Use Case Consolidation

Peter Chunchi Liu

Huawei

Use Case Consolidation

1. Data leakage prevention during wide area transmission
   - While uploading data from Campus to DC
   - While communicating from Campus to Campus
   - While training remotely from DC to AI-DC
   - For data residency considerations (within country border)

2. Orchestrate paths that meets client-customized trustworthy property requirements
   - Reliability/resilience/robustness properties

3. Routing auditing
   - Prove traffic went through **specific elements**
   - Prove traffic went through **elements with certain properties**

Business Use Case	
Operator high-security connectivity for businesses • No-leakage guarantee • Data residency guarantee • Trust/Security Level Assurance Service Function Chaining (SFC) orchestration	A U D I T

Problem Statement

Peter Chunchi Liu

Huawei

Why VPN/TLS/… is NOT enough?

No perception to the trustworthiness of bearing network element, so traffic can be accessed and processed by insecure devices, permitting further attacks.

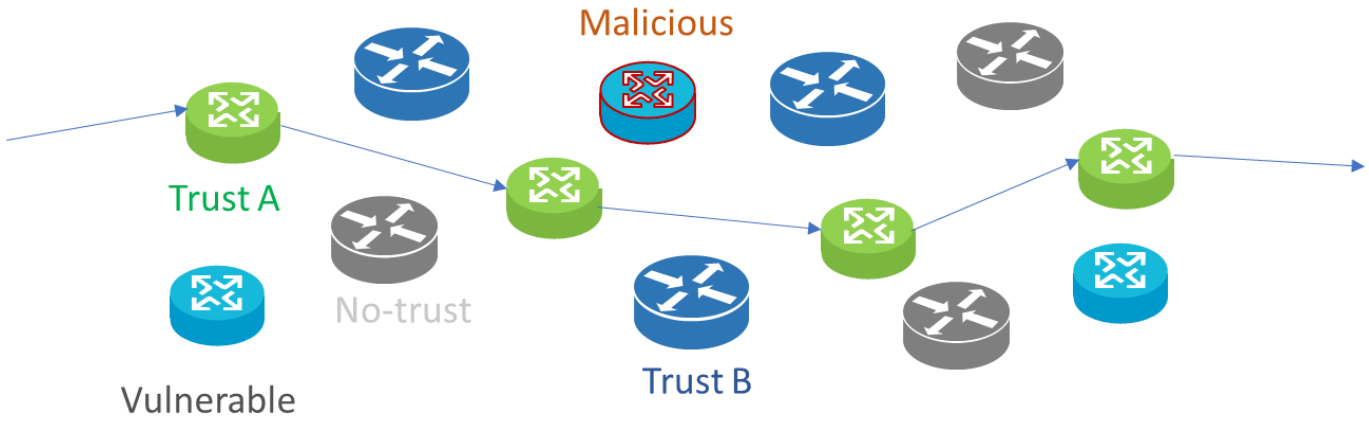
- Crypto-exploit
  - Store-Now, Decrypt Later attacks (Quantum computer attack)
  - Crypto that was secure at the time of deployment but not secure anymore (MD5)
  - Poor crypto engineering/implementation
  - Other unknown crypto vulnerabilities that permits cryptanalysis, obtaining more than negligible information ϵ about plaintext message m
- Plaintext exposure
  - Star-topology for VPNs implies a privileged middlebox (encryption is not end-to-end but segment-to-segment)
- Traffic analysis
  - Traffic analysis for pattern recognition
  - The attack is not about adversary getting all plaintext decrypted, but obtaining any additional information more than it should
- No routing audit statement

Problem Statement

Goal: Achieve dependable hop-by-hop forwarding on top of trusted devices and links only, so to **minimize data leakage/exposure to insecure/untrusted devices**.

Why?: The data, plain or encrypted, if accessed by insecure/untrusted devices, could be copied, cryptanalyzed for decryption or forgery; or dropped.

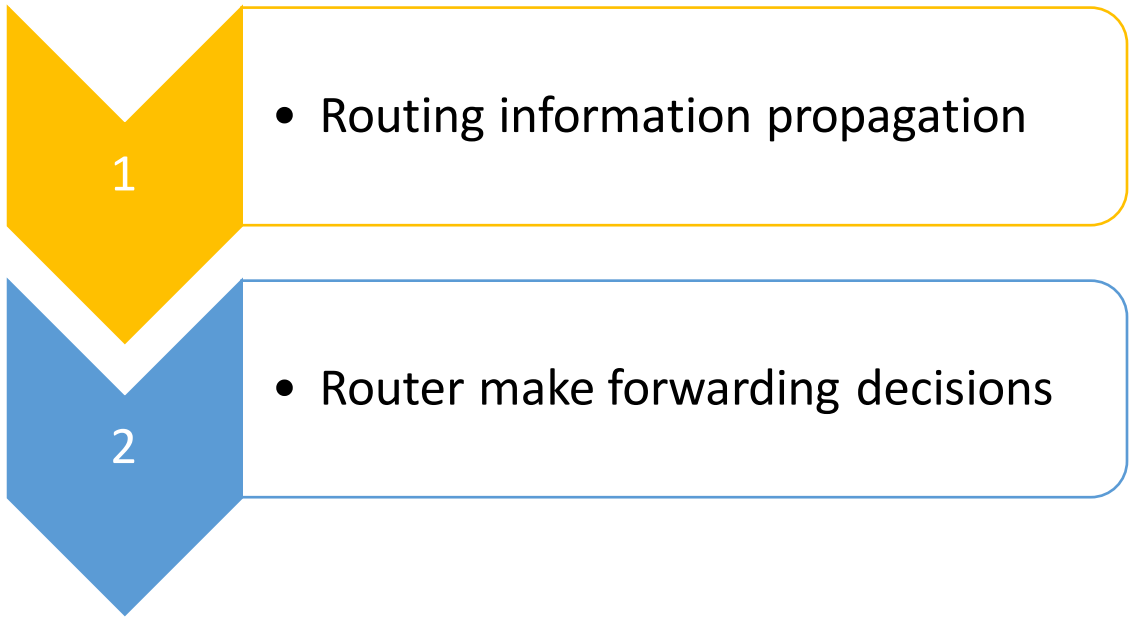
"Trusted" device: Integrity-checked device that executes forwarding dependably.



