

Human-in-the-loop for Secure Digital Wallet Transactions

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Theft
Fraud
Skimming



Google Pay



Apple Pay

Ubiquitous
Convenient
Secure

Theft
Fraud
Skimming



Google Pay



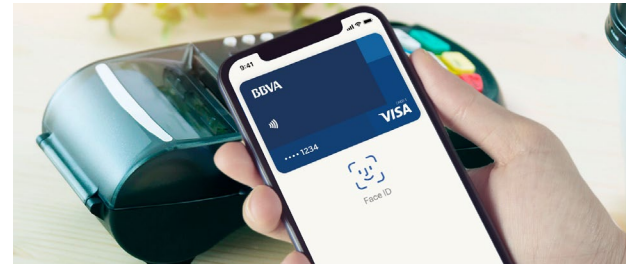
Apple Pay

Ubiquitous
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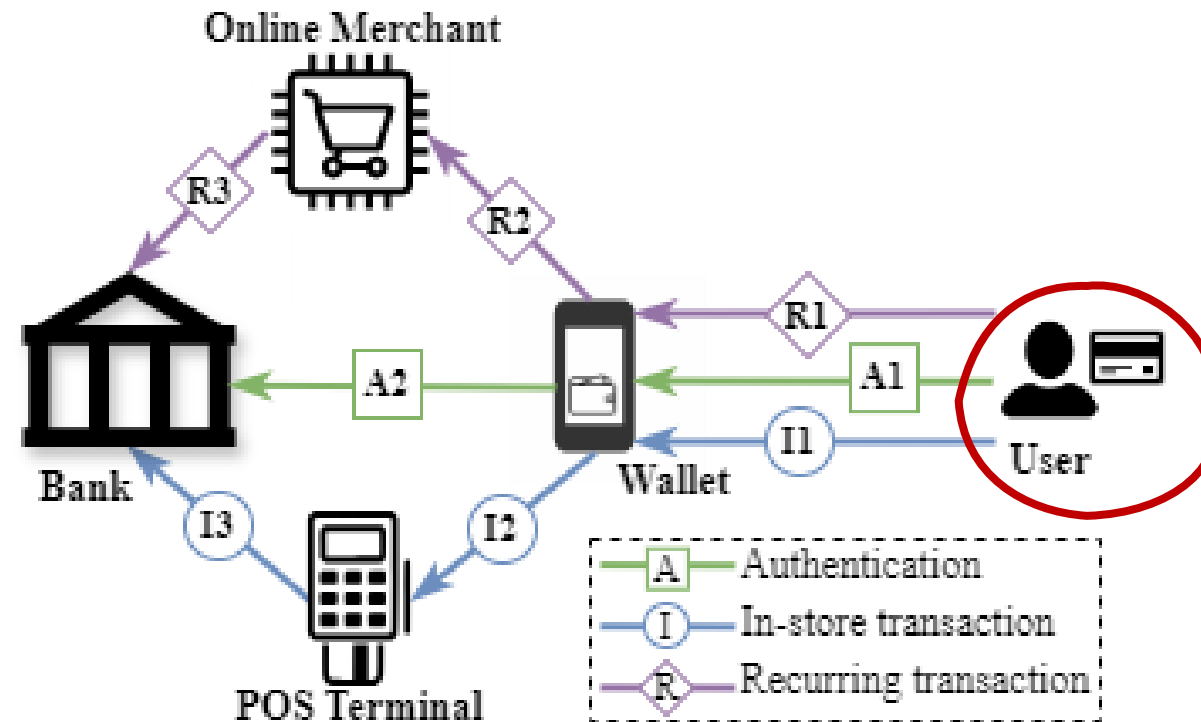


Apple Pay

Ubiquitous
Convenient
Secure?

