Trustworthy RFID Technologies for E-Logistics and Internet of Things
可信無線射頻標籤技術在電子物流及物聯網中之應用

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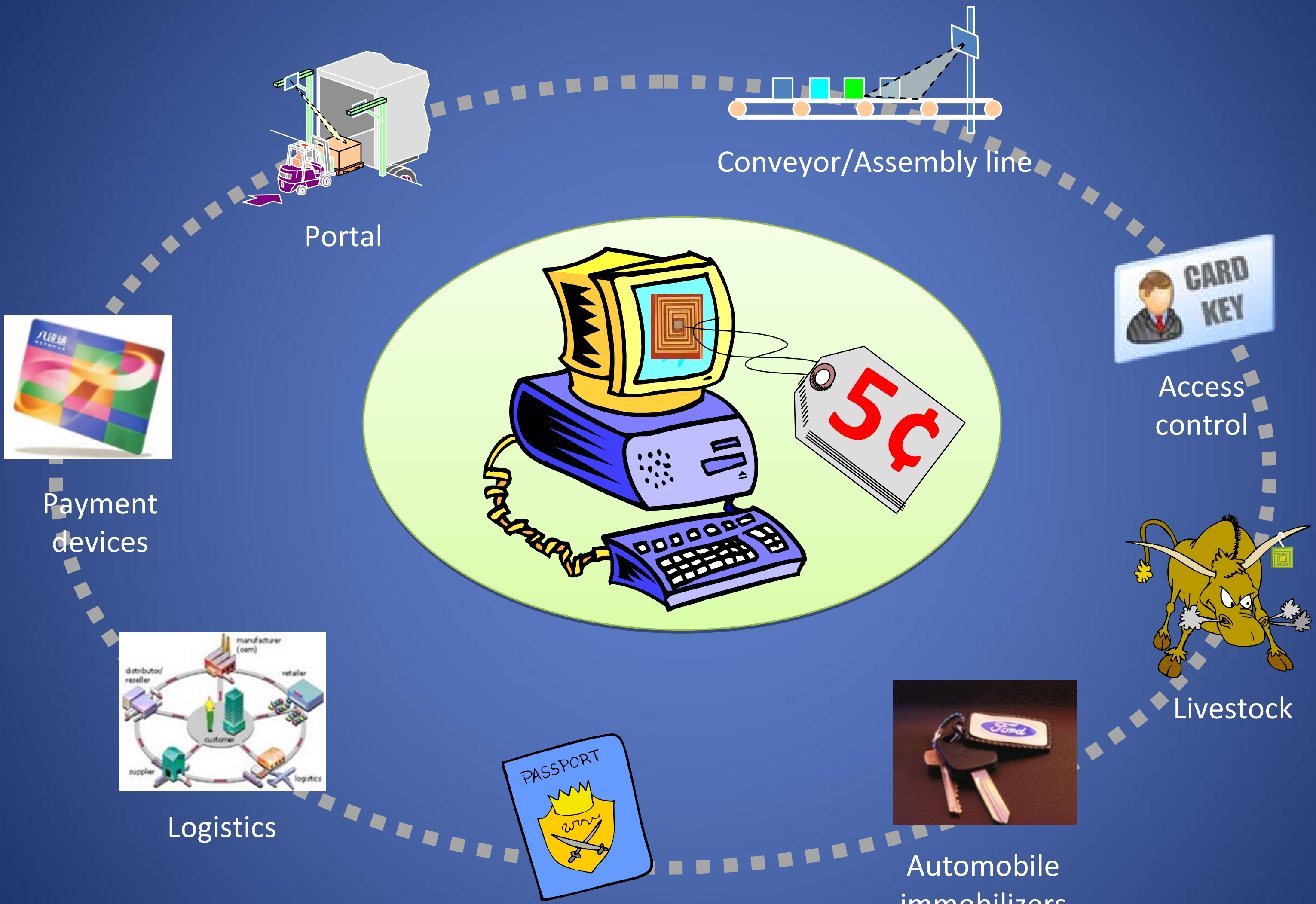
2011.9.23

