreas
Tanja La
Ruben M
Christine

safecur
/bada55

o? If not,
rt into
yption,
ntication?

standards
data, or
oxies?

protocols and
ave weaknesses.

weak crypto?

king with
sabotage.

Emphasize performance: “The
‘heart’ of RC4 is its **exceptionally
simple and extremely efficient
pseudo-random generator.**”

Bamboozle people: Dual EC is
“**the only DRBG mechanism in
this Recommendation whose
security is related to a hard
problem** in number theory.”

Make crypto protocols
**so complicated that
nobody will get them right.**
Standards committees rarely
fight against complications.

Sabotaging crypto

*How to
manipulate curve s
a white paper for*

Daniel J. Bernstein
Tung Chou

Chitchanok Chuen

Andreas Hülsing

Tanja Lange

Ruben Niederhage

Christine van Vrec

[safecurves.cr.y
/bada55.html](https://safecurves.cr.y/bada55.html)

Emphasize performance: “The ‘heart’ of RC4 is its **exceptionally simple and extremely efficient pseudo-random generator.**”

Bamboozle people: Dual EC is “**the only DRBG mechanism in this Recommendation whose security is related to a hard problem** in number theory.”

Make crypto protocols **so complicated that nobody will get them right.**
Standards committees rarely fight against complications.

Sabotaging crypto details

*How to
manipulate curve standards:
a white paper for the black*

Daniel J. Bernstein

Tung Chou

Chitchanok Chuengsatiansup

Andreas Hülsing

Tanja Lange

Ruben Niederhagen

Christine van Vredendaal

[safecurves.cr.yp.to
/bada55.html](https://safecurves.cr.yp.to/bada55.html)

Emphasize performance: “The ‘heart’ of RC4 is its **exceptionally simple and extremely efficient pseudo-random generator.**”

Bamboozle people: Dual EC is “**the only DRBG mechanism in this Recommendation whose security is related to a hard problem** in number theory.”

Make crypto protocols **so complicated that nobody will get them right.**
Standards committees rarely fight against complications.

Sabotaging crypto details

*How to
manipulate curve standards:
a white paper for the black hat*

Daniel J. Bernstein

Tung Chou

Chitchanok Chuengsatiansup

Andreas Hülsing

Tanja Lange

Ruben Niederhagen

Christine van Vredendaal

[safecurves.cr.yp.to
/bada55.html](https://safecurves.cr.yp.to/bada55.html)

ize performance: “The
of RC4 is its **exceptionally**
and extremely efficient
random generator.”

zle people: Dual EC is
y DRBG mechanism in
ommendation whose
is related to a hard
in number theory.”

ypto protocols
licated that

will get them right.

ds committees rarely
ainst complications.

Sabotaging crypto details

*How to
manipulate curve standards:
a white paper for the black hat*

Daniel J. Bernstein

Tung Chou

Chitchanok Chuengsatiansup

Andreas Hülsing

Tanja Lange

Ruben Niederhagen

Christine van Vredendaal

[safecurves.cr.yp.to
/bada55.html](https://safecurves.cr.yp.to/bada55.html)

Textboo
using sta
on a sta



formance: “The
ts exceptionally
ely efficient
enerator.”

e: Dual EC is
mechanism in
tion whose
to a hard
r theory.”

ocols
at

em right.
tees rarely
lications.

Sabotaging crypto details

*How to
manipulate curve standards:
a white paper for the black hat*

Daniel J. Bernstein

Tung Chou

Chitchanok Chuengsatiansup

Andreas Hülsing

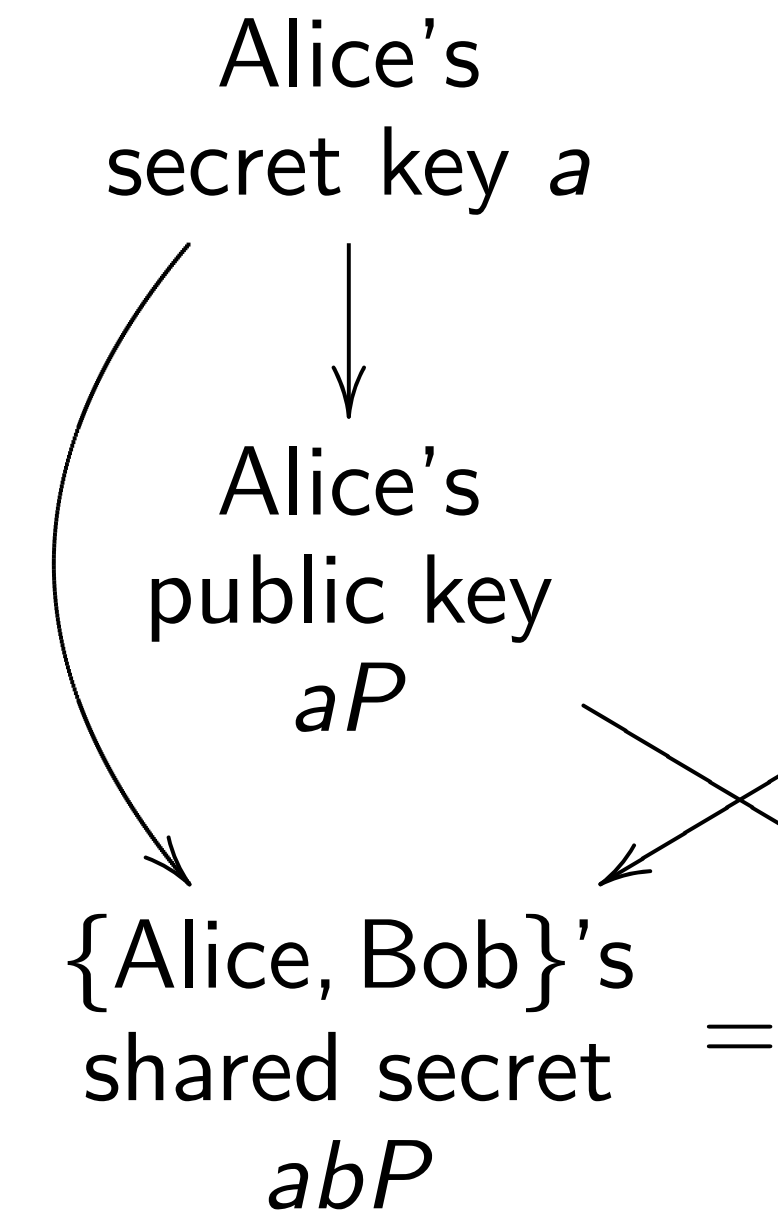
Tanja Lange

Ruben Niederhagen

Christine van Vredendaal

[safecurves.cr.yp.to
/bada55.html](https://safecurves.cr.yp.to/bada55.html)

Textbook key exchange
using standard point multiplication
on a standard elliptic curve



Sabotaging crypto details

*How to
manipulate curve standards:
a white paper for the black hat*

Daniel J. Bernstein

Tung Chou

Chitchanok Chuengsatiansup

Andreas Hülsing

Tanja Lange

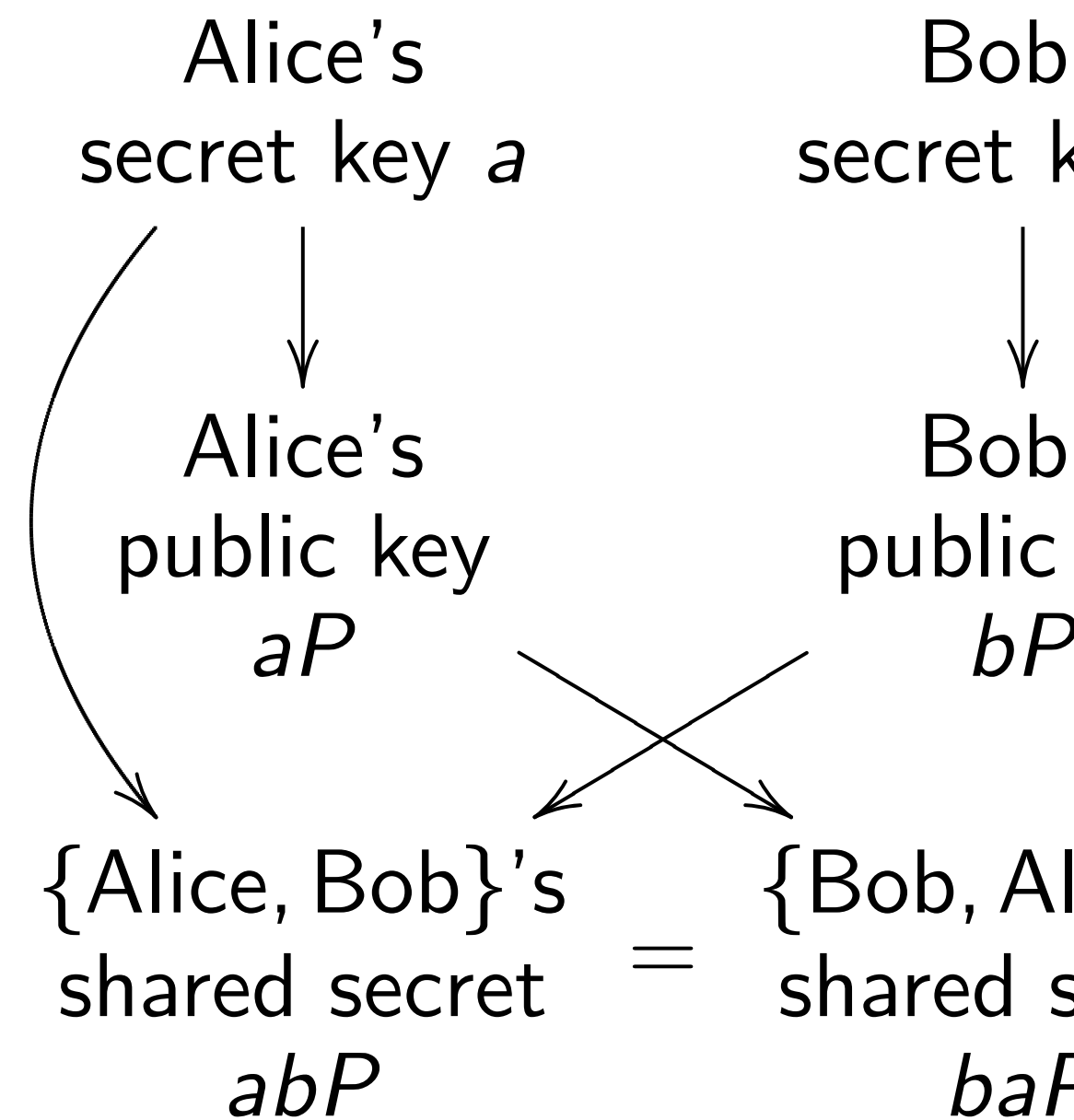
Ruben Niederhagen

Christine van Vredendaal

safecurves.cr.yp.to

[/bada55.html](https://safecurves.cr.yp.to/bada55.html)

Textbook key exchange
using standard point P
on a standard elliptic curve



Sabotaging crypto details

*How to
manipulate curve standards:
a white paper for the black hat*

Daniel J. Bernstein

Tung Chou

Chitchanok Chuengsatiansup

Andreas Hülsing

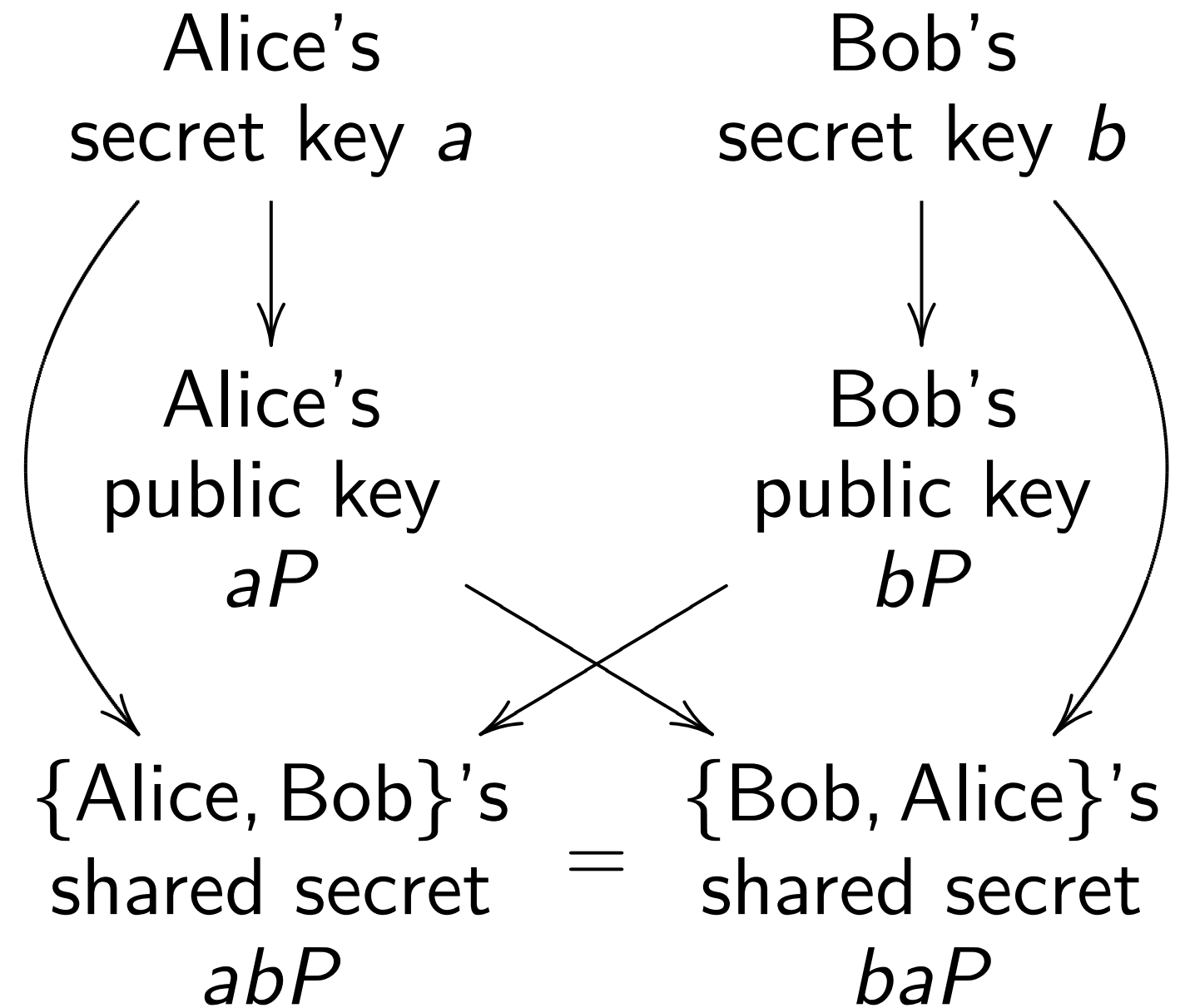
Tanja Lange

Ruben Niederhagen

Christine van Vredendaal

[safecurves.cr.yp.to
/bada55.html](https://safecurves.cr.yp.to/bada55.html)

Textbook key exchange
using standard point P
on a standard elliptic curve E :