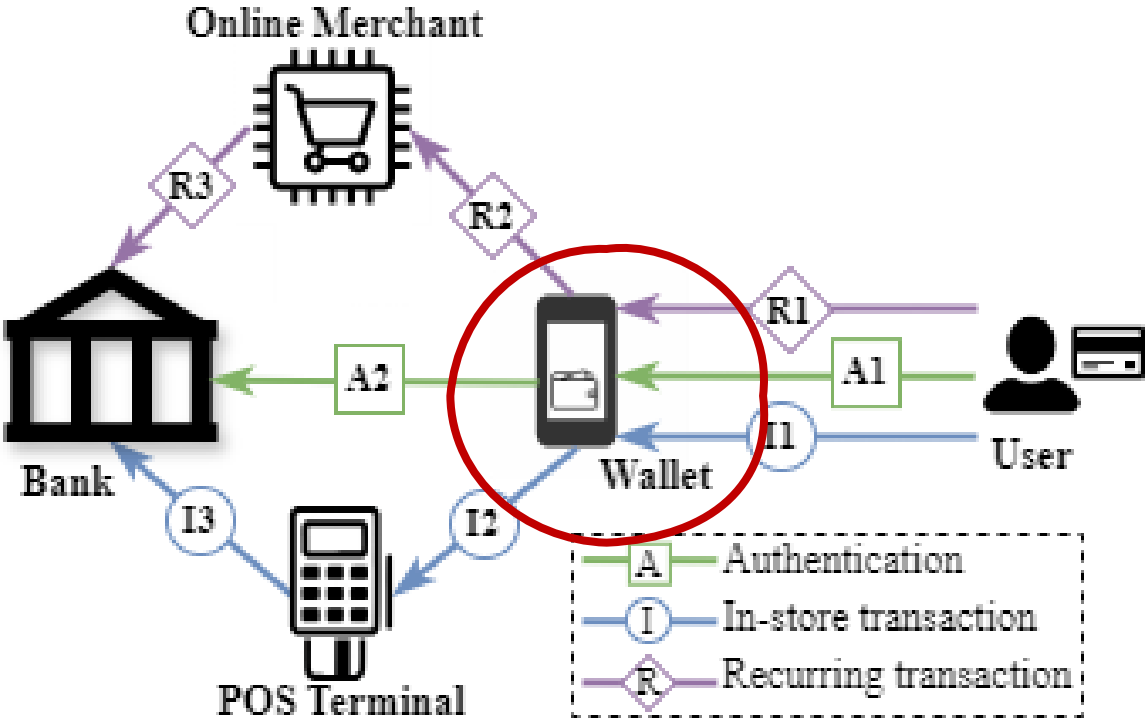
Are digital wallets more secure than physical cards?

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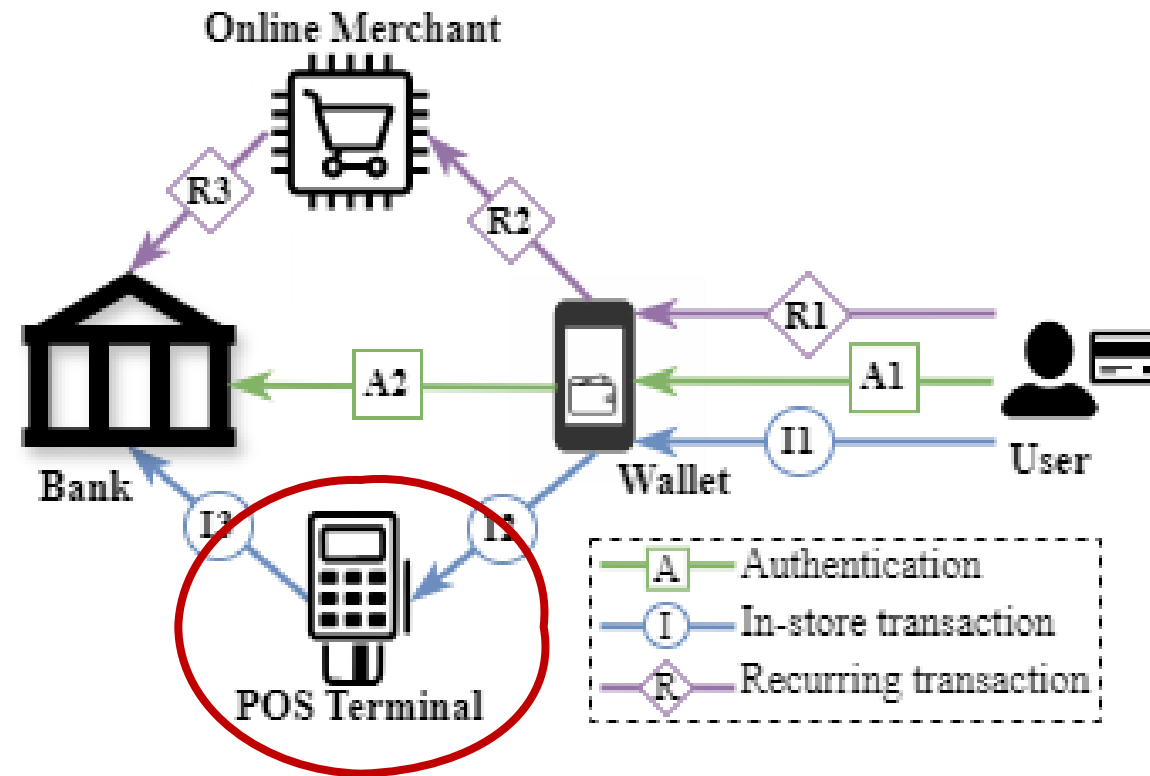
Digital Payments Ecosystem