RFID Overview



Portal

Conveyor/Assembly line

Access control

Livestock

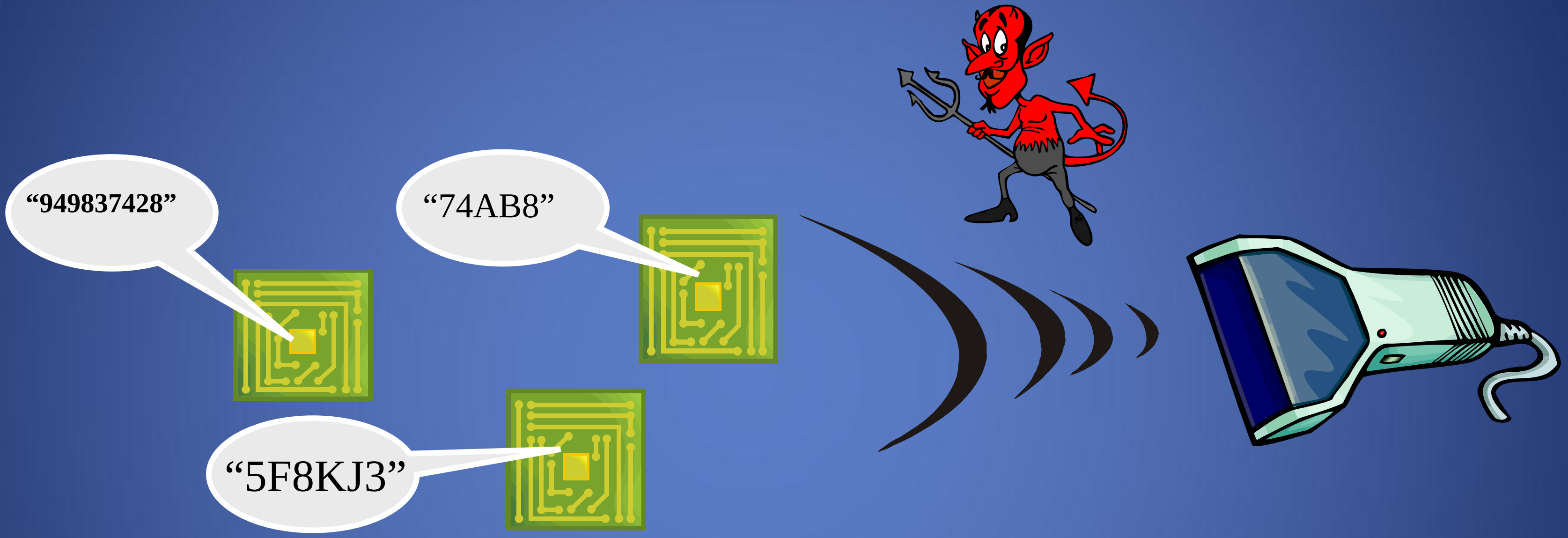
Automobile immobilizers

Passport

Logistics

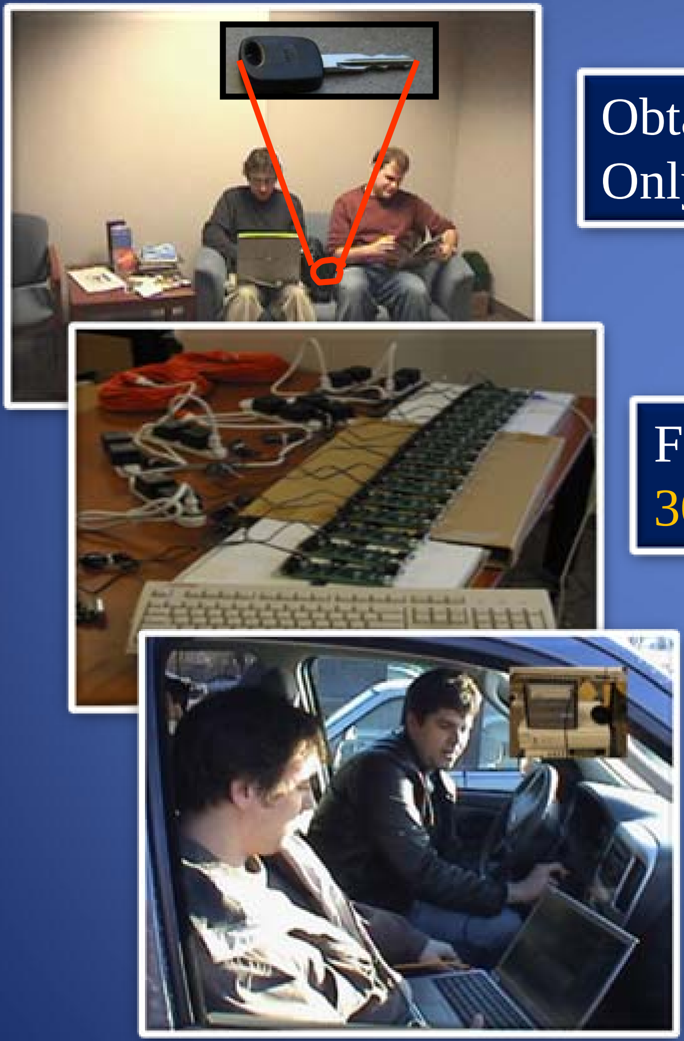
Payment devices

Privacy and Security Concerns



- Passive overhearing, cloning, compromising, etc.
- Setting a password is still not secure!

Cracking EPC Tag Password



Obtain responses from tag.
Only 1/4 second!

Find the access password
30 minutes with 16 parallel crackers!

Simulate radio signals or produce a fake tag with cracked password!