Sabotaging crypto details

*How to
manipulate curve standards:
a white paper for the black hat*

Daniel J. Bernstein

Tung Chou

Chitchanok Chuengsatiansup

Andreas Hülsing

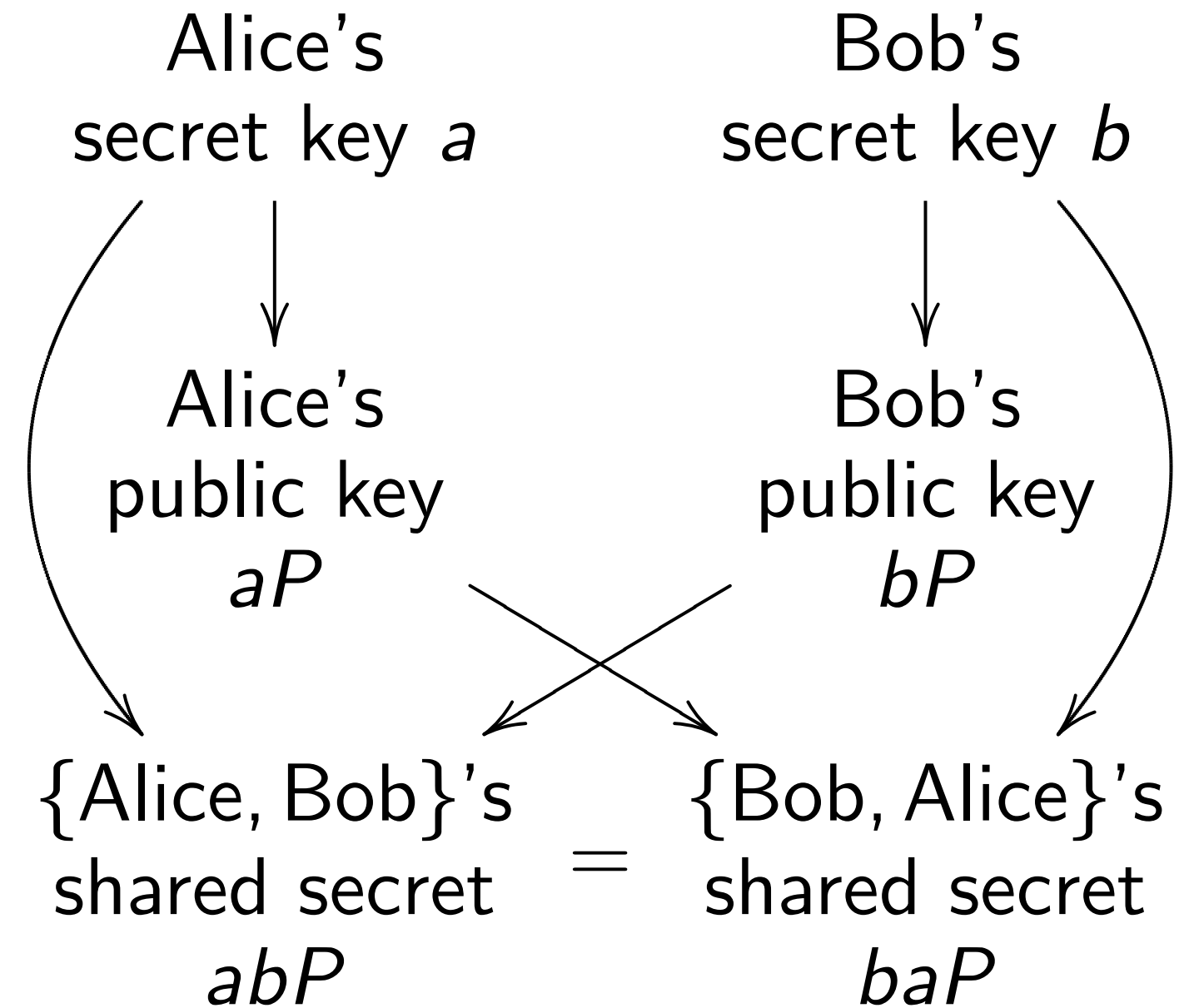
Tanja Lange

Ruben Niederhagen

Christine van Vredendaal

[safecurves.cr.yp.to
/bada55.html](https://safecurves.cr.yp.to/bada55.html)

Textbook key exchange
using standard point P
on a standard elliptic curve E :



Security depends on choice of E .

ing crypto details

ate curve standards:

paper for the black hat

. Bernstein

hou

ok Chuengsatiansup

Hülsing

ange

Niederhagen

e van Vredendaal

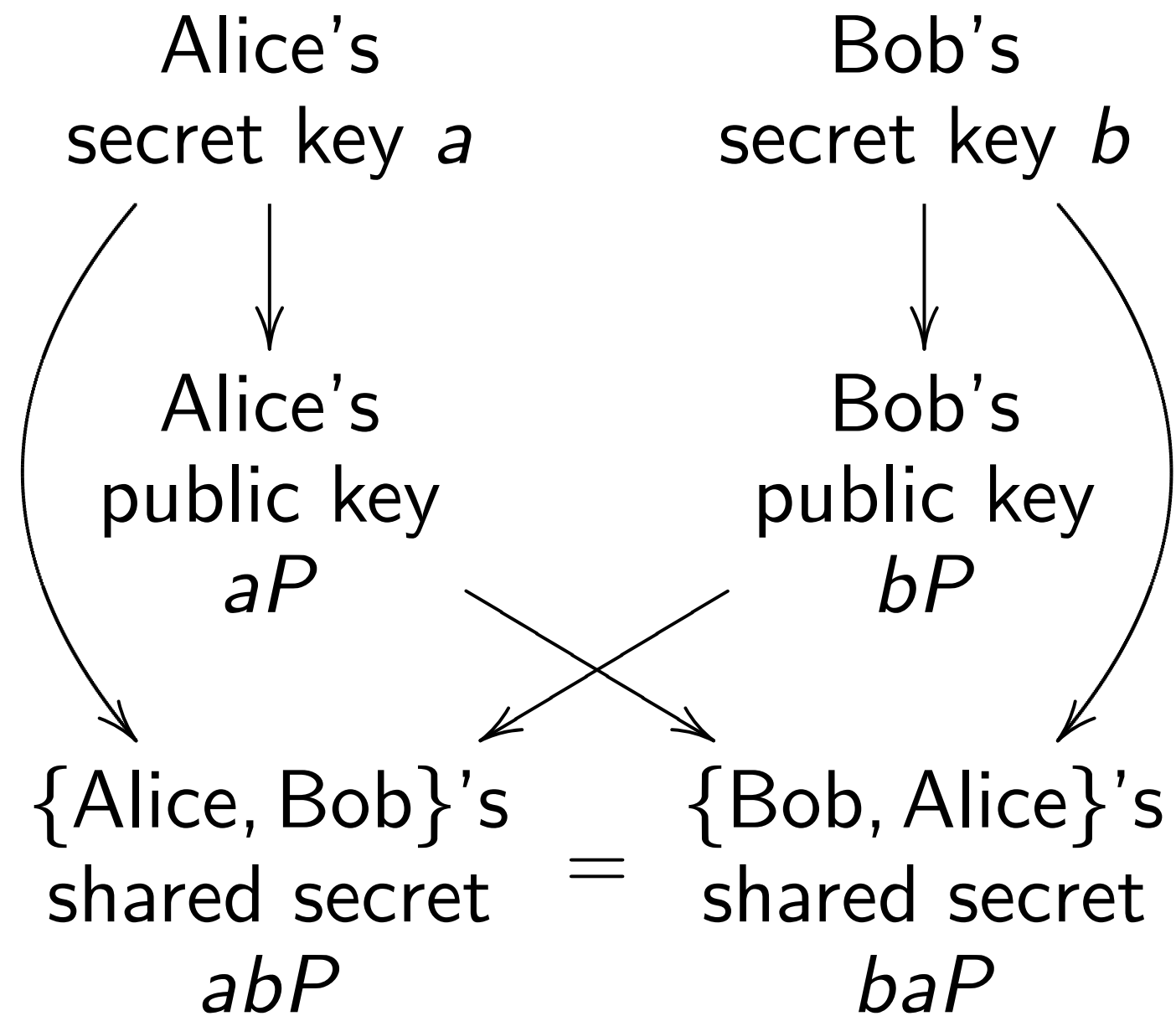
cr.yp.to

[5.html](#)

Textbook key exchange

using standard point P

on a standard elliptic curve E :



Security depends on choice of E .

details

standards:

the black hat

n

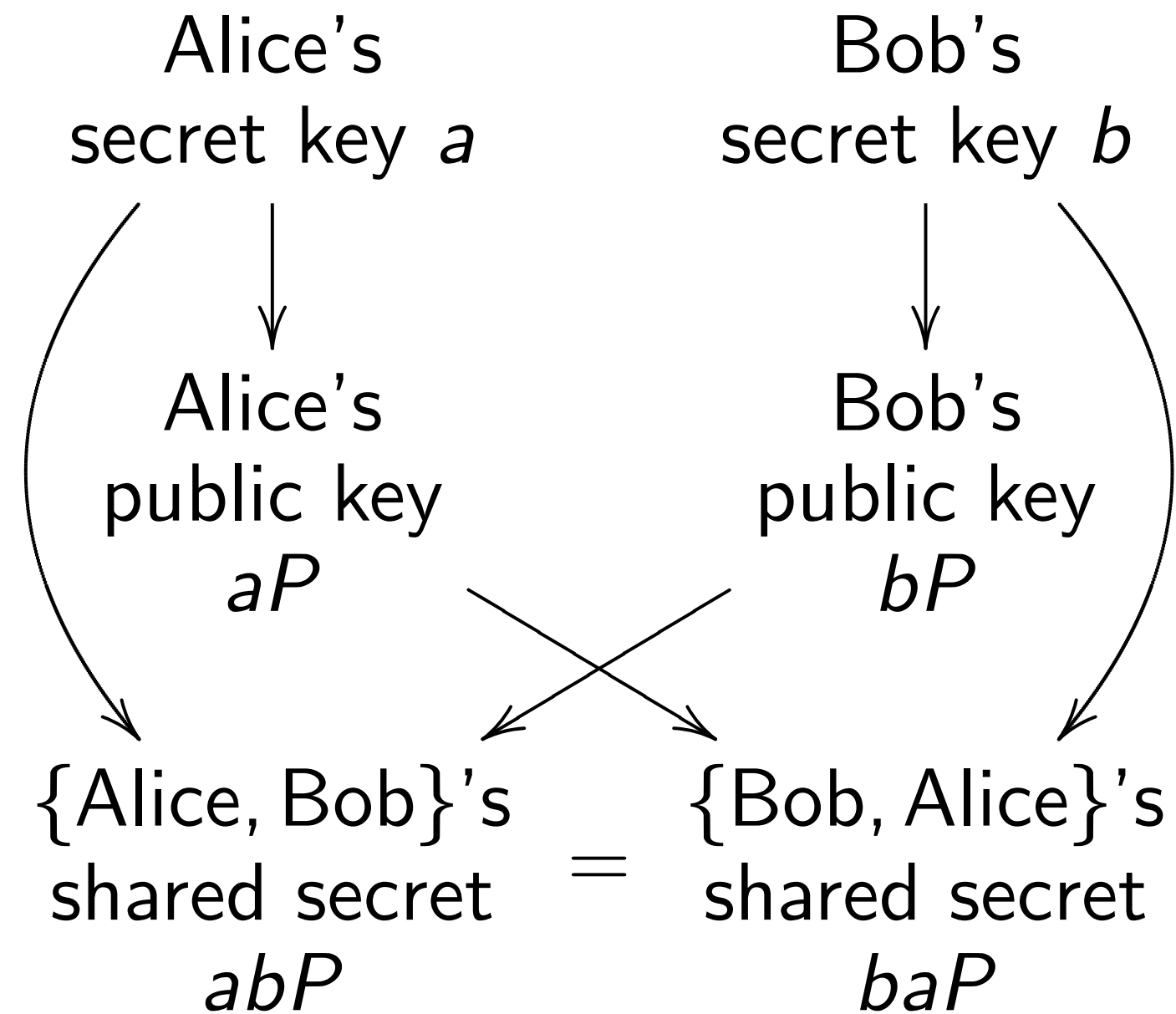
gsatiansup

n

lendaal

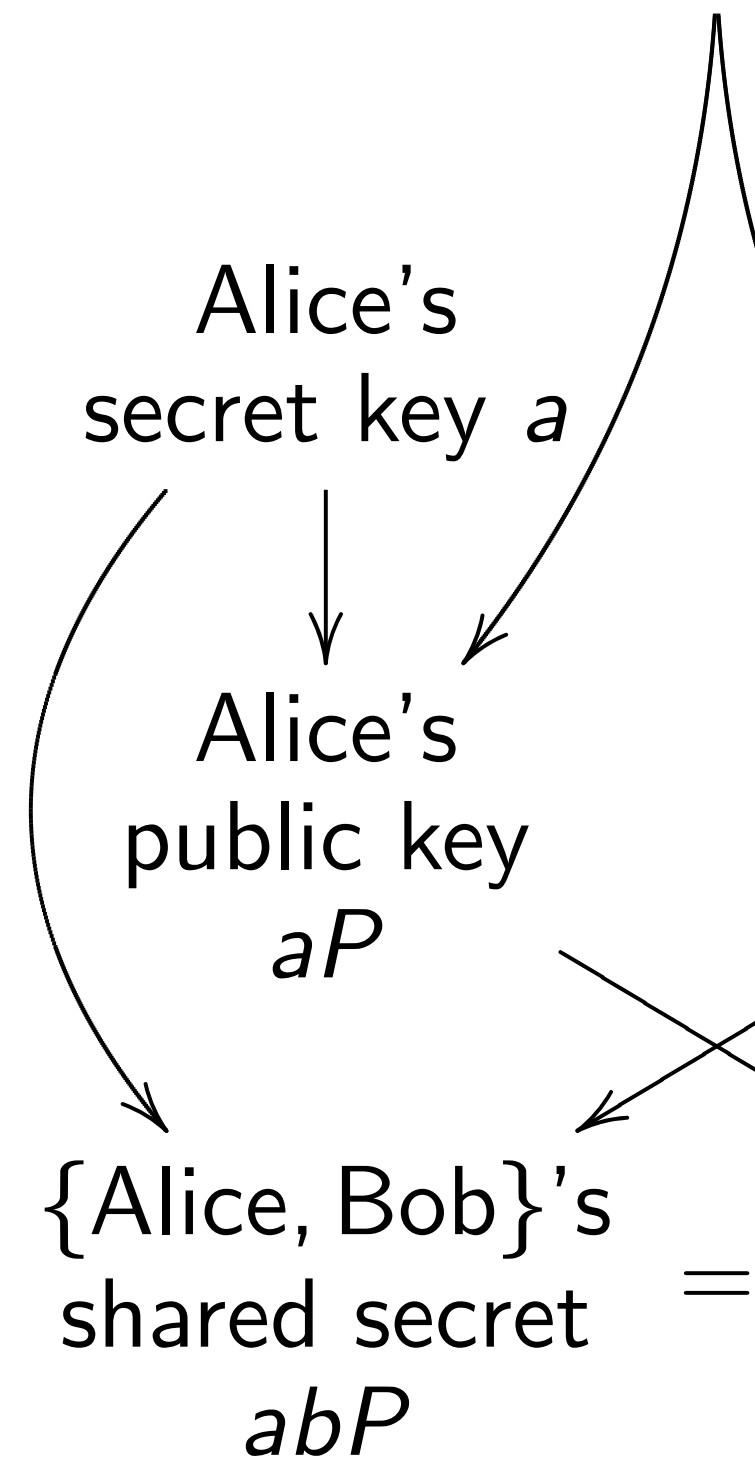
yp.to

Textbook key exchange
using standard point P
on a standard elliptic curve E :