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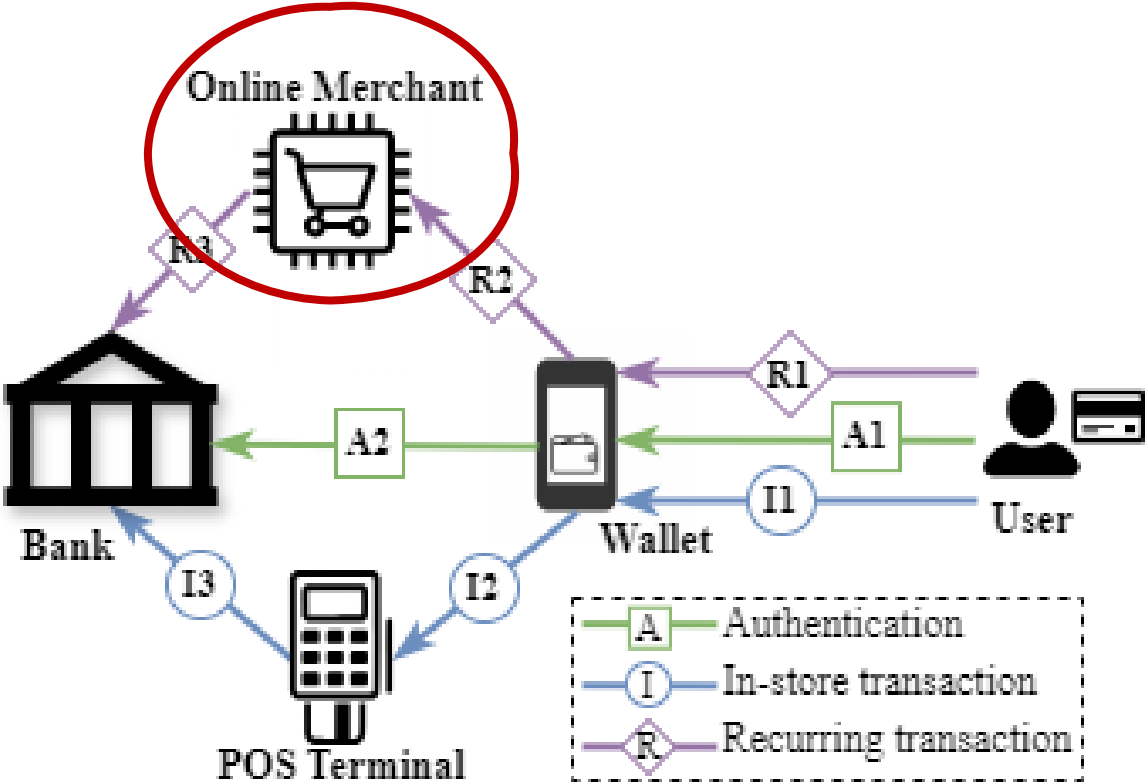
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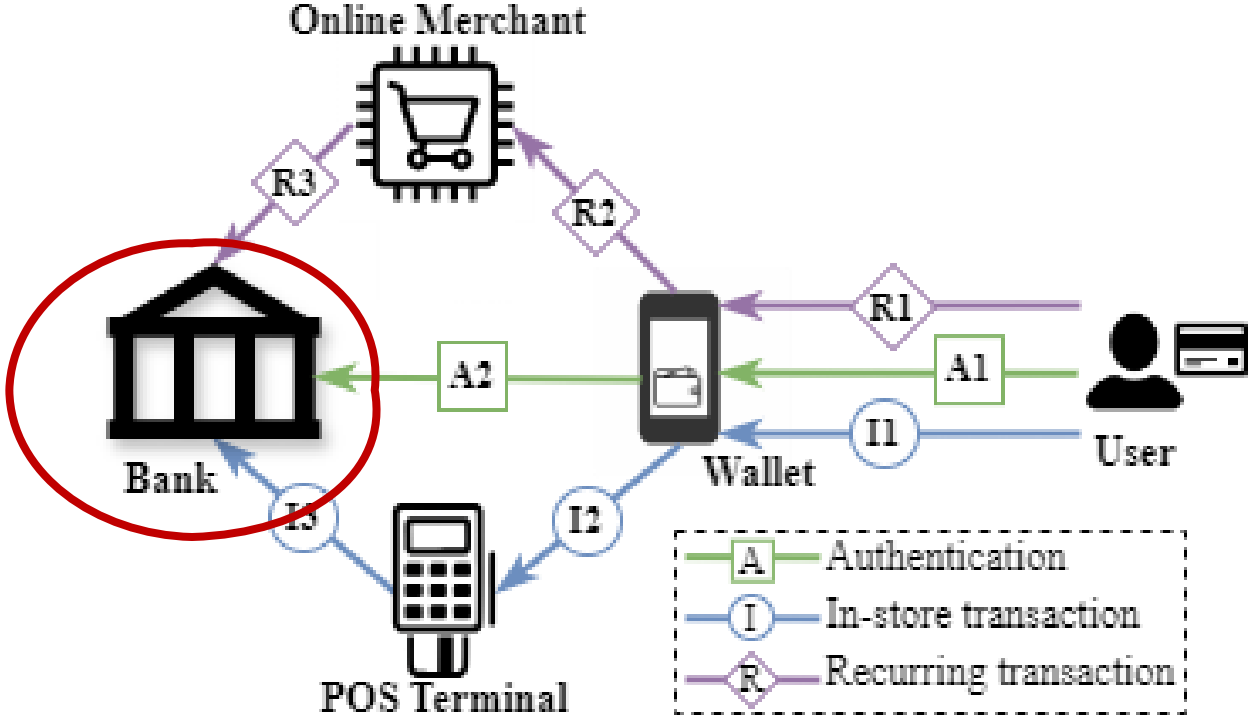