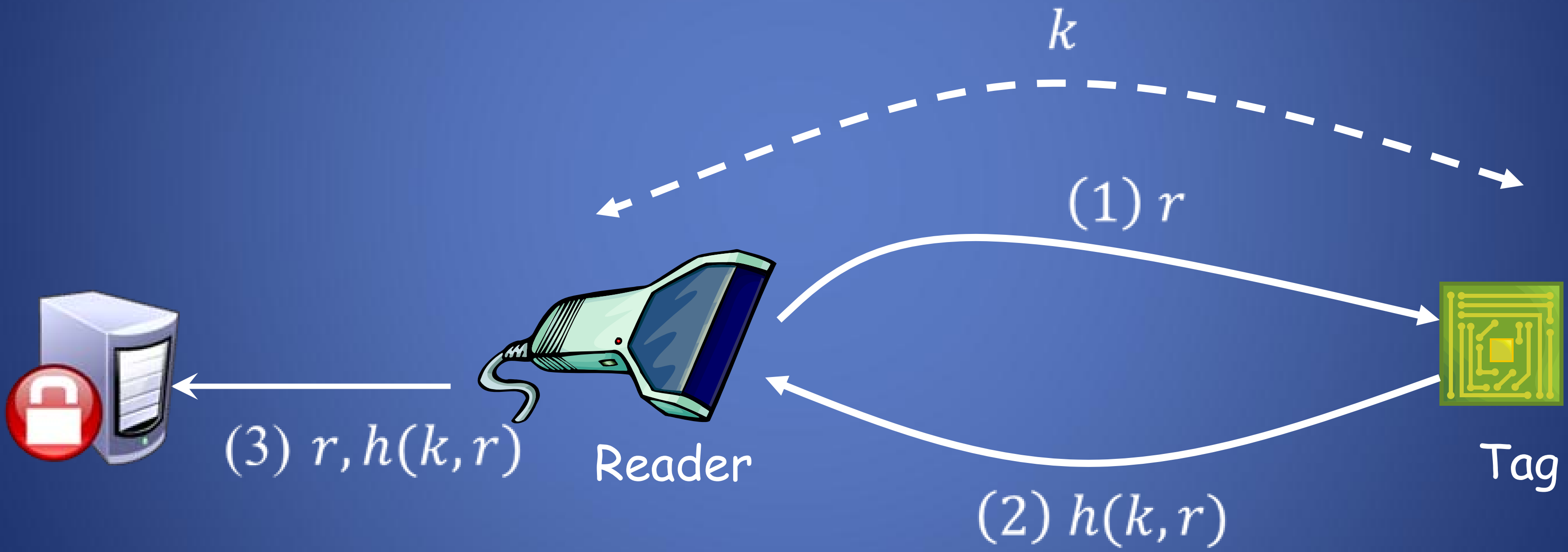
LSCM Project Overview ——GHP/044/07LP

- Phase I: Trustworthy RFID Technologies: Methodology and Practice, GHP/044/07LP, 2008-2010, done
- Ssponsored by ITF Funding
- Supervised by LSCM
- Platform research programs