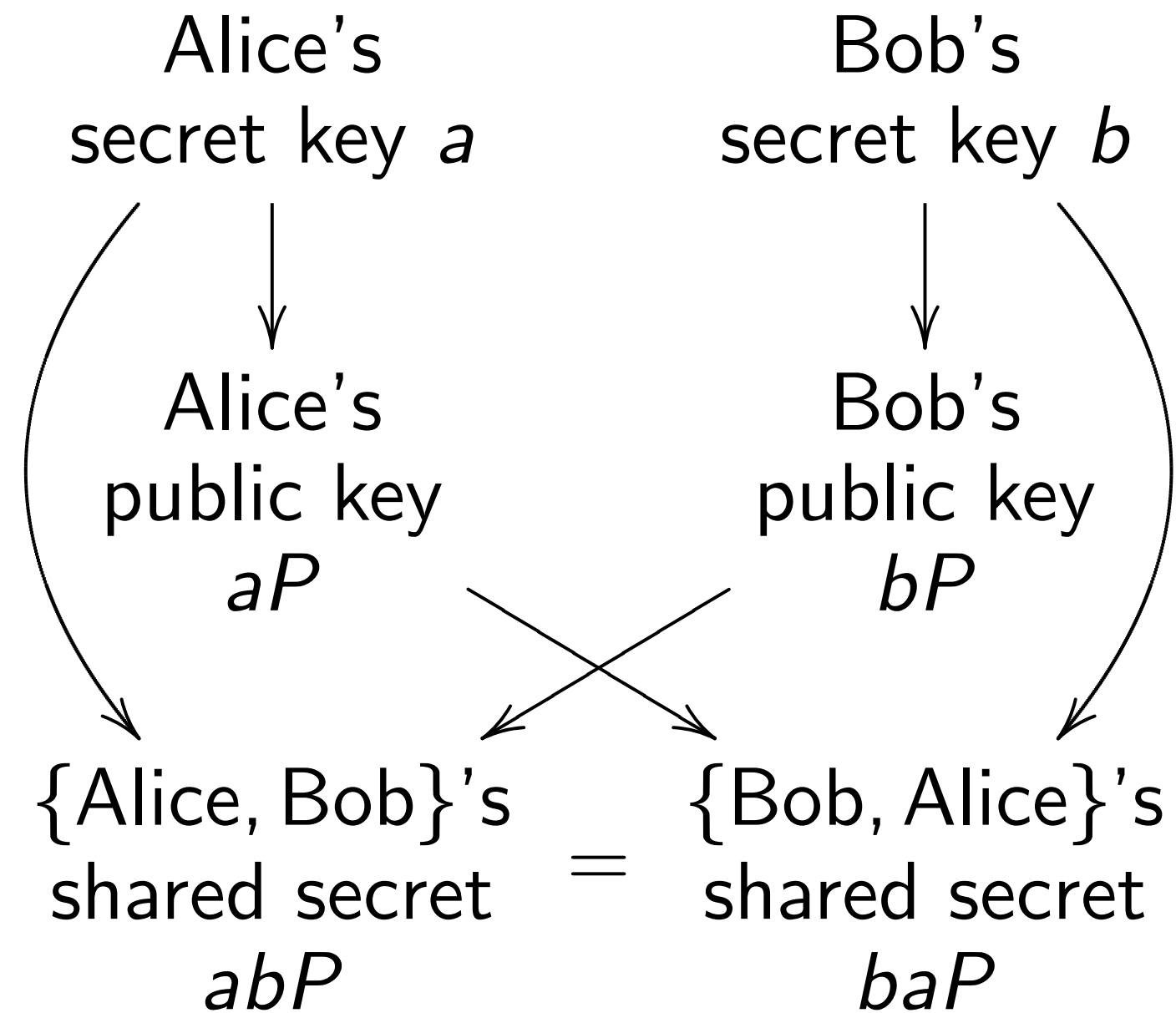


Security depends on choice of E .

Our partner
choice o

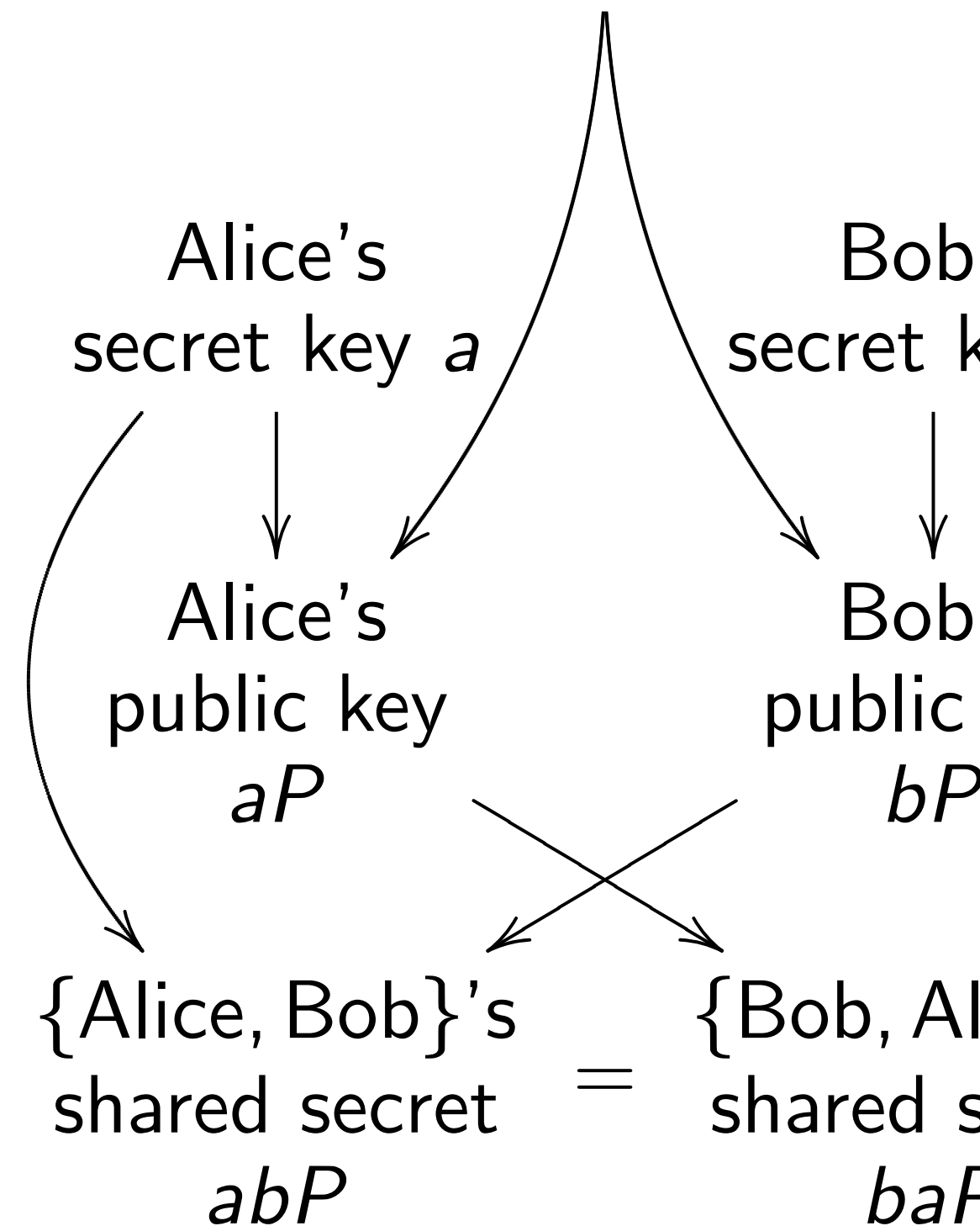


Textbook key exchange
using standard point P
on a standard elliptic curve E :

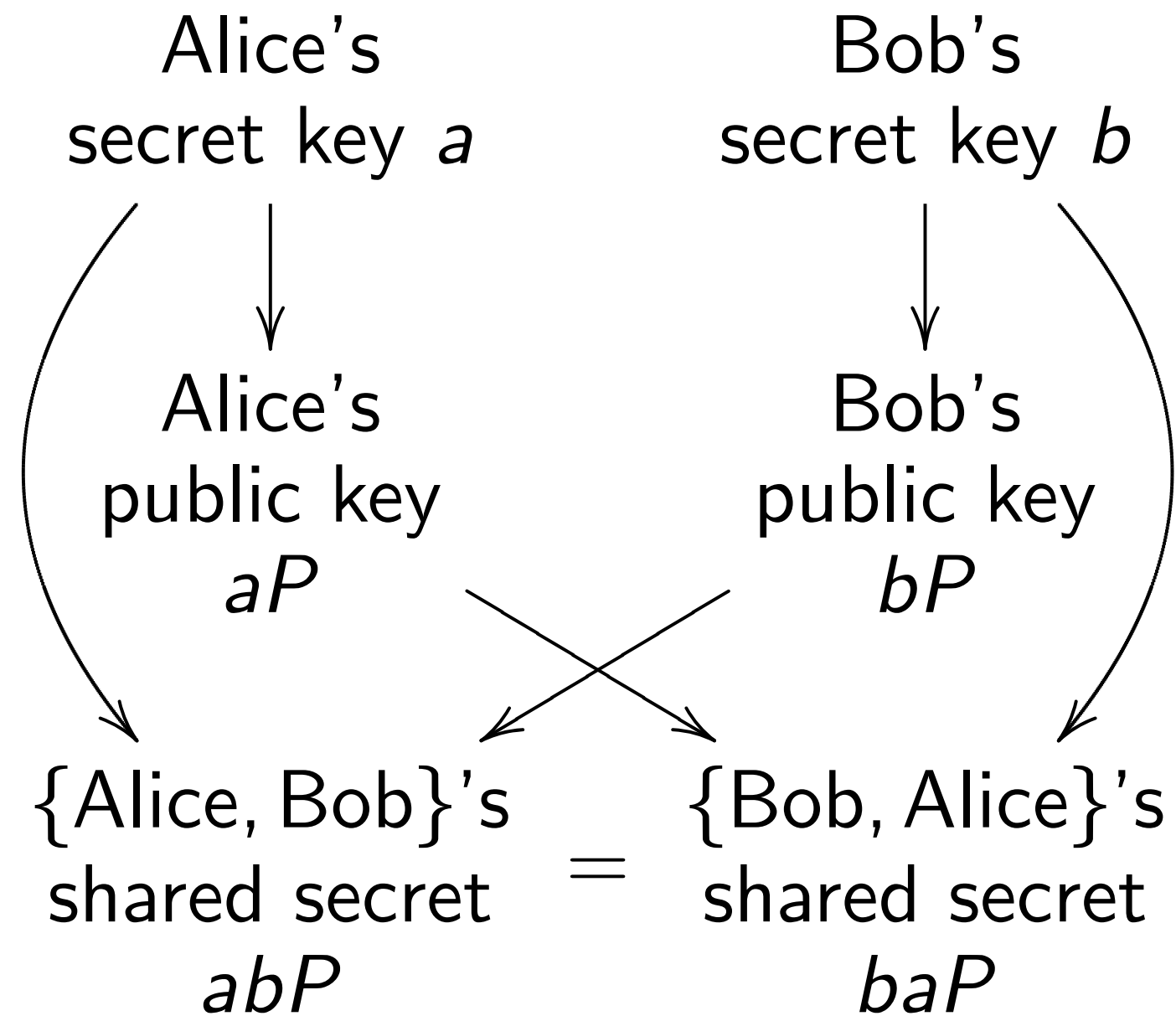


Security depends on choice of E .