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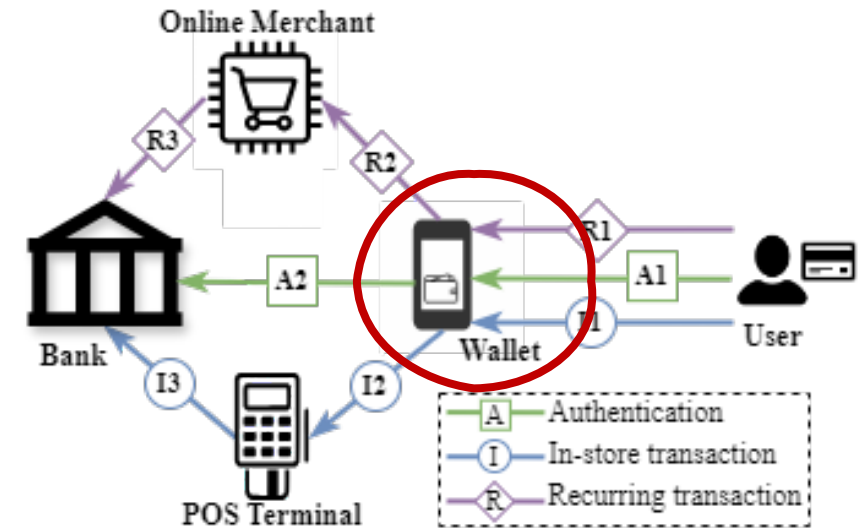
Are digital wallets more secure than physical cards?