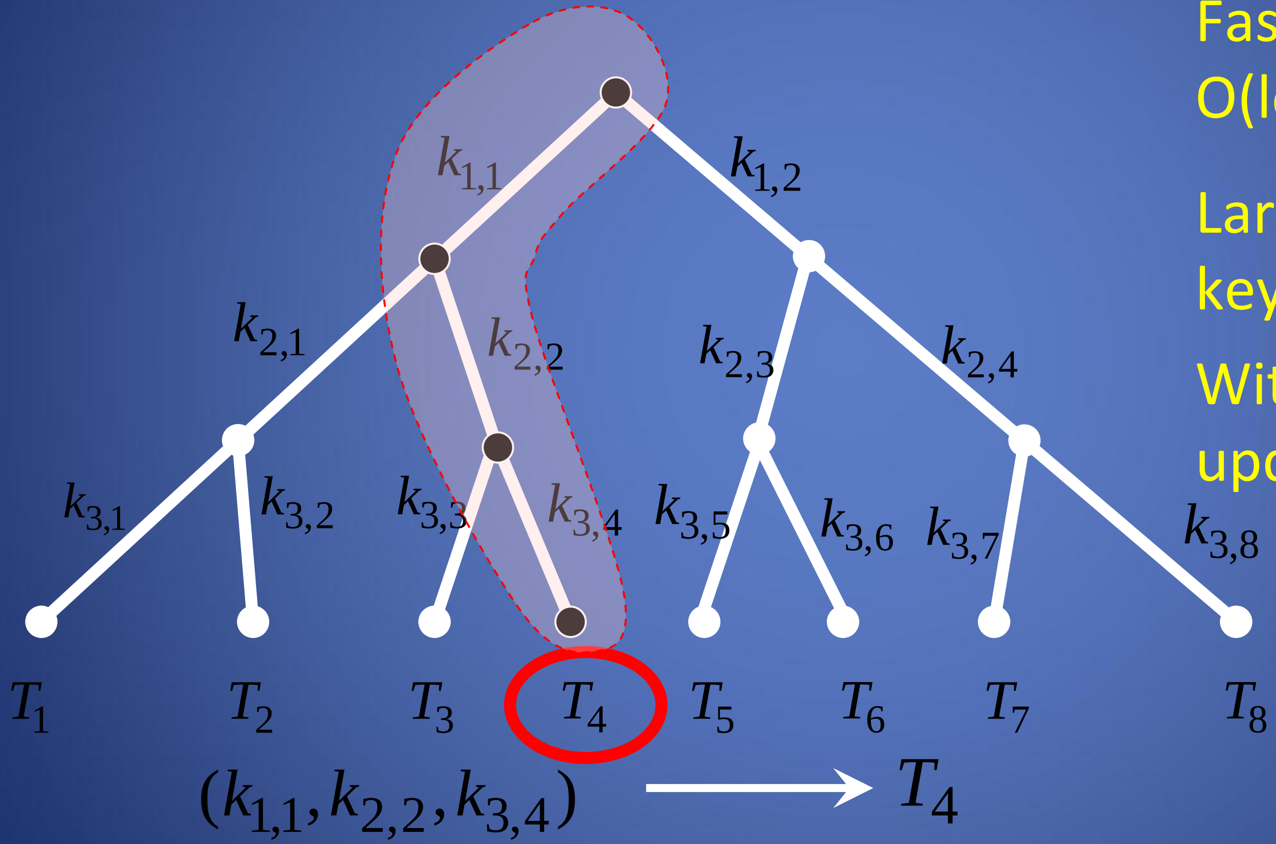
項目發展計劃

- 開發基於RFID安全技術 (Phase I)
- 加解密 (En/Decryption)
- 認證 (Authentication)
- 隱私保護 (Privacy Protection)
- 基於RFID的安全可信架構技術 (Phase II)
- 可信中心 (Trust Center)
- 信任及信用管理 (Trust management and auditing)
- 所有权转移 (Secure Ownership Transfer)
- 可信合作 (Trustworthy Collaboration)

Digital Signature based Solution



秘钥搜索



Fast and scalable, O(log*n*)