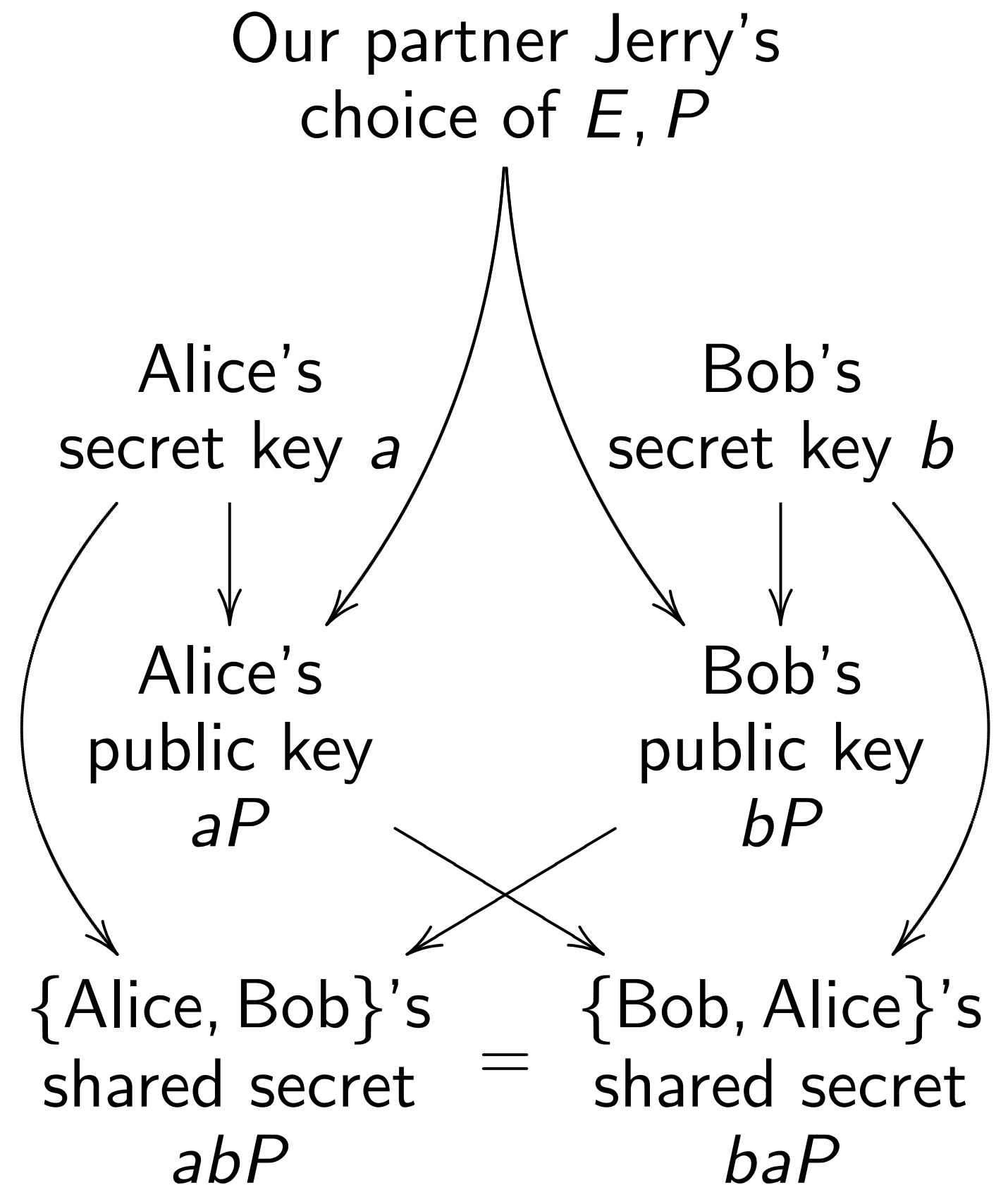
Our partner Jerry's
choice of E, P



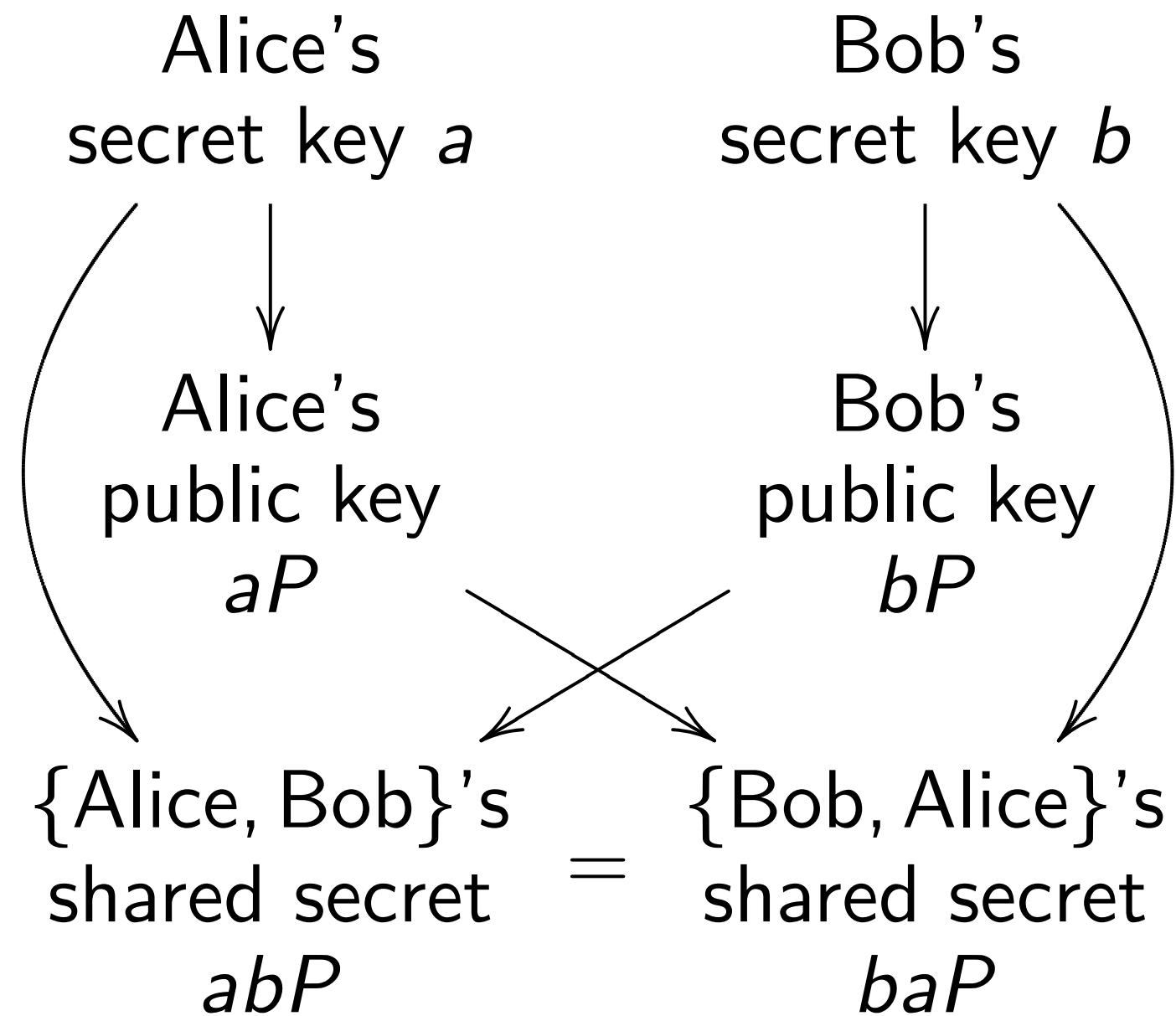
Textbook key exchange
using standard point P
on a standard elliptic curve E :



Security depends on choice of E .

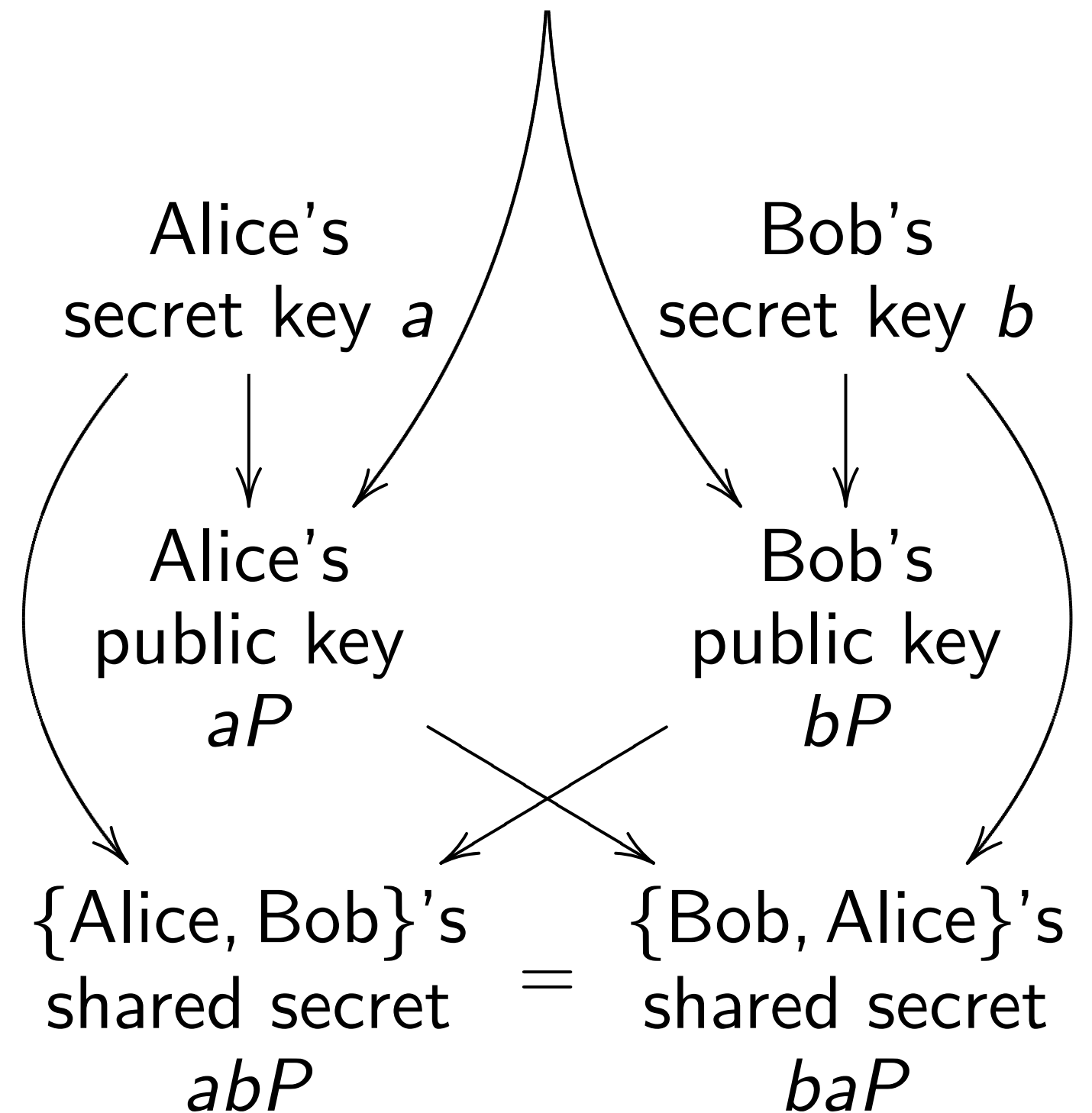


Textbook key exchange
using standard point P
on a standard elliptic curve E :



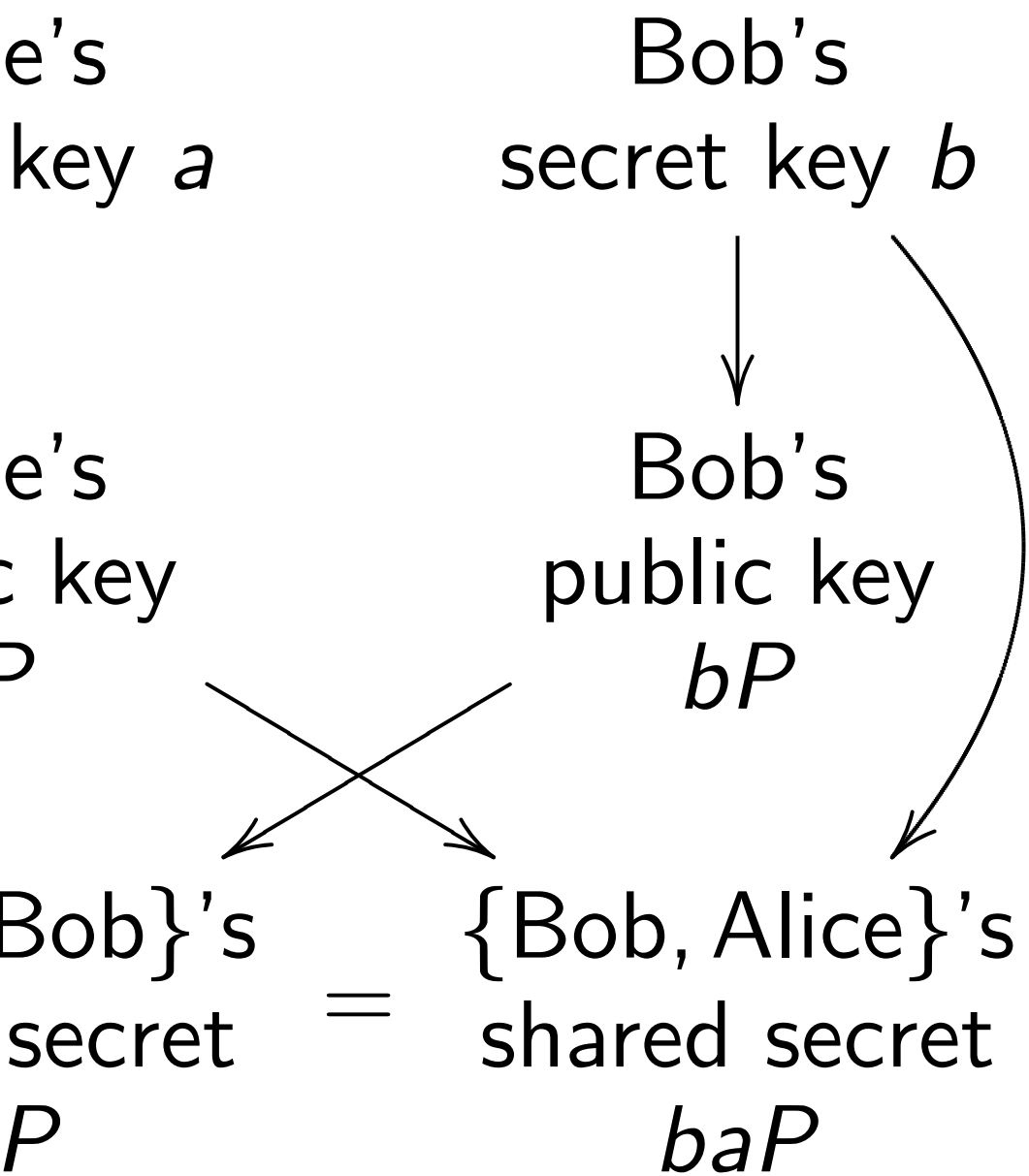
Security depends on choice of E .

Our partner Jerry's
choice of E, P



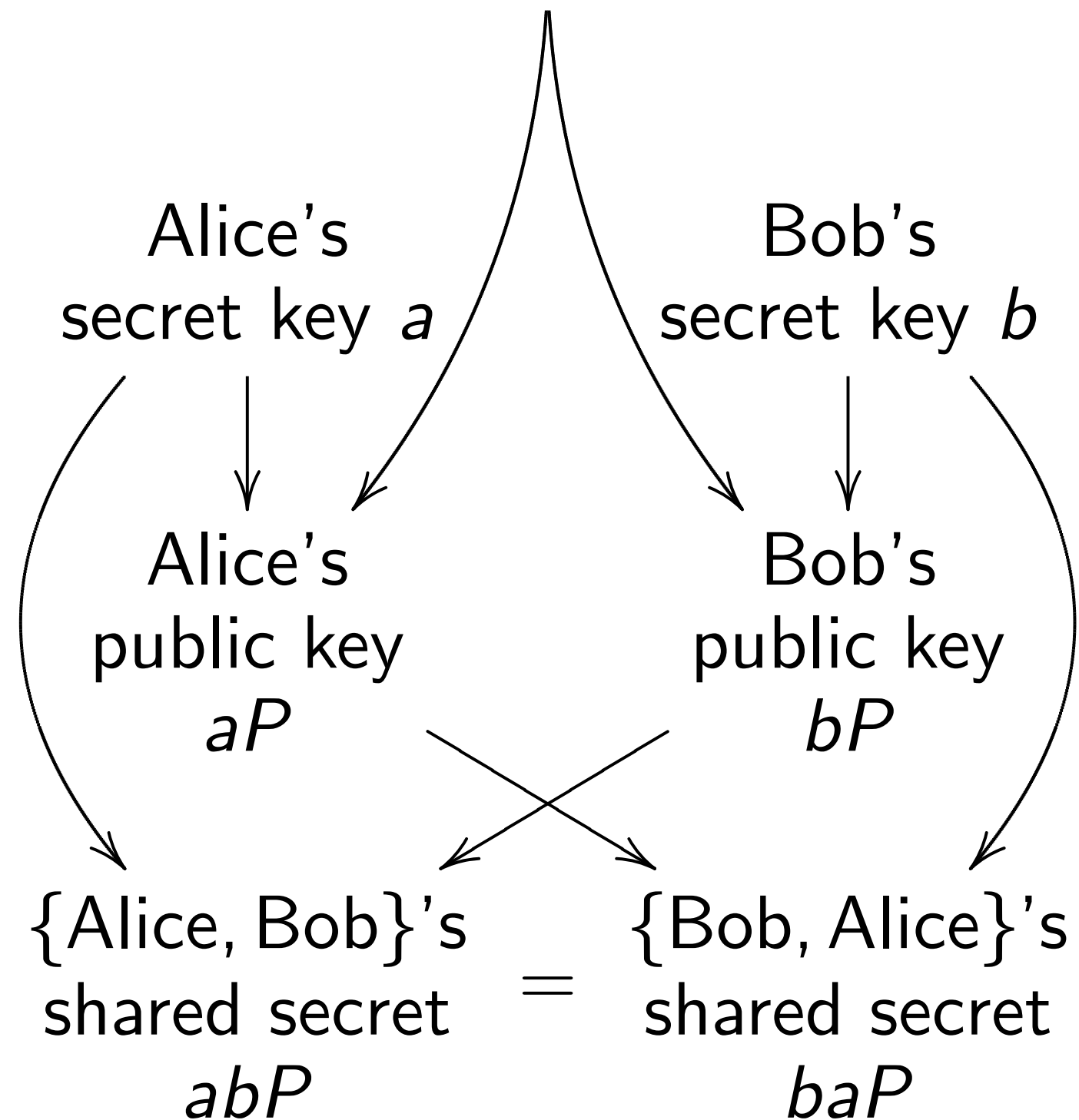
Can we exploit this picture?

k key exchange
 andard point P
 ndard elliptic curve E :



depends on choice of E .