A long standing problem

Correctly propagated routing information does NOT guarantee correct forwarding

Steps to **dependable hop-by-hop forwarding**



BGPSEC

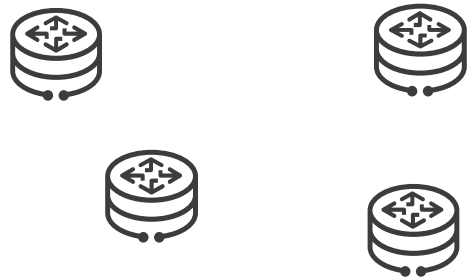
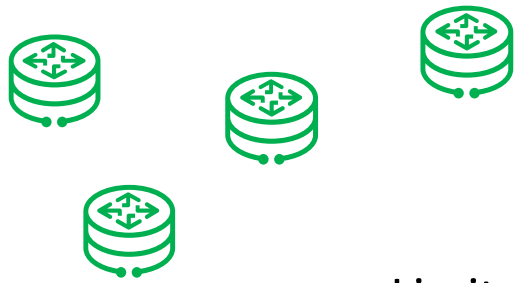
NO guarantee for correct forwarding decisions because we have little to no control of the device execution integrity.

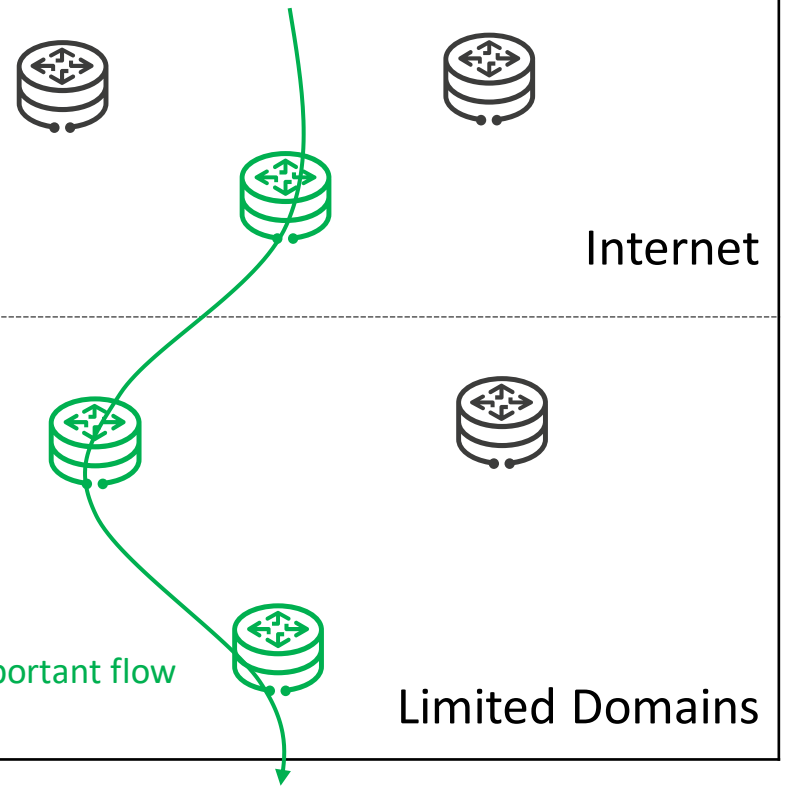
- We (used to) assume router is stateless hop-by-hop, not trusted, provides no security guarantee, doing the best it can.
- Under this assumption, routing security have been forced to narrow its focus on **assuring the correctness of routing information during propagation.**
- Does that really suffice? No! But it was the best we could do.

Why NASR now?

RATS foundationally changed assumptions to routing security

RATS: Establish a level of confidence in the trustworthiness of remote peers

Without RATS	
Security Assumption of Devices	Limitations
Not trusted/no trustworthiness  Internet	Correctly propagated routing information does NOT guarantee correct forwarding
Completely trusted  Limited Domains	Is your device *really* unconditionally trustworthy? • Security by obscurity is bad

With RATS
Security Assumption of Devices
• Device has different trustworthiness properties • Finer-granularity of discretion is now possible


One more step… how to say a device is “trusted”?

- Integrity-checked device from hardware to configuration so as to deliver dependable or deterministic forwarding.

…
RIB
Configuration
Operational State
Software Integrity
OS Integrity
Firmware Integrity
Hardware Integrity
Root of Trust

Trusted? Yes!

- Device with certain security/trustworthiness properties that *meet client requirement*.
- We focus on defining **objective options for clients to choose from.**

1 YANG w/ provenance
2 BGPSEC
3 BGP Flowspec
4 Flap Damping
5 Anti-DDoS
6 uRPF
7 xx ciphersuite/PQ-keys
8 MACSEC
9 Root of Trust

Trusted? Also yes!
If this is what client wants && is attested.

NASR Goal

1. Allow clients to choose desired security/trust properties of his received network service

2. Achieve dependable forwarding by routing on top of only devices that satisfies certain trust requirements

3. Provide **auditable** evidence that certain packets or flows traversed a network path that has certain trust or security properties.