Case 1: Adding Card to Wallet



Banks delegate the choice of authentication method to the wallet:

- **Knowledge-based Authentication (KBA)**
 - Billing Address
 - ZIP Code
 - Date of Birth
 - Last four digits of ID (e.g., SSN)
- **Multi-factor Authentication (MFA)**
 - SMS
 - Call
 - Email

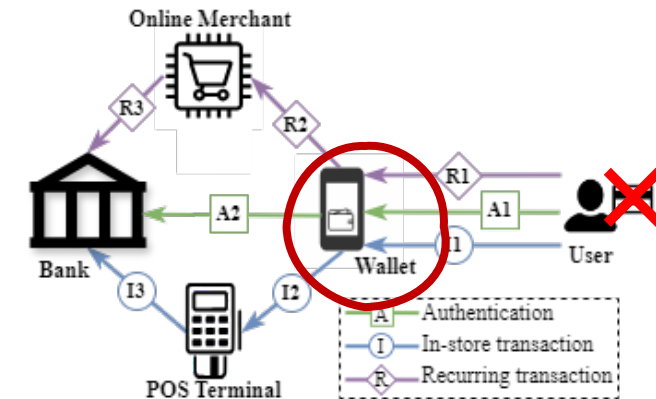


Delegation of authentication allows an attacker to add a stolen card to their wallet using weaker authentication.

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Case 2: Transactions on Locked Card

Card Issuer Banks	Physical Card	Wallet (one-time)	Wallet (Recurring)
AMEX	x	✓	✓
Chase	x	✓	✓
Discover	x	✓	✓
US Bank	x	x	✓
Citibank	x	x	✓
BoAmerica	x	x	✓



Banks have established an unconditional trust with digital wallets.

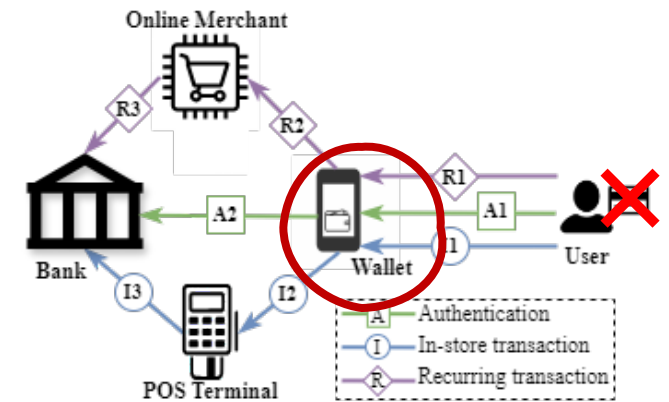
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Case 3: Card Replacement



