

مقدمه‌ای بر رمزنگاری در کامپیوتر

نوشته بهرادی (TadavomnisT)

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اجازه کپی، توزیع و/یا اصلاح این سند، تحت شرایط مجوز مستندات آزاد گنو، نسخه 1.3 یا هر نسخه بعدی منتشر شده توسط بنیاد نرم افزار آزاد داده شده است؛ بدون بخش‌های ثابت، بدون متن‌های روی جلدی و بدون متن‌های پشت جلدی. یک کپی از مجوز در قسمتی با عنوان «مجوز مستندات آزاد گنو» نیز موجود می‌باشد.

مقدمه:

امروزه کریپتوگرافی یا رمزنگاری، یکی از موضوعات مهم و پایه‌ای مطرح شده در علم کامپیوتر می‌باشد. در حقیقت رمزنگاری چیزی نیست جز روش‌ها و الگوریتم‌های ریاضیاتی که با استفاده از آن‌ها می‌توانیم از روی داده‌های صریح، معادلات پیچیده ریاضیاتی را بسازیم که هیچ موجودیتی نمیتواند آن‌ها را رمزگشایی بنماید، مگر آن که کلید معادله را داشته باشد. در پروسه این فعالیتها می‌توانیم به دستیابی به اهدافی در راستای اطمینان از حریم شخصی و امنیت نزدیک‌تر بشویم. قصد من این است که در این کتاب، مقدمه‌ای بر فیلد رمزنگاری داشته باشم و موارد بیسیک آنرا از پایه مورد بررسی و توضیح قرار دهم. اگرچه من متخصص این رشته بخصوص، یا تحصیل کرده در این فیلد نیستم، اما تجربیاتی عملی در رمزنگاری دارم و امیدوارم که بتوانم آن‌ها را از طریق این کتاب به اشتراک بگذارم.

بهرادی (TadavomnisT)

فصل 1: کریپتوگرافی یا رمزنگاری چیست؟

1.1 مفهوم رمزنگاری چیست؟

هدف اصلی در رمزنگاری این است که یک داده [1] را جوری پنهان کنیم که کسی نتواند محتوای آنرا ببیند، مگر کسی که از کلید با خبر باشد. نکته بسیار مهم این است که رمزگشایی مفهومی کاملاً متفاوت از سیستمهای اعتبارسنجی دارد. بیاید تا یک مثال از رمزنگاری را ببینیم.

نکته [1]: داده میتواند هر چیزی باشد، یک مفهوم، یک کلام، یک گفتار، هر چیزی که بتوان با قاعده خاصی مبنی بر ریاضیات آنرا بیان کرد. در حوزه کامپیوتر ممکن است مقصود ما از داده هرچیزی باشد، فایلها، اطلاعات و ...

فرض کنید ما یک داده به اسم «داده پلین» یا «داده صریح» یا «داده آشکار» داریم.

داده آشکار (Plain):

Data is a precious thing and will last longer than the systems themselves. - Tim Berners Lee

حال میخواهیم کاری کنیم که این داده آشکار را پنهان شود، بدین منظور هر حرف موجود در داده را با 3 حرف بعد از خودش در ترتیب الفبا جایگزین میکنیم. پس نگاشت حرفها اینچنین است:

Plain letter Replacement

A	D
B	E
C	F
D	G
E	H
F	I
G	J
H	K
I	L

J	M
K	N
L	O
M	P
N	Q
O	R
P	S
Q	T
R	U
S	V
T	W
U	X
V	Y
W	Z
X	A
Y	B
Z	C

پس از جایگزینی حرفها، به متن زیر میرسیم که اسم آن را «داده سایفر» یا «داده نهان» یا «داده پنهان» یا حتی «داده رمزشده» میگذاریم:

داده نهان (Cipher):

Gdwd lv d suhflrxv wklqj dqg zloo odvw orqjhu wkdq wkh vbwwhpv wkhpvhoyhv. - Wlp Ehuqhuv Ohh

به این فرایند **رمزگزاری** (Encrypting) یا **سایفر کردن** (Ciphering) داده پلین میگویند. به داده سایفر شده نگاهی بیاندازید. آیا بدون دانستن روند فرایند متوجه معنی آن میشدید؟ آن قطعه‌ای از اطلاعات که بیان میکند چه اتفاقی برای داده پلین افتاده است که به داده سایفر تبدیل شده است (به زبان ساده انکریپت شده است)، **کلید رمزنگاری** (Encryption-Key) نام دارد. بعد از همه این اتفاقات، شخصی که کلید را میداند، میتواند سایفر را رمزگشایی یا دیکریپت (Decrypt) یا دیسایفر (Decipher) نماید:

کلید:

هر حرف را با 3 حرف قبل خودش در الفبا جایگزین کنید.

داده رمز:

Gdwd lv d suhflrxv wklqj dqg zloo odvw orqjhu wkdq wkh vbwwhpv wkhpvhoyhv. - Wlp Ehuqhuv Ohh

Cipher letter	Replacement
D	A
E	B
F	C
G	D
H	E
I	F
J	G
K	H
L	I
M	J
N	K
O	L
P	M
Q	N
R	O
S	P
T	Q
U	R
V	S
W	T
X	U
Y	V
Z	W
A	X
B	Y
C	Z

داده رمزگشایی شده (داده آشکار):

Data is a precious thing and will last longer than the systems themselves. - Tim Berners Lee

و این ماجرا تعریفی ساده از رمزنگاری بود!

