Security

Emerging technologies & open source

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Intros

Mike Bursell
● Security geek
● Red Hatter
● Theologian

Nathaniel McCallum
● Security geek
● Red Hatter
● Theologian
Intros

Mike Bursell
● Security geek
● Red Hatter
● Theologian (Emacs, Protestantism)

Nathaniel McCallum
● Security geek
● Red Hatter
● Theologian (vi, Catholicism)
Security - or risk?
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- Security isn’t an end in itself
- Security helps with risk
  - Monitoring, mitigating, measuring, managing
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- Up and down the stack
  - From kernel...to UI
  - From developer to C-level
Security - or risk?

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● Up and down the stack
  ○ From kernel…to UI
  ○ From developer to C-level
● Through the lifecycle
  ○ Dev… through Ops… through auditing … through design…
Security - or risk?

Open source - what’s different?

- Everybody can see everything
  - Both good and bad

- “Build or buy” is an option

- Risk is difficult to quantify
  - This is something vendors & community need to work on
  - Trade-offs - business vs security
  - Stack, infrastructure, component, even package-level
  - Cyber-insurance
Tech, process and culture
Tech

Basic

Tech is easy*

*yeah, I know: stick with me here

#redhat #rhsummit
Tech

Basic

Tech is easy

- We know how to implement technology
- Open source has won*

- Of course: security tech *isn’t* easy
- But there are options, certifications and standards to help
  - (e.g. the excellent NIST-800 series)

Process

D&D Expert Edition

Process is harder

- Methodologies (DevSecOps, Kanban, Agile, Prince II)
- Project management (stand-ups, videocalls, IRC)
- Management structures (matrix, project-based, specialism)
- External-internal information split (open source, innersource)
- Lifecycle (CI/CD, automation, boundaries/gate checks...)
Culture

**Who’s the Daddy? (AD&D Dungeon Master)**

Cultural changes are **hard**.

- Security folks...
  - Are “special”
  - Are known for “no”
  - Like their ivory towers
Cultural changes are hard.

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- But…
  - Need to be integrated
  - Don’t scale
  - Require management support
  - Are real people, too
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  ○ Are real people, too
Shh! It’s a secret
Confidentiality and secrets

Keeping data secret
● Quantum computing
● Crypto-agility

And sharing it (selectively)
● Zero-sum proofs
● MPC (Multi-party computation)
● Homomorphic encryption
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...and open source is vital.

If we get left behind in standards, it will be a huge step backwards.
“All the world is made of faith, and trust,* and pixie dust”
“All the world is made of faith, and trust,* and pixie dust”

*(with apologies for the Oxford comma)
Trust

Vital for Open Hybrid Cloud

Trust definition

"Trust is the assurance that
one entity holds that
another will perform
particular actions
according to a specific expectation."

http://aliceevebob.com/2017/05/09/what-is-trust-with-apologies-to-pontius-pilate/
Trust

Vital for Open Hybrid Cloud

The fallacy of “zero-trust”

- E.g. blockchain
Trust

Vital for Open Hybrid Cloud

The fallacy of “zero-trust”

- **E.g. blockchain**
  - “What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party.”
  - Satoshi Nakamoto: bitcoin white paper ([https://bitcoin.org/bitcoin.pdf](https://bitcoin.org/bitcoin.pdf)).
Trust
Vital for Open Hybrid Cloud

The fallacy of “zero-trust”

- E.g. blockchain
  - “What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party.”
  - Maybe not a run-time third party, but unless you audit and compile the code yourself (and the toolchain, and the infrastructure), then you have trust in a third party.

Move to “explicit trust”
Trust

*Vital for Open Hybrid Cloud*

Move to “explicit trust”
Trust
Vital for Open Hybrid Cloud

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The Perimeter is dead.
Trust

Vital for Open Hybrid Cloud

Move to “explicit trust”
Explicit trust allows for risk calculations
Trust

Vital for Open Hybrid Cloud

Move to “explicit trust”
Explicit trust allows for risk calculations

Some of the pieces
● Policy
● Host attestation
● Hardware
The Perimeter is dead
What to trust, what not to trust?

Policy management
● Policies
  ○ Networking, authentication, crypto, workload scheduling, ...
  ○ Define: Apply: Validate: Enforce
The Perimeter is dead

*What to trust, what not to trust?*

Policy management

- Policies
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  - Define: Apply: Validate: Enforce
  - “D.A.V.E.”
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● Policies
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● Domain specific
● Definition language required
● Federation, hierarchies complex - danger of “firewalls problem”
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Example: Open Policy Agent (OPA)

https://www.openpolicyagent.org/
The Perimeter is dead

*What to trust, what not to trust?*

Trust in the host
The Perimeter is dead

What to trust, what not to trust?

Trust in the host
- Attestation
- Measurement
- Hardware root-of-trust

Example: Keylime (attestation)

https://keylime.dev/
The Perimeter is dead
What to trust, what not to trust?

Hardware: for when you’re really paranoid
The Perimeter is dead

What to trust, what not to trust?

Hardware: for when you’re really paranoid

- Card-readers
- HSMs (Hardware Security Modules)
- TPMs (Trusted Platform Modules)
- TEEs (Trusted Execution Environments)
It’s DEMO time!
Announcing “Enarx” (almost)

https://github.com/enarx
Who - and what - to trust

Classic cloud virtualisation architecture

Each colour is a different trust relationship.

(And they all need to be trustworthy.)
Who - and what - to trust

Standard cloud container architecture

Each colour is a different trust relationship.

(And they *all* need to be trustworthy.)
What will I see?

“Client”

Tenant

“Server”

Host

Secure VM
What will I see?

“Client” — Tenant

Attestation handshake

“Server” — Host

Secure VM
What will I see?

“Client”

Tenant

“Server”

Host

Secure VM

Attestation handshake

Code + data delivery (encrypted)
What will I see?

"Client"

Tenant

"Server"

Host

Secure VM

Code runs

Attestation handshake

Code + data delivery (encrypted)
Now - the demo...
What did I just see?

- "Client"
  - Tenant
  - Attestation handshake

- "Server"
  - Host
  - Secure VM
    - Code runs
  - Code + data delivery (encrypted)
Who - and what - to trust

Enarx architecture

Each colour is a different trust relationship.

Many fewer pieces.

We aim for Enarx to be small and fully auditable (and open source, of course!).
Four threat vectors

Hypervisor attacks on guest

1. Reading CPU registers
2. Writing CPU registers
3. Moving memory pages
4. Selecting decryption location
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Hypervisor attacks on guest

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Solved by SEV-ES (future AMD roadmap)
Red Hat working with AMD to mitigate
Our design is not vulnerable to this class of attacks
Is this all AMD-specific?

Well, it is for now...

https://github.com/enarx
Wrap up
Thank you

Enarx on github  https://github.com/enarx

Blogs:  https://aliceevebob.com/
        https://npmccallum.gitlab.io/

LinkedIn:  https://www.linkedin.com/in/mikebursell/

Twitter:  @MikeCamel
THANK YOU

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