Large overhead in key-updating

Without key-updating,

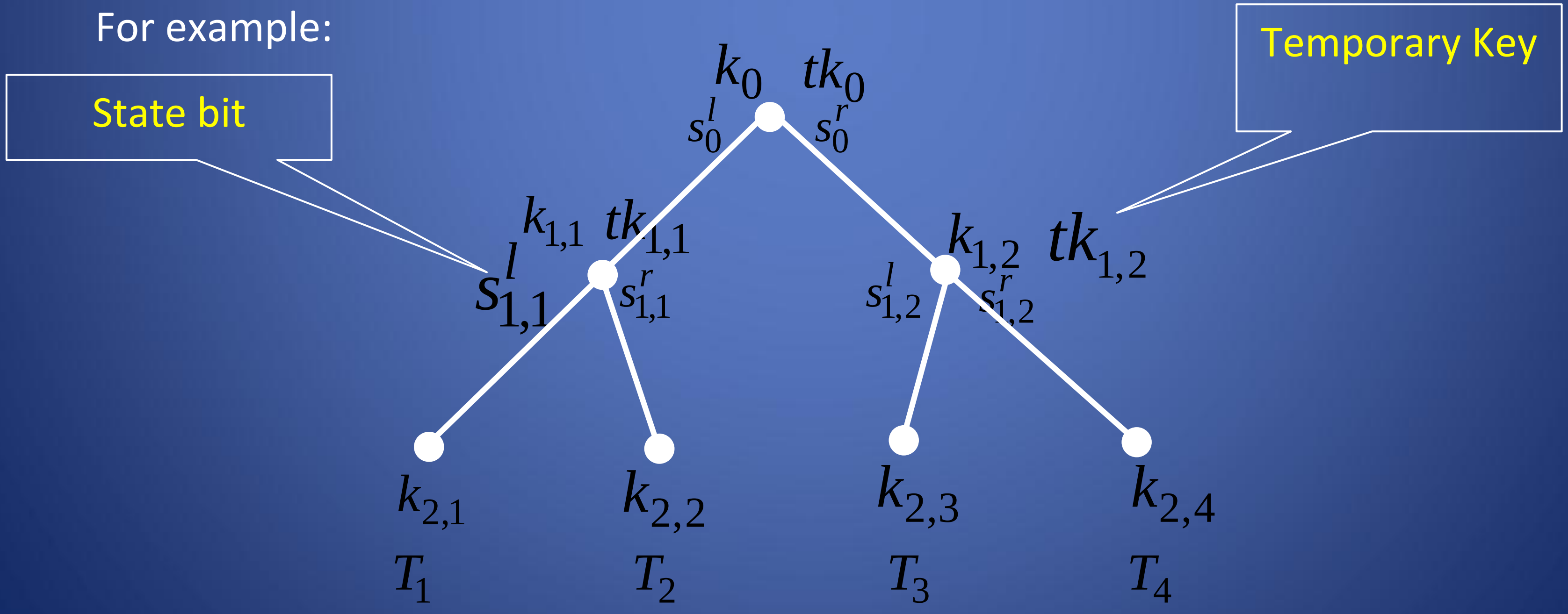
No forward security

Vulnerable to compromising attack

支持秘钥更新的认证协议： SPA

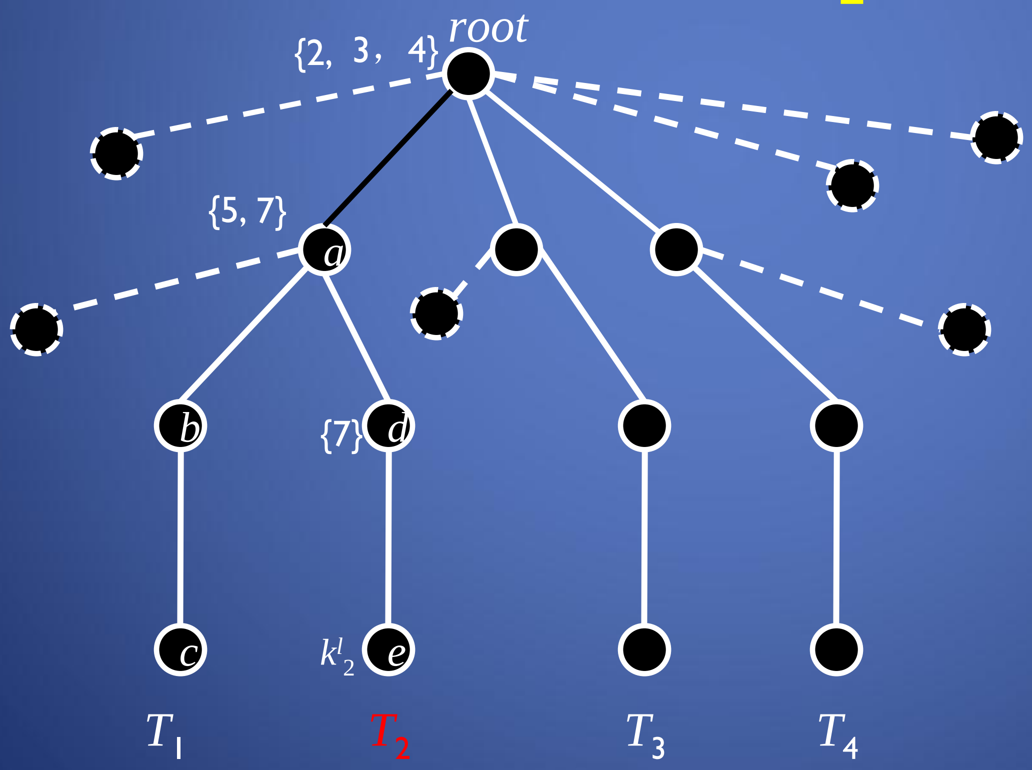
- Temporary keys are used to store old keys.
- State bits are used to record the key-updating status of nodes in the sub-trees.

For example:



ACTION: Anti-Compromising Attacks

- Sparse tree based
- For example, to identify T_2

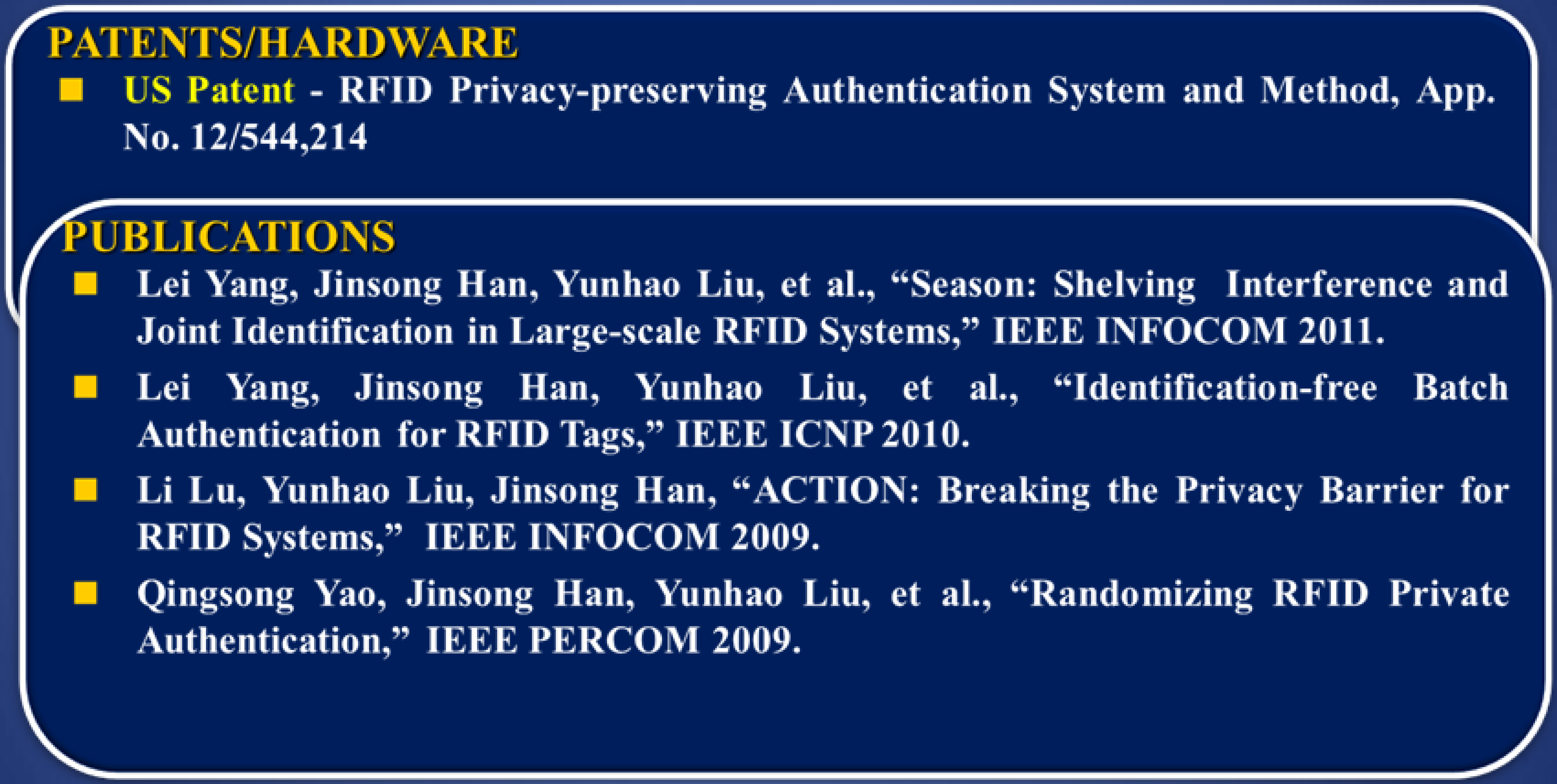


Reader sends: Request, r_1

T_2 replies: r_2, $h(r_1, r_2, 2)$, $h(r_1,r_2,7)$, $h(r_1,r_2,7)$, $h(r_1, r_2, k^l_2)$