1.1.1 رمزگذاری / سایفر کردن

1.1.2 رمزگشایی / دیسایفر کردن

1.2 چرا رمزنگاری موضوع مهمی است؟

1.3 چند نقل قول مرتبط با رمزنگاری

"Cryptography shifts the balance of power from those with a monopoly on violence to those who comprehend mathematics and security design."

«رمزنگاری توازن قدرت را از سمت مونوپولی بر روی خشونت به سمت افرادی که ریاضیات و طراحی امنیتی را درک میکنند میراند»

— Jacob Appelbaum - جیکوب اپلبام

"Cryptography is the ultimate form of non-violent direct action"

«رمزنگاری شکل نهایی اقدام مستقیم بدون خشونت است»

— Julian Assange - جولین آسانژ

"One must acknowledge with cryptography no amount of violence will ever solve a math problem."

«باید قبول کنیم که با رمزنگاری هیچ مقدار خشونتی هرگز نمیتواند یک مساله ریاضی را حل کند»

— Jacob Appelbaum - جیکوب اپلبام

"There are two kinds of cryptography in this world: cryptography that will stop your kid sister from reading your files, and cryptography that will stop major governments from reading your files."

«در جهان دو نوع رمزنگاری وجود دارد: آن رمزنگاری که جلوی خوانده شدن فایل‌های شما توسط خواهر کوچکتان را میگیرد و آن رمزنگاری که جلوی خوانده شدن فایل‌های شما توسط دولت‌های بزرگ را میگیرد»
— Bruce Schneier - بروس اشنایر

"Cryptography is the essential building block of independence for organisations on the internet, just like armies are the essential building blocks of states, because otherwise one state just takes over another."

«رمزنگاری آجر سازنده و اساسی استقلال برای سازمان‌ها در اینترنت است، درست مانند ارتش‌ها که پایه‌های سازنده اساسی دولت‌ها هستند، زیرا در غیر این صورت یک دولت فقط دیگری را تصاحب می‌کند.»
— Julian Assange - جولین آسانژ

"When cryptography is outlawed, bayl bhgynjf jvyu unir cevinpl."

«زمانی که رمزنگاری غیرقانونی است، بایل به‌گینجف جیوی یونیر سئوینپل.»
— John Perry Barlow - جان پری بارلو

"Bitcoin was created to serve a highly political intent, a free and uncensored network where all can participate with equal access."

«بیتکوین ساخته شد تا به یک هدف والای سیاسی خدمت کند، یک شبکه آزاد و بدون سانسور که همه میتوانند با دسترسی برابر به آن متصل شوند»
— Amir Taaki - امیر تاکی

"Privacy is an inherent human right, and a requirement for maintaining the human condition with dignity and respect."

«حریم خصوصی یک حق ذاتی انسان است و لازمه حفظ شرایط عزت و احترام انسانی است.»
— Bruce Schneier - بروس اشنایر

فصل 2: چه چیزهایی رمزنگاری نیستند؟!

2.1 کدینگ / انکدینگ

2.2 هاش

2.3 آبفاسکیشن یا پنهان نگاری

2.4 استیگانوگرافی یا نهان نگاری

2.5 فشرده سازی

فصل 3: رمزنگاری متقارن چیست؟

3.1 معنی رمزنگاری متقارن چیست؟

3.2 مثالهایی از رمزنگاری متقارن ساده

3.3 AES؟

3.4 DES؟

3.5 پد یکبارمصرف

فصل 4: رمزنگاری نامتقارن چیست؟

4.1 رمزنگاری نامتقارن چیست و چرا لازم است؟

4.2 دیفی-هلمن

4.3 RSA؟

فصل 5: هش کریپتوگرافیک

5.1 هش کریپتوگرافیک چیست؟

5.2 MD5

5.3 SHA

فصل 6: خم‌های بیضوی

فصل 7: رمزنگاری کوآنتومی

فصل 8: رمزنگاری در عمل

فصل 9: رمز-ارز

فصل 10: حملات مرسوم در حوزه رمزنگاری

کدها:

مراجع:

سپاسگزارها:

لایسنس:

مجوز مستندات آزاد گنو

نسخه 1.3، 3 نوامبر 2008

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همه مجاز به کپی و توزیع کلمه به کلمه این سند مجوز هستند، اما تغییر آن مجاز نیست.

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این مجوز نوعی "کپی‌لفت" است، به این معنی که هر نوع آثاری که از سند مشتق شده باشند باید خود به همین معنا آزاد باشند. این مجوز به نوعی مکمل مجوز عمومی عمومی گنو (GPL) است که یک مجوز کپی‌لفت است که برای نرم افزار آزاد طراحی شده است.

ما این مجوز را به منظور استفاده از آن برای دفترچه های راهنما برای نرم افزار آزاد طراحی کرده ایم، زیرا نرم افزار آزاد به مستندات آزاد نیز نیاز دارد: یک برنامه آزاد باید با راهنماهایی همراه باشد که همان آزادی‌هایی را که نرم افزار دارد را نیز داشته باشند. اما این مجوز به کتابچه راهنمای نرم افزار محدود نمی شود. می توان از آن برای هر اثر متنی، صرف نظر از موضوع اثر یا حتی اثری منتشر شده به صورت کتاب چاپی، استفاده کرد. ما این مجوز را اصولاً برای کارهایی که هدف آنها دستورالعمل یا مرجع است توصیه می کنیم.

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