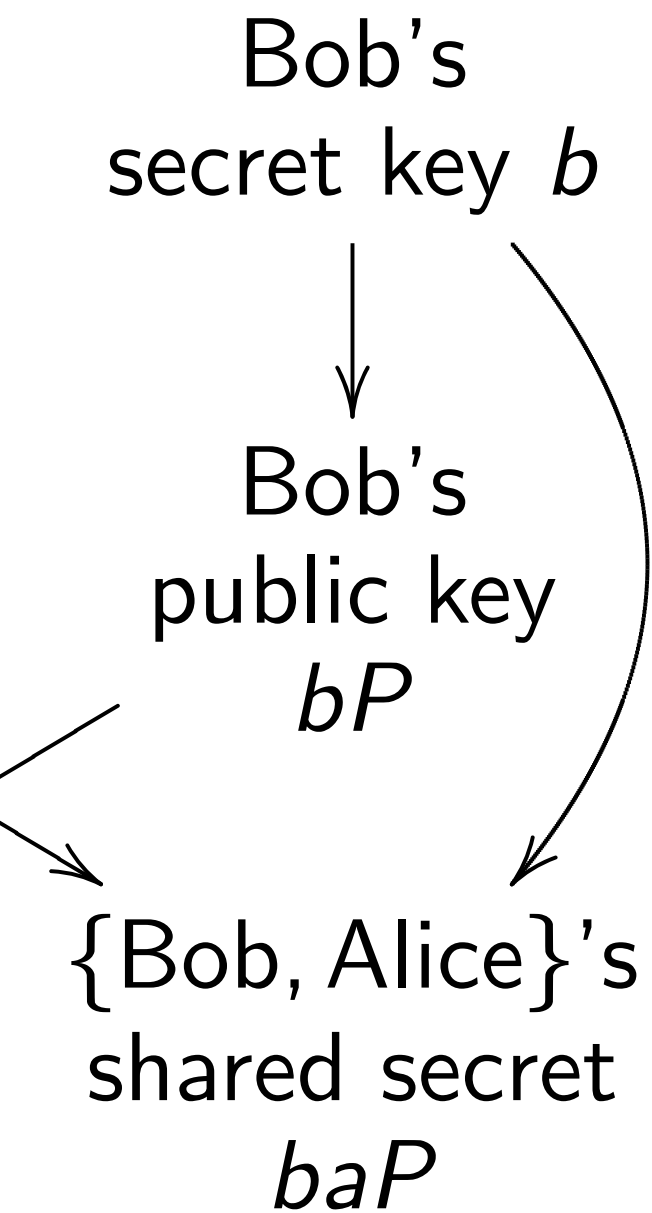
Our partner Jerry's
choice of E, P



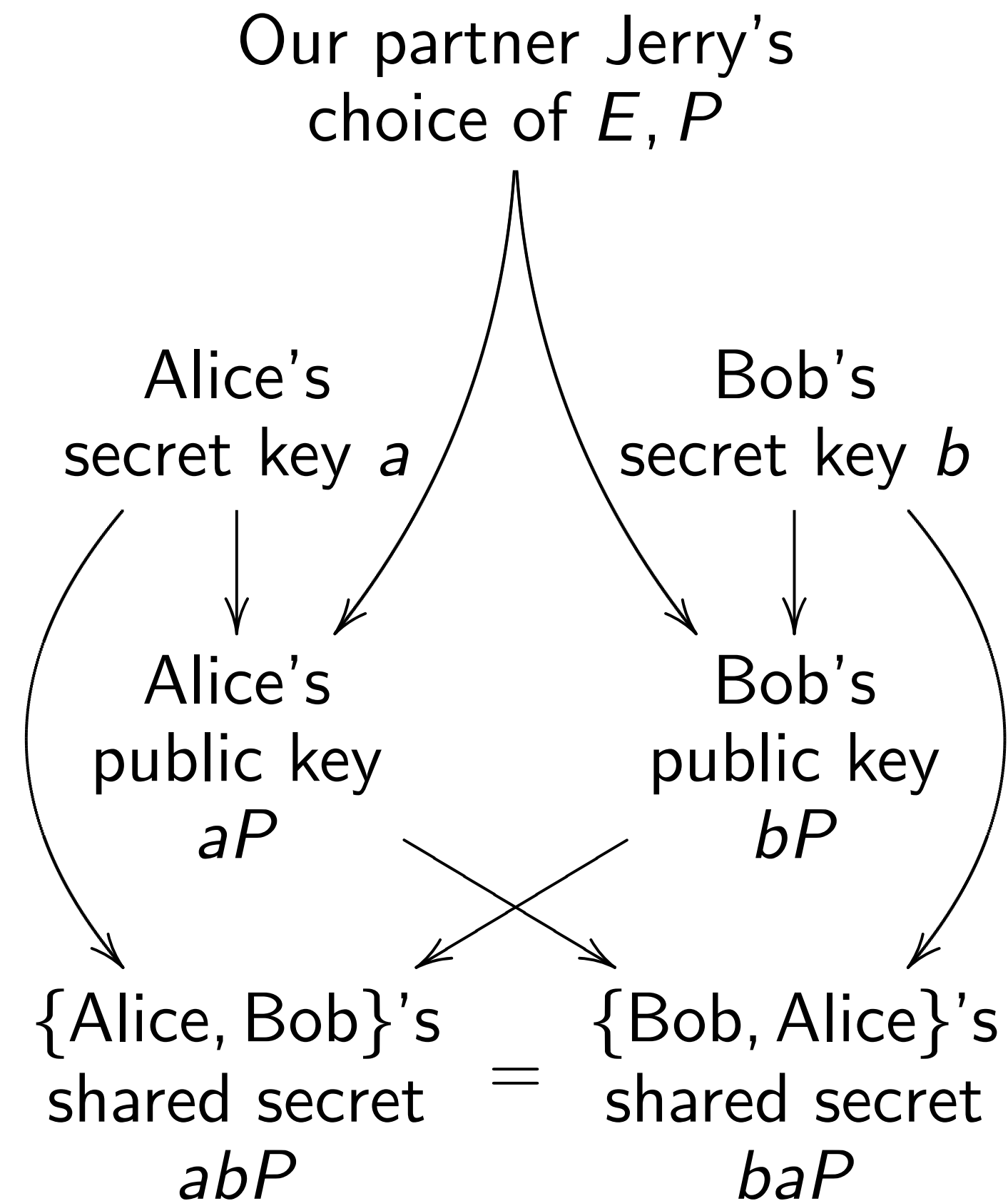
Can we exploit this picture?

Depends
for accep

change
 point P
 elliptic curve E :



on choice of E .



Can we exploit this picture?

Depends on public
 for accepting E, P

E :

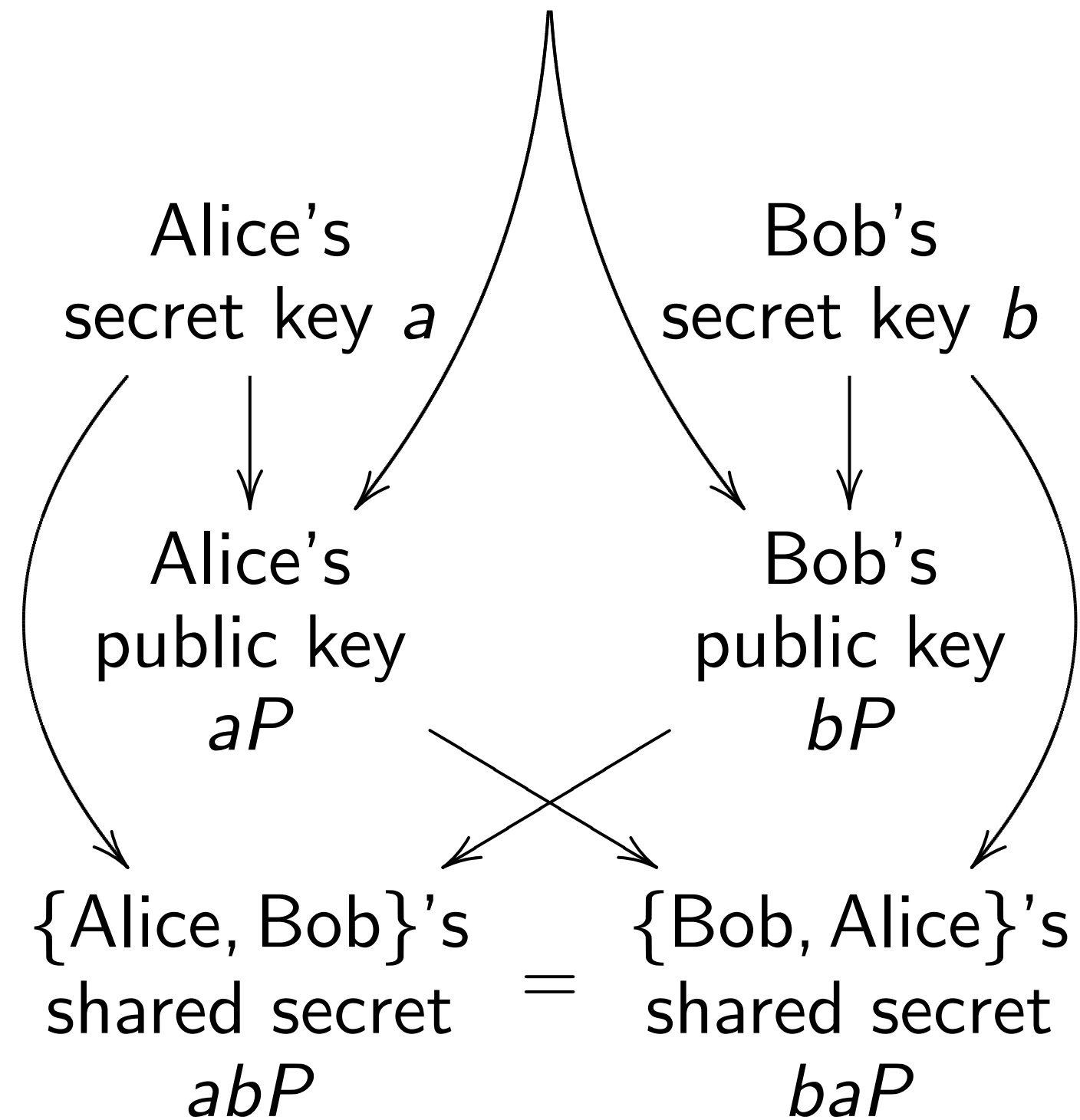
's
key b

's
key

ice}'s
secret

of E .

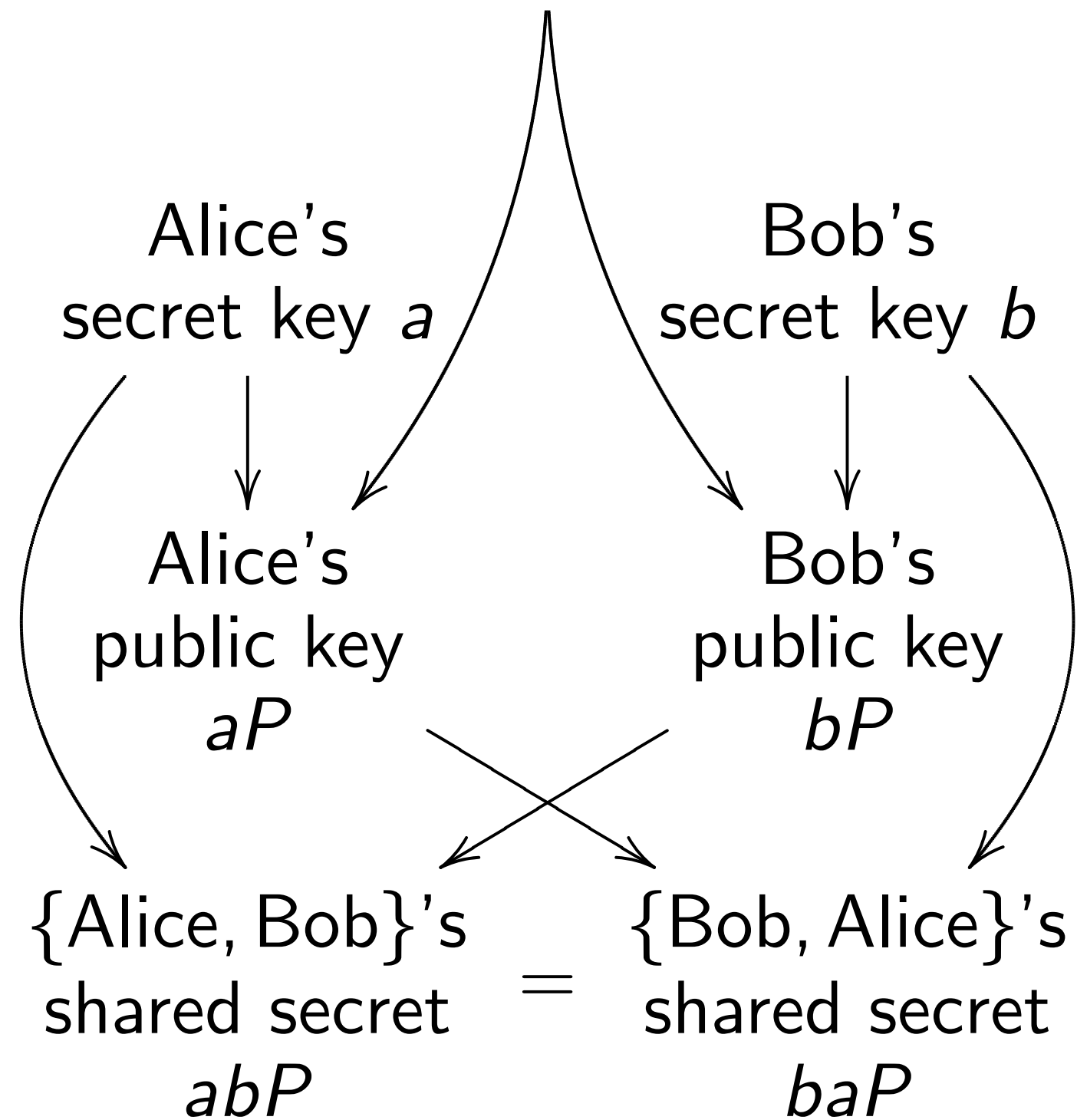
Our partner Jerry's
choice of E, P



Can we exploit this picture?

Depends on public criteria
for accepting E, P .