$h(r_1, r_2, 2)$
$h(r_1, r_2, 7)$
$h(r_1, r_2, 7)$
$h(r_1, r_2, k^l_2)$

Results



PATENTS/HARDWARE

- **US Patent** - RFID Privacy-preserving Authentication System and Method, App. No. 12/544,214

PUBLICATIONS

- Lei Yang, Jinsong Han, Yunhao Liu, et al., “Season: Shelving Interference and Joint Identification in Large-scale RFID Systems,” IEEE INFOCOM 2011.
- Lei Yang, Jinsong Han, Yunhao Liu, et al., “Identification-free Batch Authentication for RFID Tags,” IEEE ICNP 2010.
- Li Lu, Yunhao Liu, Jinsong Han, “ACTION: Breaking the Privacy Barrier for RFID Systems,” IEEE INFOCOM 2009.
- Qingsong Yao, Jinsong Han, Yunhao Liu, et al., “Randomizing RFID Private Authentication,” IEEE PERCOM 2009.

Preliminary Implementation

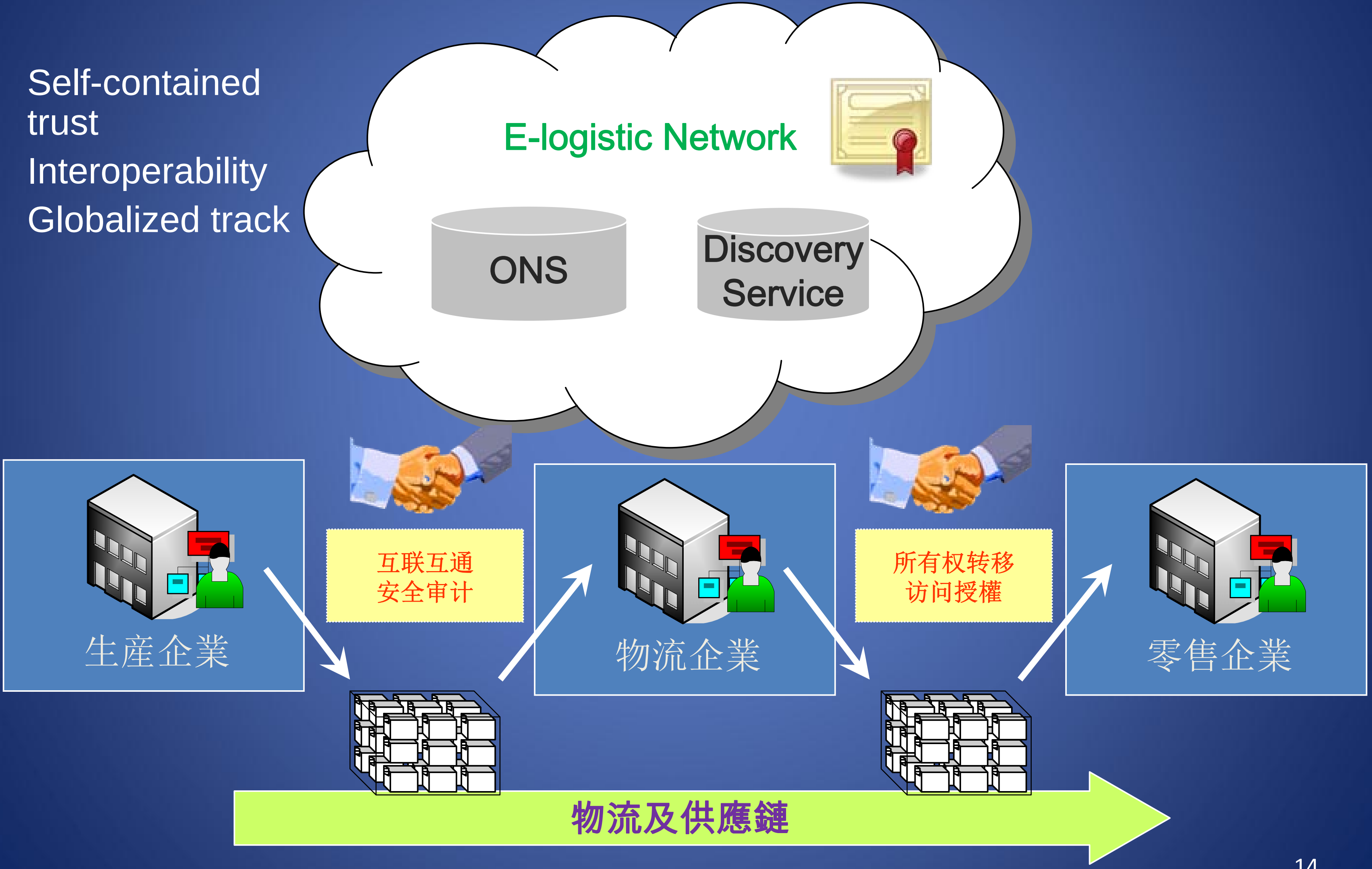
- Preliminary implementation in Xi'an Postal Processing Center
  - One of the 7 key-processing centers in China
  - 20 million packages of mails, 640 million letters, 32 million flat mails, 10.8 million parcel-like mails per year.
- gi