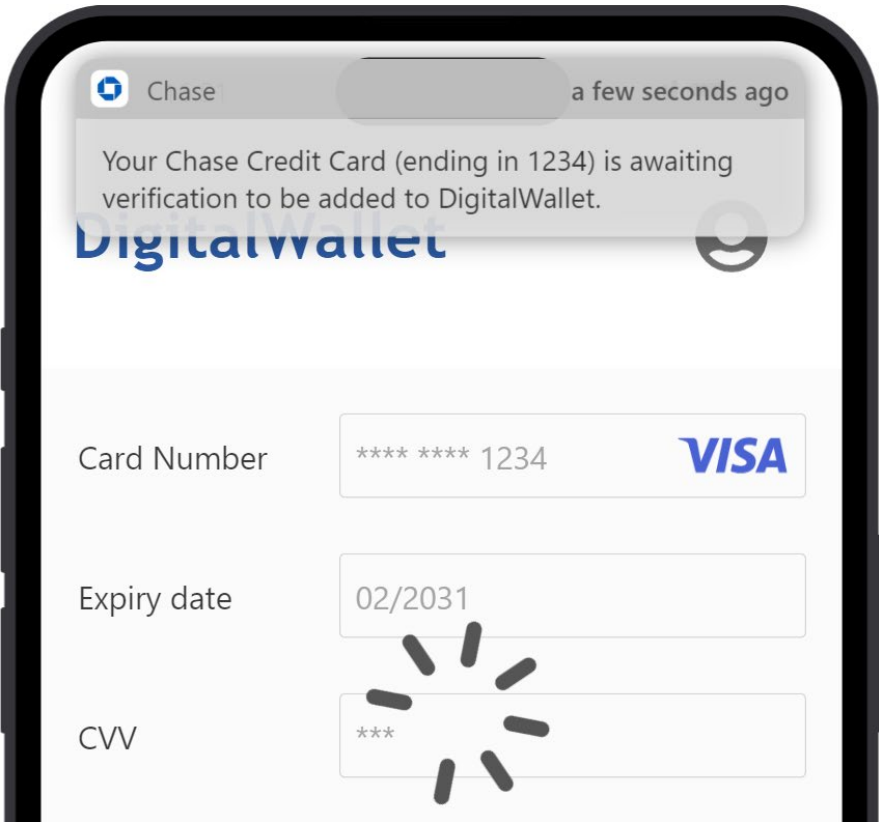
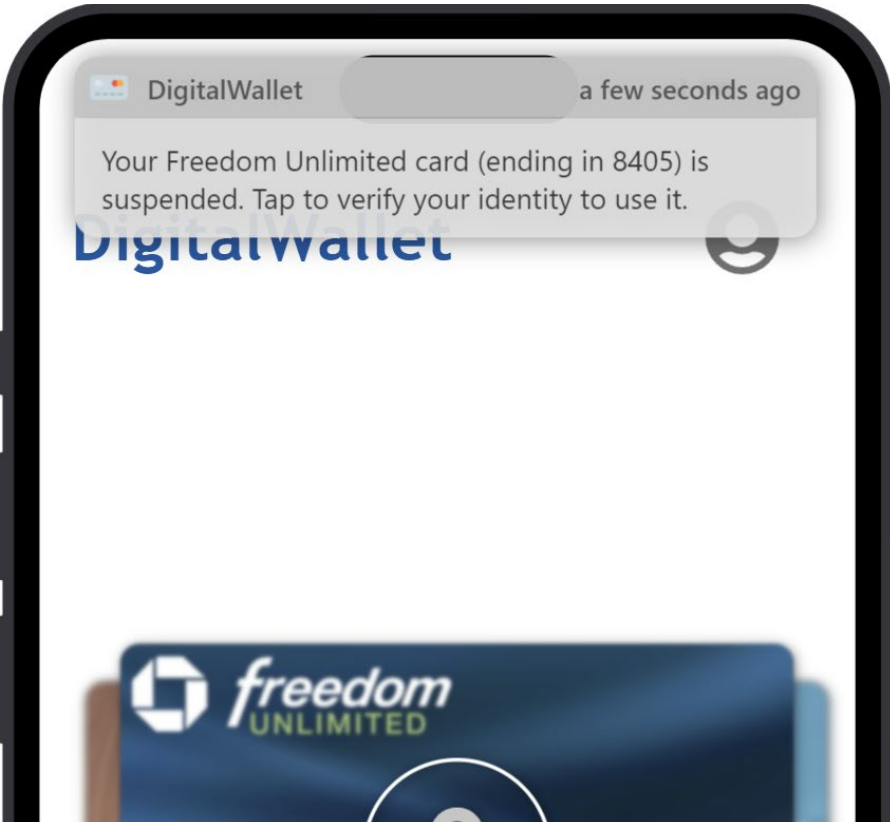
...this update is **automatic**, without any involvement from the Cardholder, it should provide a positive Cardholder **user experience** with the Merchant (Token Requester) and Card Issuer.

EMV® Payment Tokenisation: A Guide to Use Cases v2.1 (\$10.7)



A compromised wallet continues to use added credit **without re-authentication.**

Solution?



Bring human back in the loop!

A network diagram with nodes and connecting lines in blue and orange on a dark background.

Thank you!

USENIX Security'24 Track 1:
Wednesday August 14 @ 2:15 PM

**In Wallet We Trust:
Bypassing the Digital Wallets Payment
Security for Free Shopping**