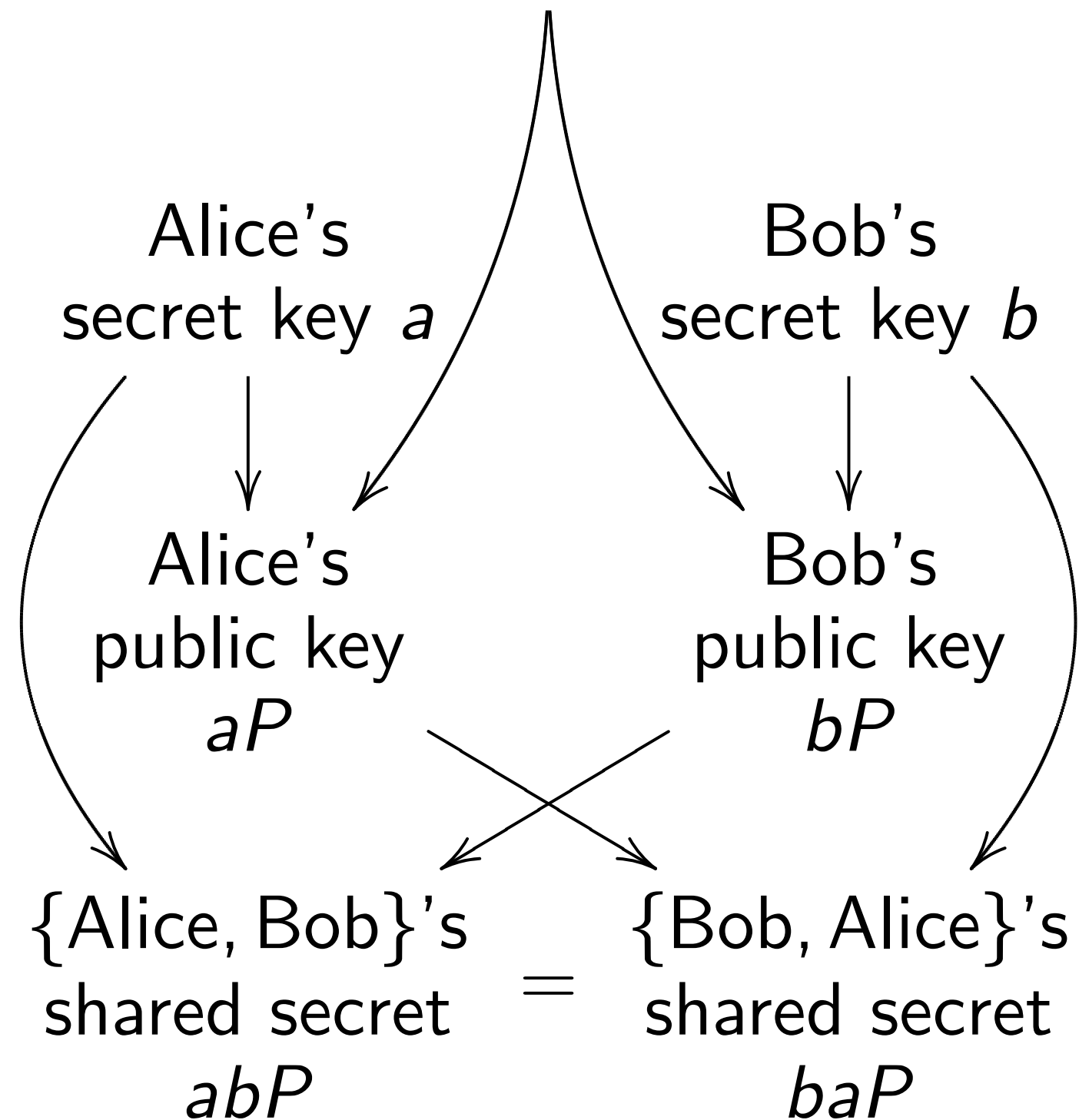
Our partner Jerry's
choice of E, P



Depends on public criteria
for accepting E, P .

Can we exploit this picture?

Our partner Jerry's
choice of E, P



Can we exploit this picture?

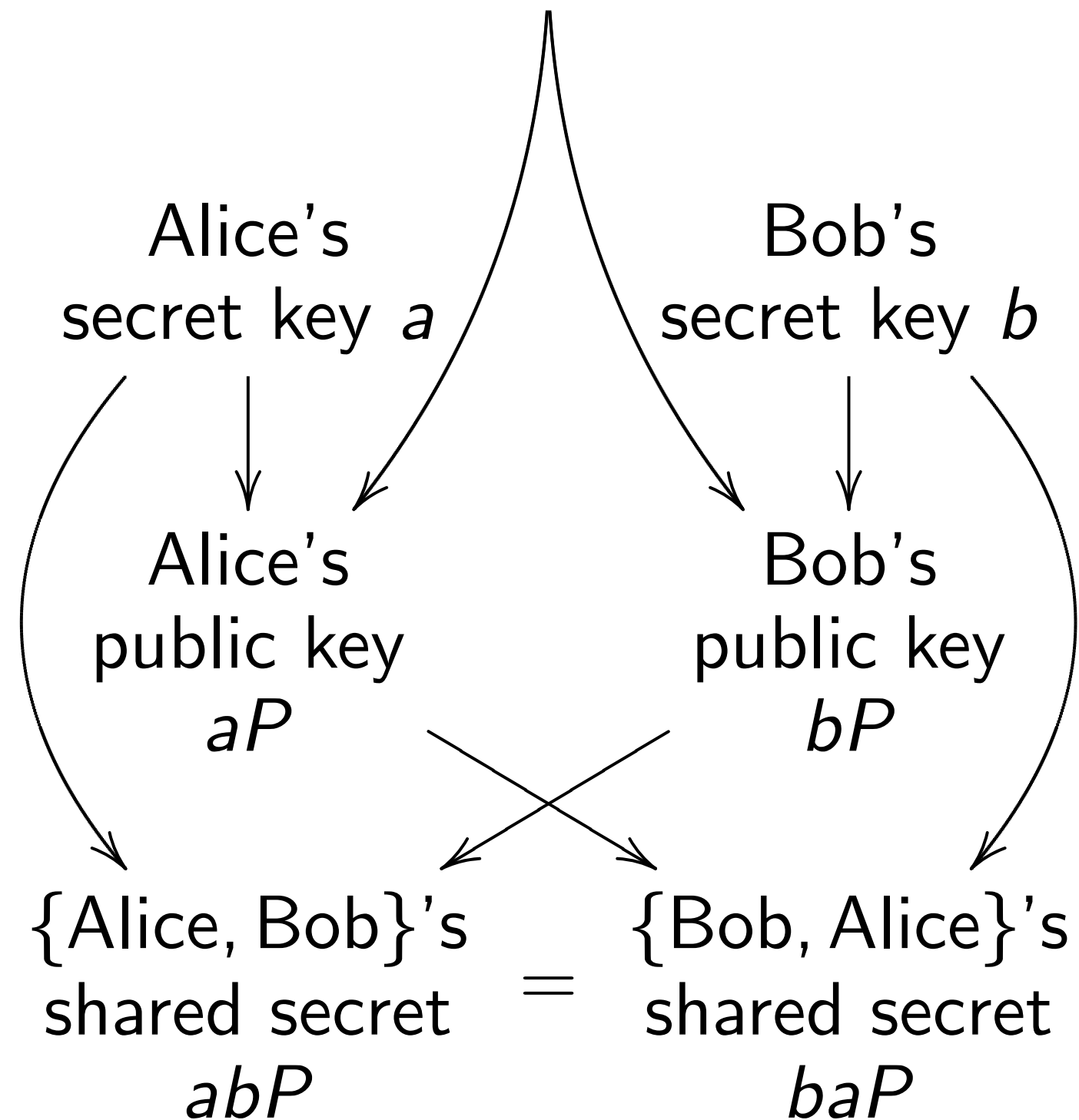
Depends on public criteria
for accepting E, P .

Extensive ECC literature:

Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

Assume that public will accept
any E not publicly broken.

Our partner Jerry's
choice of E, P



Can we exploit this picture?

Depends on public criteria
for accepting E, P .

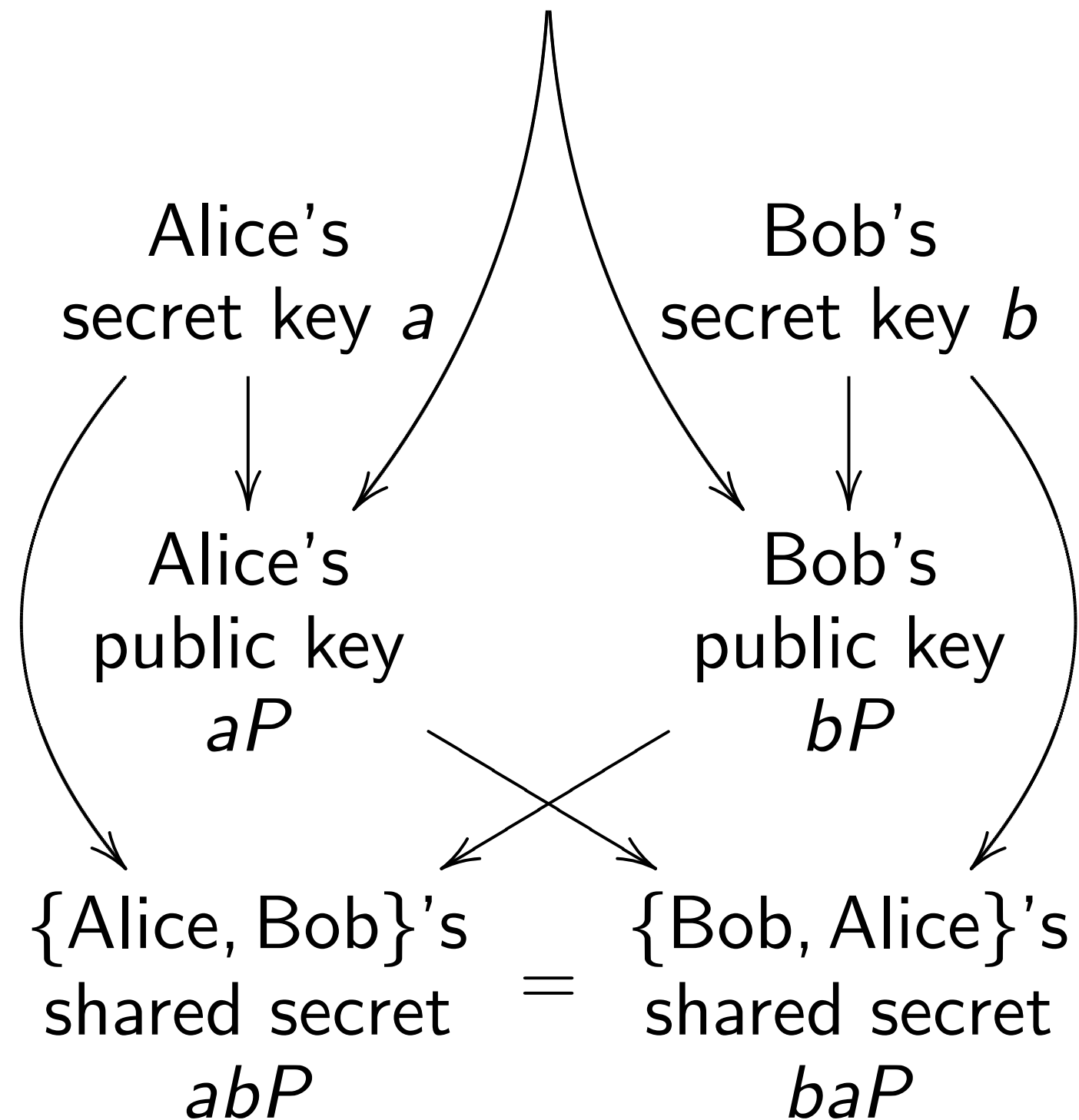
Extensive ECC literature:

Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

Assume that public will accept
any E not publicly broken.

Assume that we've figured out
how to break another curve E .

Our partner Jerry's
choice of E, P



Can we exploit this picture?

Depends on public criteria
for accepting E, P .

Extensive ECC literature:

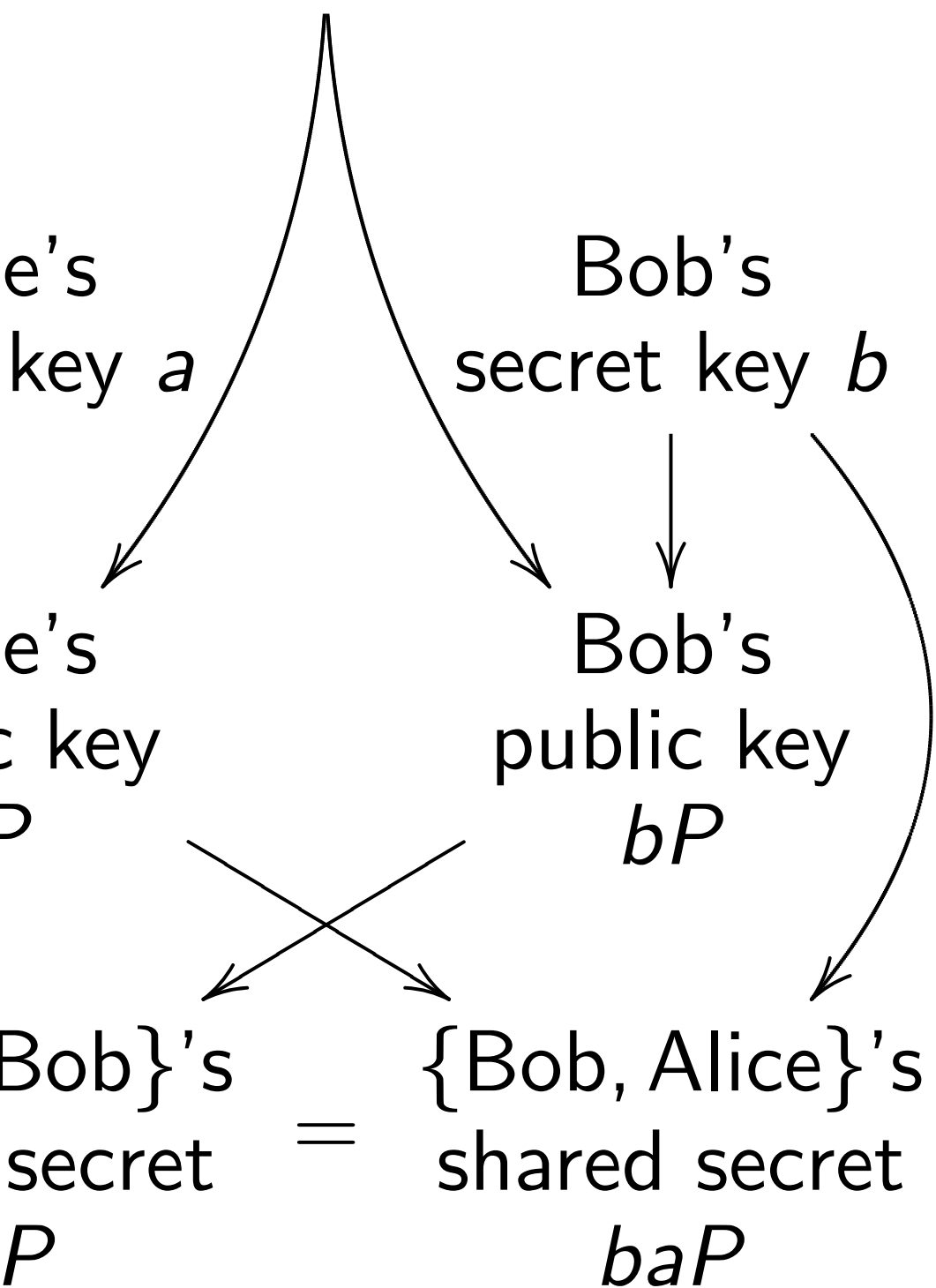
Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

Assume that public will accept
any E not publicly broken.