LSCM Project Overview ——ITP/037/09LP

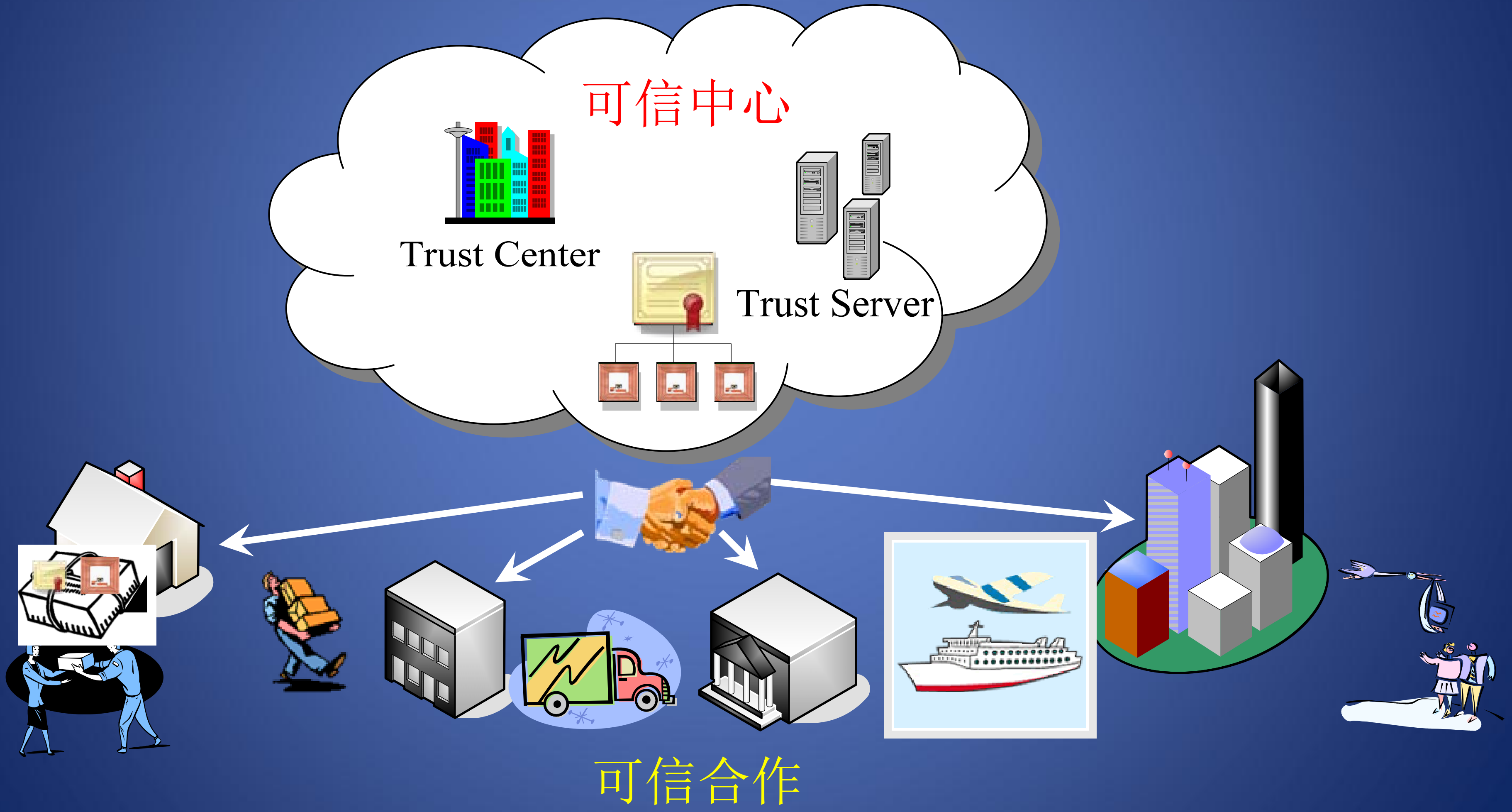
- Phase II: Trust Solution for RFID Enabled Interoperable E-logistics, ITP/037/09LP, 2010-2012, ongoing
- Sponsored by ITF Funding
- Supervised by LSCM
- Platform research programs

安全电子物流

- Self-contained trust
- Interoperability
- Globalized track



面向RFID的可信安全架构技术



防伪需求

海關打擊冒牌藥物		
事項	2009年	2010 年
案件	46宗	22宗
檢獲藥物數量	71417件	55080件
檢獲藥物總值	HK$ 332 萬元	HK$ 495萬元
被捕人數	50人	37人
冒牌西藥投訴	62宗	28宗

Hong Kong Customs seized 55,000 fake drugs, worth around 5M HK$ in 2010.

China loses about 600 billion per year due to fake goods.

According to the WHO, 7 - 10% of the world's pharmaceuticals are counterfeit in developed countries, 25%~50% in developing countries.

Online counterfeit sales will cost businesses $135 billion in 2011

- Internet retailer

5% of world trade!

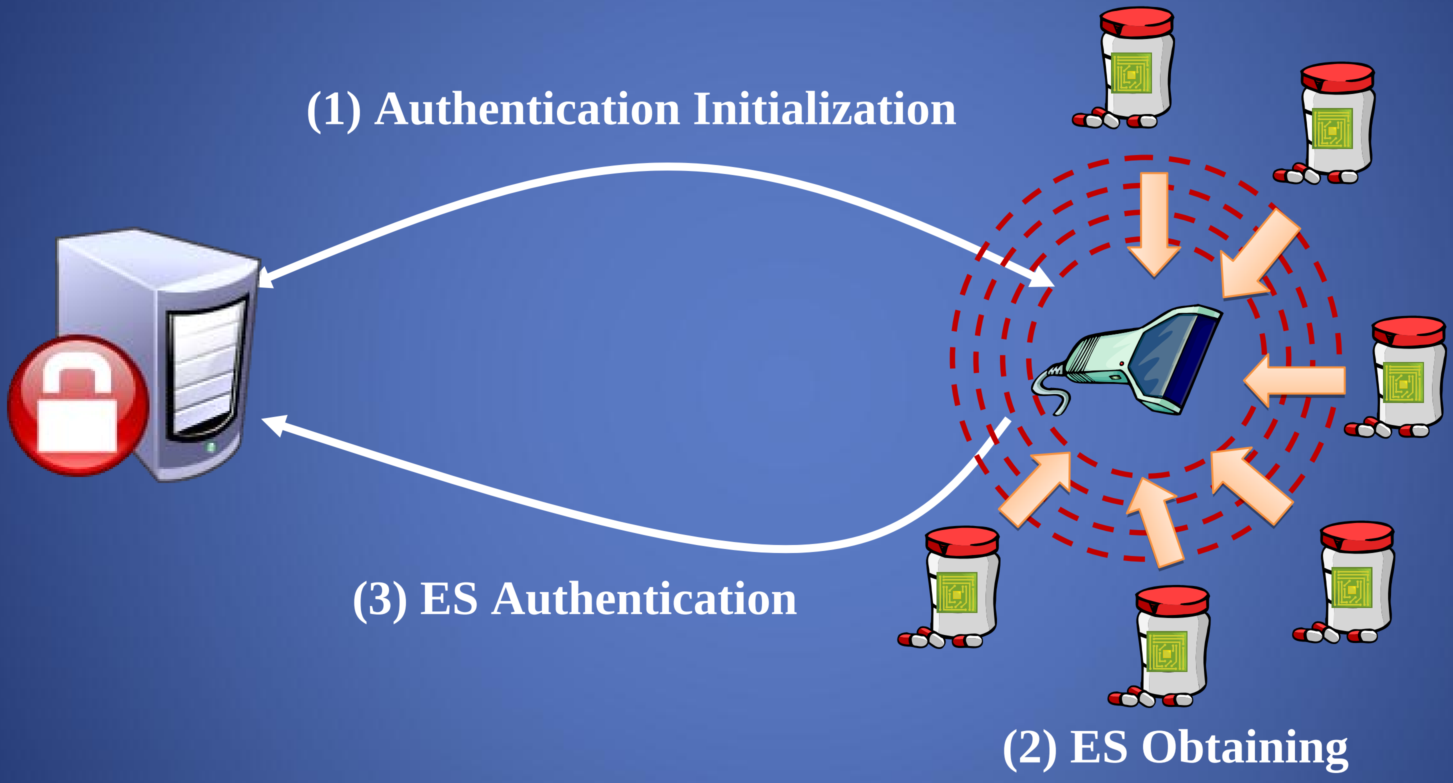
RFID 防伪技术的瓶颈 – 逐一认证

ULTRA THIN PORTABLE SPACE SUITS

- Anti-Collision
- Per-tag Authentication

- Low efficient Identification
- High volume of authentication data
- Significant server workload

Single Echo based Batch Authentication (SEBA) - Overview



(1) Authentication Initialization

(3) ES Authentication

(2) ES Obtaining

The reader abstracts the response results as Echo Sketch.

Dissemination

- **Hong Kong ICT Awards 2011**: Best Innovation & Research Award competition, with the entry, “Identification-Free Batch Authentication for RFID Tags”, Feb 19, 2011.
  - Granted the Silver Award in the Postgraduates & Open stream.
  - Four rounds of competition.

TION CEREMONY 頒獎典禮 15.4.2011
formation Officer
inistrative Region
rade Development Council
香港特別行政區政府 政府資訊科技總監辦公室
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HONG KONG ICT AWARDS
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HONG KONG ICT AWARDS 2011
HONG KONG ICT AWARDS 2011 :
BEST INNOVATION & RESEARCH
(POSTGRADUATES & OPEN)
Silver Award
Han Jinsong, Liu Yunhao, Yang Lei
iProA

Conclusion

- Trustworthy and privacy-preserving RFID computing
- Internet of things (IOT)
- Any time, Anywhere, Any service

Thanks!