Assume that we've figured out
how to break another curve E .

Jerry standardizes this curve.
Alice and Bob use it.

Our partner Jerry's
choice of E, P



exploit this picture?

Depends on public criteria
for accepting E, P .

[Extensive ECC literature:](#)

Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

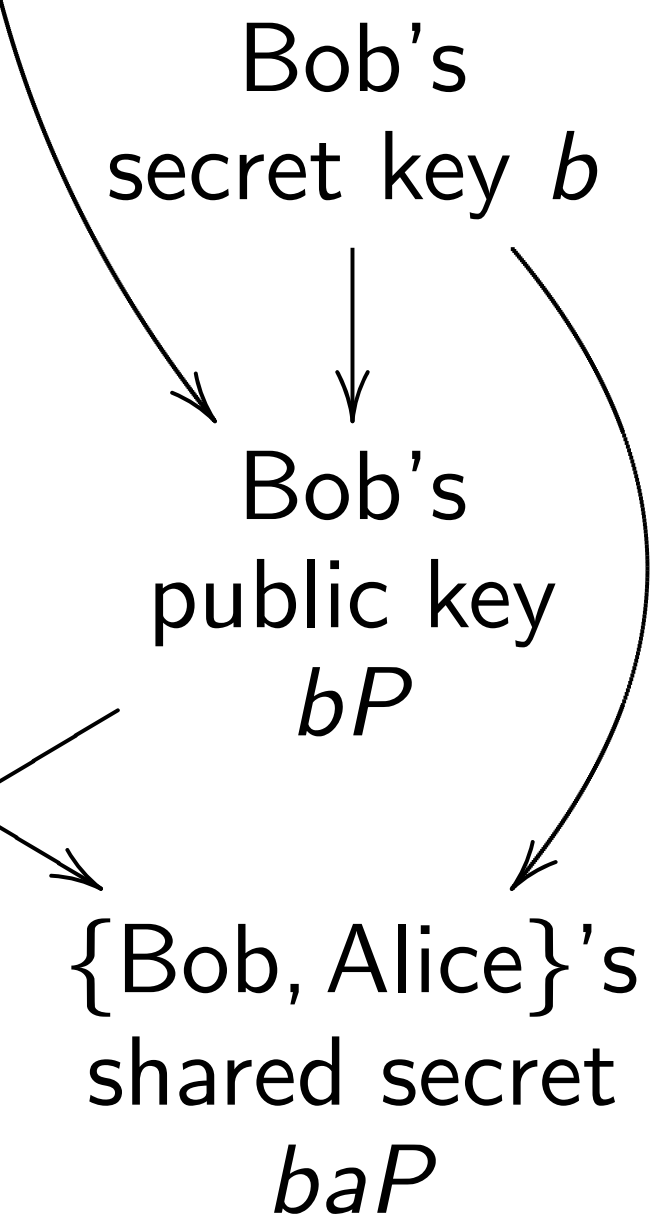
Assume that public will accept
any E not publicly broken.

Assume that we've figured out
how to break another curve E .

Jerry standardizes this curve.
Alice and Bob use it.

Is first a
Would t
any curve
that sur

er Jerry's
f E, P



s picture?

Depends on public criteria
for accepting E, P .

Extensive ECC literature:

Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

Assume that public will accept
any E not publicly broken.

Assume that we've figured out
how to break another curve E .

Jerry standardizes this curve.
Alice and Bob use it.

Is first assumption

Would the public
any curve chosen
that survives these

's
key b

's
key

ice}'s
secret
b



Depends on public criteria
for accepting E, P .

Extensive ECC literature:

Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

Assume that public will accept
any E not publicly broken.

Assume that we've figured out
how to break another curve E .

Jerry standardizes this curve.
Alice and Bob use it.

Is first assumption plausible?

Would the public really accept
any curve chosen by Jerry
that survives these criteria?

Depends on public criteria
for accepting E, P .

Extensive ECC literature:

Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

Assume that public will accept
any E not publicly broken.

Assume that we've figured out
how to break another curve E .

Jerry standardizes this curve.
Alice and Bob use it.

Is first assumption plausible?

Would the public really accept
any curve chosen by Jerry
that survives these criteria?

Depends on public criteria
for accepting E, P .

Extensive ECC literature:

Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

Assume that public will accept
any E not publicly broken.

Assume that we've figured out
how to break another curve E .

Jerry standardizes this curve.
Alice and Bob use it.

Is first assumption plausible?

Would the public really accept
any curve chosen by Jerry
that survives these criteria?

Example showing plausibility:
French [ANSSI FRP256V1](#) (2011)
is a random-looking curve
that survives these criteria
and has no other justification.

Depends on public criteria
for accepting E, P .

Extensive ECC literature:

Pollard rho breaks small E ,
Pohlig–Hellman breaks most E ,
MOV/FR breaks some E ,
SmartASS breaks some E , etc.

Assume that public will accept
any E not publicly broken.

Assume that we've figured out
how to break another curve E .

Jerry standardizes this curve.
Alice and Bob use it.

Is first assumption plausible?

Would the public really accept
any curve chosen by Jerry
that survives these criteria?

Example showing plausibility:
French [ANSSI FRP256V1](#) (2011)
is a random-looking curve
that survives these criteria
and has no other justification.

Earlier example:
Chinese OSCCA SM2 (2010).

s on public criteria
oting E, P .

e ECC literature:

rho breaks small E ,
Hellman breaks most E ,
R breaks some E ,
SS breaks some E , etc.

that public will accept
ot publicly broken.

that we've figured out
break another curve E .

andardizes this curve.

d Bob use it.

Is first assumption plausible?

Would the public really accept
any curve chosen by Jerry
that survives these criteria?

Example showing plausibility:
French [ANSSI FRP256V1](#) (2011)
is a random-looking curve
that survives these criteria
and has no other justification.

Earlier example:
Chinese OSCCA SM2 (2010).

Maybe p
outside l
 E must
and Jerry
“seed” s

c criteria . erature: small E, breaks most E, ome E, some E, etc. c will accept y broken. e figured out her curve E. this curve. it.	Is first assumption plausible? Would the public really accept <i>any</i> curve chosen by Jerry that survives these criteria? Example showing plausibility: French ANSSI FRP256V1 (2011) is a random-looking curve that survives these criteria and has no other justification. Earlier example: Chinese OSCCA SM2 (2010).	Maybe public is m outside France and E must not be pu <i>and</i> Jerry must pr “seed” s such that
--	---	--

Is first assumption plausible?

Would the public really accept
any curve chosen by Jerry
that survives these criteria?

Example showing plausibility:

French [ANSSI FRP256V1](#) (2011)

is a random-looking curve
that survives these criteria
and has no other justification.

Earlier example:

Chinese OSCCA SM2 (2010).

Maybe public is more demanding
outside France and China:
E must not be publicly broken
and Jerry must provide a
“seed” *s* such that $E = H(s)$

Is first assumption plausible?

Would the public really accept
any curve chosen by Jerry
that survives these criteria?

Example showing plausibility:

French [ANSSI FRP256V1](#) (2011)

is a random-looking curve
that survives these criteria
and has no other justification.

Earlier example:

Chinese OSCCA SM2 (2010).

Maybe public is more demanding
outside France and China:

E must not be publicly broken,
and Jerry must provide a
“seed” s such that $E = H(s)$.

Is first assumption plausible?

Would the public really accept *any* curve chosen by Jerry that survives these criteria?

Example showing plausibility:
French [ANSSI FRP256V1](#) (2011)
is a random-looking curve
that survives these criteria
and has no other justification.

Earlier example:
Chinese OSCCA SM2 (2010).

Maybe public is more demanding
outside France and China:
 E must not be publicly broken,
and Jerry must provide a
“seed” s such that $E = H(s)$.

Examples: [ANSI X9.62](#) (1999)
“selecting an elliptic curve
verifiably at random”; [Certicom
SEC 2 1.0](#) (2000) “verifiably
random parameters offer
some additional conservative
features” — “parameters cannot
be predetermined”; [NIST FIPS
186-2](#) (2000); [ANSI X9.63](#) (2001);
[Certicom SEC 2 2.0](#) (2010).

assumption plausible?

he public really accept
ve chosen by Jerry
vives these criteria?

e showing plausibility:

[ANSI X9.62](#) (1999)

om-looking curve

vives these criteria

no other justification.

xample:

[OSCCA SM2](#) (2010).

Maybe public is more demanding
outside France and China:

E must not be publicly broken,
and Jerry must provide a
“seed” s such that $E = H(s)$.

Examples: [ANSI X9.62](#) (1999)

“selecting an elliptic curve
verifiably at random”; [Certicom](#)

[SEC 2 1.0](#) (2000) “verifiably
random parameters offer

some additional conservative
features” — “parameters cannot
be predetermined”; [NIST FIPS](#)

[186-2](#) (2000); [ANSI X9.63](#) (2001);

[Certicom SEC 2 2.0](#) (2010).

What ex

NIST de

$y^2 = x^3$

$b^2c = -$

hash is S

plausible?

really accept

by Jerry

e criteria?

plausibility:

[P256V1](#) (2011)

g curve

e criteria

ustification.

M2 (2010).

Maybe public is more demanding
outside France and China:

E must not be publicly broken,
and Jerry must provide a
“seed” s such that $E = H(s)$.

Examples: [ANSI X9.62](#) (1999)

“selecting an elliptic curve
verifiably at random”; [Certicom](#)

[SEC 2 1.0](#) (2000) “verifiably
random parameters offer

some additional conservative
features” — “parameters cannot
be predetermined”; [NIST FIPS](#)

[186-2](#) (2000); [ANSI X9.63](#) (2001);
[Certicom SEC 2 2.0](#) (2010).

What exactly is H

NIST defines curve

$y^2 = x^3 - 3x + b$

$b^2c = -27$; c is a

hash is SHA-1 con

Maybe public is more demanding outside France and China:

E must not be publicly broken, *and* Jerry must provide a “seed” s such that $E = H(s)$.

Examples: [ANSI X9.62](#) (1999) “selecting an elliptic curve verifiably at random”; [Certicom SEC 2 1.0](#) (2000) “verifiably random parameters offer some additional conservative features” — “parameters cannot be predetermined”; [NIST FIPS 186-2](#) (2000); [ANSI X9.63](#) (2001); [Certicom SEC 2 2.0](#) (2010).

What exactly is H ?

NIST defines curve E as $y^2 = x^3 - 3x + b$ where $b^2c = -27$; c is a hash of s hash is SHA-1 concatenation

Maybe public is more demanding outside France and China:

E must not be publicly broken, *and* Jerry must provide a “seed” s such that $E = H(s)$.

Examples: [ANSI X9.62](#) (1999)

“selecting an elliptic curve verifiably at random”; [Certicom](#)

[SEC 2 1.0](#) (2000) “verifiably random parameters offer

some additional conservative features” — “parameters cannot be predetermined”; [NIST FIPS](#)

[186-2](#) (2000); [ANSI X9.63](#) (2001); [Certicom SEC 2 2.0](#) (2010).

What exactly is H ?

NIST defines curve E as

$y^2 = x^3 - 3x + b$ where

$b^2c = -27$; c is a hash of s ;

hash is SHA-1 concatenation.

Maybe public is more demanding outside France and China:

E must not be publicly broken, *and* Jerry must provide a “seed” s such that $E = H(s)$.

Examples: [ANSI X9.62](#) (1999) “selecting an elliptic curve verifiably at random”; [Certicom SEC 2 1.0](#) (2000) “verifiably random parameters offer some additional conservative features” — “parameters cannot be predetermined”; [NIST FIPS 186-2](#) (2000); [ANSI X9.63](#) (2001); [Certicom SEC 2 2.0](#) (2010).

What exactly is H ?

NIST defines curve E as $y^2 = x^3 - 3x + b$ where $b^2c = -27$; c is a hash of s ; hash is SHA-1 concatenation.

But clearly public will accept other choices of H .

Maybe public is more demanding outside France and China:

E must not be publicly broken, *and* Jerry must provide a “seed” s such that $E = H(s)$.

Examples: [ANSI X9.62](#) (1999)

“selecting an elliptic curve verifiably at random”; [Certicom](#)

[SEC 2 1.0](#) (2000) “verifiably random parameters offer

some additional conservative features” — “parameters cannot be predetermined”; [NIST FIPS](#)

[186-2](#) (2000); [ANSI X9.63](#) (2001);

[Certicom SEC 2 2.0](#) (2010).

What exactly is H ?

NIST defines curve E as

$y^2 = x^3 - 3x + b$ where

$b^2c = -27$; c is a hash of s ;

hash is SHA-1 concatenation.

But clearly public will accept other choices of H .

Examples: [Brainpool](#) (2005)

uses $c = g^3/h^2$ where

g and h are separate hashes.

NIST FIPS 186-4 (2013) requires an “approved hash function, as specified in FIPS 180”;

no longer allows SHA-1!

public is more demanding
France and China:
not be publicly broken,
y must provide a
s such that $E = H(s)$.

es: [ANSI X9.62](#) (1999)
g an elliptic curve
y at random”; [Certicom](#)
.0 (2000) “verifiably
parameters offer
ditional conservative
’ — “parameters cannot
etermined”; [NIST FIPS](#)
2000); [ANSI X9.63](#) (2001);
n [SEC 2 2.0](#) (2010).

What exactly is H ?

NIST defines curve E as
 $y^2 = x^3 - 3x + b$ where
 $b^2c = -27$; c is a hash of s ;
hash is SHA-1 concatenation.

But clearly public will accept
other choices of H .

Examples: [Brainpool](#) (2005)
uses $c = g^3/h^2$ where
 g and h are separate hashes.
NIST FIPS 186-4 (2013) requires
an “approved hash function, as
specified in FIPS 180”;
no longer allows SHA-1!

1999 Sc
possibilit
of all cu
structure
but we c
[generate](#)
until the
one of ‘t
get us to

more demanding
d China:
publicly broken,
provide a
t $E = H(s)$.

X9.62 (1999)
tic curve
m”; Certicom

“verifiably
s offer
onservative
eters cannot
; NIST FIPS
SI X9.63 (2001);
.0 (2010).

What exactly is H ?

NIST defines curve E as
 $y^2 = x^3 - 3x + b$ where
 $b^2c = -27$; c is a hash of s ;
hash is SHA-1 concatenation.

But clearly public will accept
other choices of H .

Examples: Brainpool (2005)
uses $c = g^3/h^2$ where
 g and h are separate hashes.
NIST FIPS 186-4 (2013) requires
an “approved hash function, as
specified in FIPS 180”;
no longer allows SHA-1!

1999 Scott: “Cons
possibility that one
of all curves have
structure that ‘the
but we don’t. The
generate a million
until they find one
one of ‘their’ curves
get us to use them

What exactly is H ?

NIST defines curve E as

$$y^2 = x^3 - 3x + b \text{ where}$$

$b^2c = -27$; c is a hash of s ;

hash is SHA-1 concatenation.

But clearly public will accept other choices of H .

Examples: [Brainpool](#) (2005)

uses $c = g^3/h^2$ where

g and h are separate hashes.

NIST FIPS 186-4 (2013) requires

an “approved hash function, as

specified in FIPS 180”;

no longer allows SHA-1!

1999 Scott: “Consider now possibility that one in a million of all curves have an exploitable structure that ‘they’ know about but we don’t. Then ‘they’ [generate a million random samples](#) until they find one that generates one of ‘their’ curves. Then they get us to use them.”

What exactly is H ?

NIST defines curve E as $y^2 = x^3 - 3x + b$ where $b^2c = -27$; c is a hash of s ; hash is SHA-1 concatenation.

But clearly public will accept other choices of H .

Examples: [Brainpool](#) (2005) uses $c = g^3/h^2$ where g and h are separate hashes. NIST FIPS 186-4 (2013) requires an “approved hash function, as specified in FIPS 180”; no longer allows SHA-1!

1999 Scott: “Consider now the possibility that one in a million of all curves have an exploitable structure that ‘they’ know about, but we don’t. Then ‘they’ [simply generate a million random seeds](#) until they find one that generates one of ‘their’ curves. Then they get us to use them.”

What exactly is H ?

NIST defines curve E as $y^2 = x^3 - 3x + b$ where $b^2c = -27$; c is a hash of s ; hash is SHA-1 concatenation.

But clearly public will accept other choices of H .

Examples: **Brainpool** (2005) uses $c = g^3/h^2$ where g and h are separate hashes. NIST FIPS 186-4 (2013) requires an “approved hash function, as specified in FIPS 180”; no longer allows SHA-1!

1999 Scott: “Consider now the possibility that one in a million of all curves have an exploitable structure that ‘they’ know about, but we don’t. Then ‘they’ **simply generate a million random seeds** until they find one that generates one of ‘their’ curves. Then they get us to use them.”

New: Optimized this computation using Keccak on cluster of 41 GTX780 GPUs. In 7 hours found “secure+twist-secure” $b = 0x$
BADA55ECD8BBEAD3ADD6C534F92197DE
B47FCEB9BE7E0E702A8D1DD56B5D0B0C.

actly is H ?

efines curve E as

$-3x + b$ where

-27; c is a hash of s ;

SHA-1 concatenation.

rly public will accept

oices of H .

es: [Brainpool](#) (2005)

$= g^3/h^2$ where

are separate hashes.

PS 186-4 (2013) requires

proved hash function, as

l in FIPS 180”;

er allows SHA-1!

1999 Scott: “Consider now the possibility that one in a million of all curves have an exploitable structure that ‘they’ know about, but we don’t. Then ‘they’ [simply generate a million random seeds](#) until they find one that generates one of ‘their’ curves. Then they get us to use them.”

New: Optimized this computation using Keccak on cluster of 41 GTX780 GPUs. In 7 hours found “secure+twist-secure” $b = 0x$

[BADA55EC](#)D8BBEAD3ADD6C534F92197DE
B47FCEB9BE7E0E702A8D1DD56B5D0B0C.

Maybe i
the publ

?

e E as
where
hash of s ;
concatenation.

will accept
/.

ool (2005)

here
ate hashes.
(2013) requires
n function, as
180";
HA-1!

1999 Scott: "Consider now the possibility that one in a million of all curves have an exploitable structure that 'they' know about, but we don't. Then 'they' **simply generate a million random seeds** until they find one that generates one of 'their' curves. Then they get us to use them."

New: Optimized this computation using Keccak on cluster of 41 GTX780 GPUs. In 7 hours found "secure+twist-secure" $b = 0x$
BADA55ECD8BBEAD3ADD6C534F92197DE
B47FCEB9BE7E0E702A8D1DD56B5D0B0C.

Maybe in some co
the public is more

1999 Scott: “Consider now the possibility that one in a million of all curves have an exploitable structure that ‘they’ know about, but we don’t. Then ‘they’ **simply generate a million random seeds** until they find one that generates one of ‘their’ curves. Then they get us to use them.”

New: Optimized this computation using Keccak on cluster of 41 GTX780 GPUs. In 7 hours found “secure+twist-secure” $b = 0x$

BADA55ECD8BBEAD3ADD6C534F92197DE
B47FCEB9BE7E0E702A8D1DD56B5D0B0C.

Maybe in some countries
the public is more demanding

1999 Scott: “Consider now the possibility that one in a million of all curves have an exploitable structure that ‘they’ know about, but we don’t. Then ‘they’ **simply generate a million random seeds** until they find one that generates one of ‘their’ curves. Then they get us to use them.”

New: Optimized this computation using Keccak on cluster of 41 GTX780 GPUs. In 7 hours found “secure+twist-secure” $b = 0x$
BADA55ECD8BBEAD3ADD6C534F92197DE
B47FCEB9BE7E0E702A8D1DD56B5D0B0C.

Maybe in some countries the public is more demanding.

1999 Scott: “Consider now the possibility that one in a million of all curves have an exploitable structure that ‘they’ know about, but we don’t. Then ‘they’ **simply generate a million random seeds** until they find one that generates one of ‘their’ curves. Then they get us to use them.”

New: Optimized this computation using Keccak on cluster of 41 GTX780 GPUs. In 7 hours found “secure+twist-secure” $b = 0x$
BADA55ECD8BBEAD3ADD6C534F92197DE
B47FCEB9BE7E0E702A8D1DD56B5D0B0C.

Maybe in some countries the public is more demanding.

Brainpool standard:

“The choice of the seeds from which the [NIST] curve parameters have been derived is not motivated leaving an essential part of the security analysis open. . . .

Verifiably pseudo-random.

The [Brainpool] curves shall be generated in a pseudo-random manner using seeds that are generated in a systematic and comprehensive way.”

ott: “Consider now the
ty that one in a million
rves have an exploitable
e that ‘they’ know about,
don’t. Then ‘they’ **simply**
a million random seeds
ey find one that generates
their’ curves. Then they
o use them.”

optimized this computation
eccak on cluster of 41
GPUs. In 7 hours found
+twist-secure” $b = 0x$
CD8BBEAD3ADD6C534F92197DE
9BE7E0E702A8D1DD56B5D0B0C.

Maybe in some countries
the public is more demanding.

Brainpool standard:

“The choice of the seeds
from which the [NIST] curve
parameters have been derived is
not motivated leaving an essential
part of the security analysis
open. . . .

Verifiably pseudo-random.

The [Brainpool] curves shall be
generated in a pseudo-random
manner using seeds that are
generated in a systematic and
comprehensive way.”

Wikiped
nothing
are any
construc
of hidde

Microsoft
“**generat**
from the

Albertin
Mendel–
hashing”
in hash t
expected
nothing–

consider now the
e in a million
an exploitable
ey' know about,
en 'they' **simply**
random seeds
e that generates
es. Then they
n."

this computation
luster of 41
n 7 hours found
ure" $b = 0x$
ADD6C534F92197DE
2A8D1DD56B5D0B0C.

Maybe in some countries
the public is more demanding.

Brainpool standard:

"The choice of the seeds
from which the [NIST] curve
parameters have been derived is
not motivated leaving an essential
part of the security analysis
open. . . .

Verifiably pseudo-random.

The [Brainpool] curves shall be
generated in a pseudo-random
manner using seeds that are
generated in a systematic and
comprehensive way."

Wikipedia: "In cry
nothing up my sl
are any numbers v
construction, are a
of hidden properties

Microsoft "NUMS
"generated determin
from the security l

Albertini–Aumasson
Mendel–Schläffer
hashing" (2014):
in hash functions a
expected to be **ide**
nothing-up-your-sl

Maybe in some countries
the public is more demanding.

Brainpool standard:

“The choice of the seeds
from which the [NIST] curve
parameters have been derived is
not motivated leaving an essential
part of the security analysis
open. . . .

Verifiably pseudo-random.

The [Brainpool] curves shall be
generated in a pseudo-random
manner using seeds that are
generated in a systematic and
comprehensive way.”

Wikipedia: “In cryptography
nothing up my sleeve num
are any numbers which, by their
construction, are **above suspicion**
of hidden properties.”

Microsoft “NUMS” curves (2000)
“**generated deterministically**
from the security level”.

Albertini–Aumasson–Eichlschütz
Mendel–Schläpfer “Malicious
hashing” (2014): “constants
in hash functions are normally
expected to be **identifiable as**
nothing-up-your-sleeve numbers”

Maybe in some countries
the public is more demanding.

Brainpool standard:

“The choice of the seeds
from which the [NIST] curve
parameters have been derived is
not motivated leaving an essential
part of the security analysis
open. . . .

Verifiably pseudo-random.

The [Brainpool] curves shall be
generated in a pseudo-random
manner using seeds that are
generated in a systematic and
comprehensive way.”

Wikipedia: “In cryptography,
nothing up my sleeve numbers
are any numbers which, by their
construction, are **above suspicion
of hidden properties.**”

Microsoft “NUMS” curves (2014):
“**generated deterministically**
from the security level” .

Albertini–Aumasson–Eichlseder–
Mendel–Schläffer “Malicious
hashing” (2014): “constants
in hash functions are normally
expected to be **identifiable as
nothing-up-your-sleeve numbers**” .

in some countries
ic is more demanding.

ol standard:

oice of the seeds

ich the [NIST] curve

ers have been derived is

ivated leaving an essential

the security analysis

ly pseudo-random.

ainpool] curves shall be

ed in a pseudo-random

using seeds that are

ed in a systematic and

ensive way.”

Wikipedia: “In cryptography,
nothing up my sleeve numbers
are any numbers which, by their
construction, are **above suspicion
of hidden properties.**”

Microsoft “NUMS” curves (2014):
“**generated deterministically**
from the security level”.

Albertini–Aumasson–Eichlseder–
Mendel–Schläffer “Malicious
hashing” (2014): “constants
in hash functions are normally
expected to be **identifiable as
nothing-up-your-sleeve numbers**”.

New: W
curve “E
with a B

ountries
demanding.
d:
e seeds
[IST] curve
een derived is
ving an essential
y analysis

o-random.
urves shall be
udo-random
ls that are
tematic and
y.”

Wikipedia: “In cryptography,
nothing up my sleeve numbers
are any numbers which, by their
construction, are **above suspicion
of hidden properties.**”

Microsoft “NUMS” curves (2014):
“**generated deterministically**
from the security level” .

Albertini–Aumasson–Eichlseder–
Mendel–Schläffer “Malicious
hashing” (2014): “constants
in hash functions are normally
expected to be **identifiable as
nothing-up-your-sleeve numbers**” .

New: We generate
curve “BADA55-V
with a Brainpool-1

Wikipedia: “In cryptography,
nothing up my sleeve numbers
are any numbers which, by their
construction, are **above suspicion
of hidden properties.**”

Microsoft “NUMS” curves (2014):
“**generated deterministically**
from the security level” .

Albertini–Aumasson–Eichlseder–
Mendel–Schläffer “Malicious
hashing” (2014): “constants
in hash functions are normally
expected to be **identifiable as
nothing-up-your-sleeve numbers**” .

New: We generated a **BADA**
curve “BADA55-VPR-224”
with a Brainpool-like explan

Wikipedia: “In cryptography, **nothing up my sleeve numbers** are any numbers which, by their construction, are **above suspicion of hidden properties**.”

Microsoft “NUMS” curves (2014):
“**generated deterministically**
from the security level”.

Albertini–Aumasson–Eichlseder–
Mendel–Schläffer “Malicious
hashing” (2014): “constants
in hash functions are normally
expected to be **identifiable as
nothing-up-your-sleeve numbers**”.

New: We generated a **BADA55**
curve “BADA55-VPR-224”
with a Brainpool-like explanation.

Wikipedia: “In cryptography, **nothing up my sleeve numbers** are any numbers which, by their construction, are **above suspicion of hidden properties**.”

Microsoft “NUMS” curves (2014): “**generated deterministically** from the security level”.

Albertini–Aumasson–Eichlseder–Mendel–Schläffer “Malicious hashing” (2014): “constants in hash functions are normally expected to be **identifiable as nothing-up-your-sleeve numbers**”.

New: We generated a **BADA55** curve “BADA55-VPR-224” with a Brainpool-like explanation.

We actually generated >1000000 curves, each having a Brainpool-like explanation.

Wikipedia: “In cryptography, **nothing up my sleeve numbers** are any numbers which, by their construction, are **above suspicion of hidden properties**.”

Microsoft “NUMS” curves (2014): “**generated deterministically** from the security level”.

Albertini–Aumasson–Eichlseder–Mendel–Schläffer “Malicious hashing” (2014): “constants in hash functions are normally expected to be **identifiable as nothing-up-your-sleeve numbers**”.

New: We generated a **BADA55** curve “BADA55-VPR-224” with a Brainpool-like explanation.

We actually generated >1000000 curves, each having a Brainpool-like explanation.

Example of underlying flexibility: Brainpool generates seeds from $\exp(1)$ and primes from $\arctan(1)$; MD5 generates constants from $\sin(1)$; BADA55-VPR-224 generated a seed from $\cos(1)$.

ia: “In cryptography,
up my sleeve numbers
numbers which, by their
tion, are **above suspicion**
n properties.”

ft “NUMS” curves (2014):
ed deterministically
e security level”.

i–Aumasson–Eichlseder–
-Schläffer “Malicious
(2014): “constants
functions are normally
d to be **identifiable as**
up-your-sleeve numbers”.

New: We generated a **BADA55**
curve “BADA55-VPR-224”
with a Brainpool-like explanation.

We actually generated
>1000000 curves, each having
a Brainpool-like explanation.

Example of underlying flexibility:
Brainpool generates seeds from
 $\exp(1)$ and primes from $\arctan(1)$;
MD5 generates constants from
 $\sin(1)$; BADA55-VPR-224
generated a seed from $\cos(1)$.

Many jo



ptography,
eeve numbers
which, by their
above suspicion
es.”
” curves (2014):
ministically
level” .
on–Eichlseder–
“Malicious
“constants
are normally
entifiable as
eeve numbers” .

New: We generated a **BADA55**
curve “BADA55-VPR-224”
with a Brainpool-like explanation.

We actually generated
>1000000 curves, each having
a Brainpool-like explanation.

Example of underlying flexibility:
Brainpool generates seeds from
 $\exp(1)$ and primes from $\arctan(1)$;
MD5 generates constants from
 $\sin(1)$; BADA55-VPR-224
generated a seed from $\cos(1)$.

Many jobs available



New: We generated a **BADA55** curve “BADA55-VPR-224” with a Brainpool-like explanation.

We actually generated >1000000 curves, each having a Brainpool-like explanation.

Example of underlying flexibility: Brainpool generates seeds from $\exp(1)$ and primes from $\arctan(1)$; MD5 generates constants from $\sin(1)$; BADA55-VPR-224 generated a seed from $\cos(1)$.

Many jobs available!



New: We generated a **BADA55** curve “BADA55-VPR-224” with a Brainpool-like explanation.

We actually generated >1000000 curves, each having a Brainpool-like explanation.

Example of underlying flexibility:
Brainpool generates seeds from $\exp(1)$ and primes from $\arctan(1)$;
MD5 generates constants from $\sin(1)$; BADA55-VPR-224 generated a seed from $\cos(1)$.

Many jobs available!



OWA
Open Web Alliance



Experian
Marketing Services