# Do I know you? Can I trust you?

## Building Trustworthy Systems

**Overview**

Stacy Cannady – Cisco  - scannady@cisco.com

TCG Board of Directors

May 2014

# Agenda

Challenge

How Does TCG Define Trusted Systems?

Designs and Architectures

Gazing into the Crystal Ball

# Challenge: Why are Trustworthy Systems Needed?

Changing
Business Models

Dynamic
Threat Landscape

Complexity
and Fragmentation

**Bottom line: When all you have is an IP address, how do you answer these two questions about what is on the other end:**

- **Do I know you?**
- **Can I trust you?**

# Trust But Verify

## In the uncertain world of software, how does one create trust?

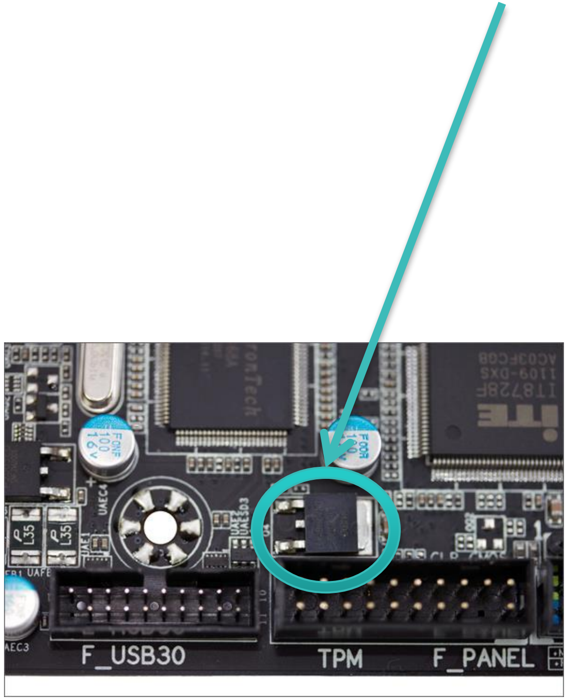
- A standard business practice is to reduce risk by building relationships with suppliers and customers
  - Meet each other – establish proof of identity
  - Get to know each other – establish knowledge of character

- How does this map to the digital world?
  - Establish proof of identity – exchange of digital certificates
  - Establish knowledge of character – measure integrity of the software inventory on the platform – is that inventory what you expect to find?
  - Perform these exchanges with the assistance of dedicated security hardware

……..“Dedicated security hardware”?  Like what?

# The Trusted Platform Module (TPM) – a standards-based hardware security module – the foundation of platform security

- The TPM is a hardware security module that protects keys, integrity measurements, digital certificates and other small secrets.
- It potentially can be used in any computing device that requires these functions.
- It is assembled onto the motherboard of the platform, or can run as software in a secure operational context.
- TPMs are now shipped in almost all enterprise end point computers
- TPMs are also found in several tablets and in a handful of other platforms such as smartphones, ATMs, servers and gaming machines



# A little more specificity – What does a TPM get me?

- Provides a hardware foundation for trusted platforms
- Provides interoperable interfaces that support trusted services
  - **Authentication – Answer the question of who this platform is with a HW-protected digital signature**
  - **Access control – Protect secrets against software-based attack**
  - **Platform/application integrity – Provide HW-protected evidence that the software has not been tampered with**
  - **Cryptographic services – signing and encryption, symmetric and asymmetric crypto**
- Secure repository for cryptographic keys
- Secure storage and reporting of measured state of resident software

# Sold!

Where do I get TPMs and How do I Use/Manage Them?

A High Security use case on PCs

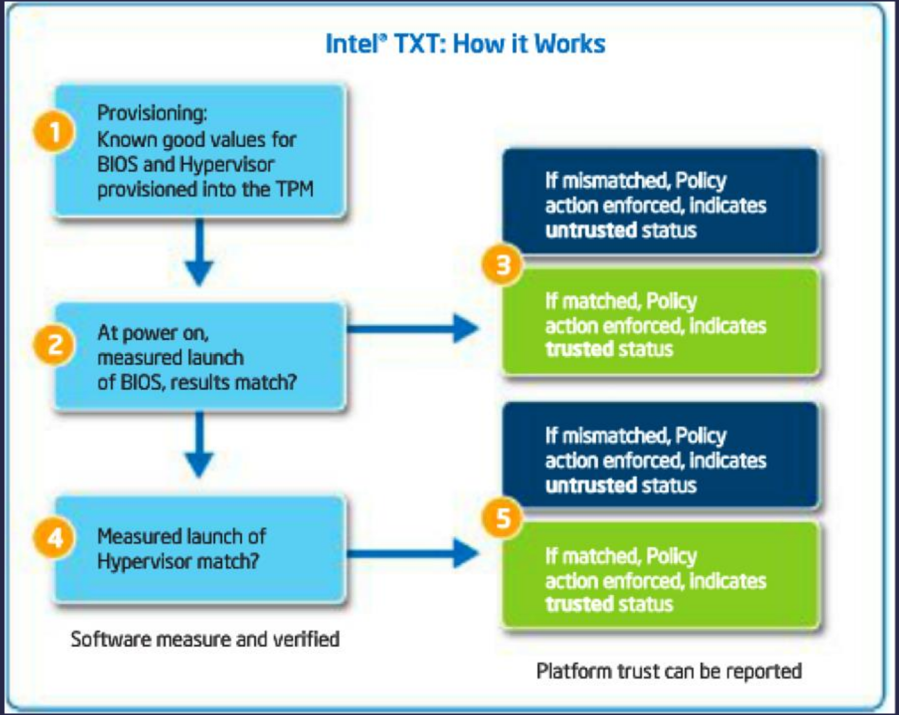
Enhancing Visibility and Control over where work is done in the Cloud

# Intel Trusted eXecution Technology (TXT) on PCs and Servers

## TXT – What does it do?

- The Sysadmin selects and configures a BIOS for the platform
- He uses Intel tools to measure and sign the BIOS
- The configured BIOS is installed on the platform, along with Golden Measurements
- Repeat this for the Hypervisor

- At power on, TXT HW and FW validate the BIOS and Hypervisor before they are booted



Intel® TXT: How it Works

1 Provisioning: Known good values for BIOS and Hypervisor provisioned into the TPM

2 At power on, measured launch of BIOS, results match?

3 If mismatched, Policy action enforced, indicates untrusted status

If matched, Policy action enforced, indicates trusted status

4 Measured launch of Hypervisor match?

5 If mismatched, Policy action enforced, indicates untrusted status

If matched, Policy action enforced, indicates trusted status

Software measure and verified

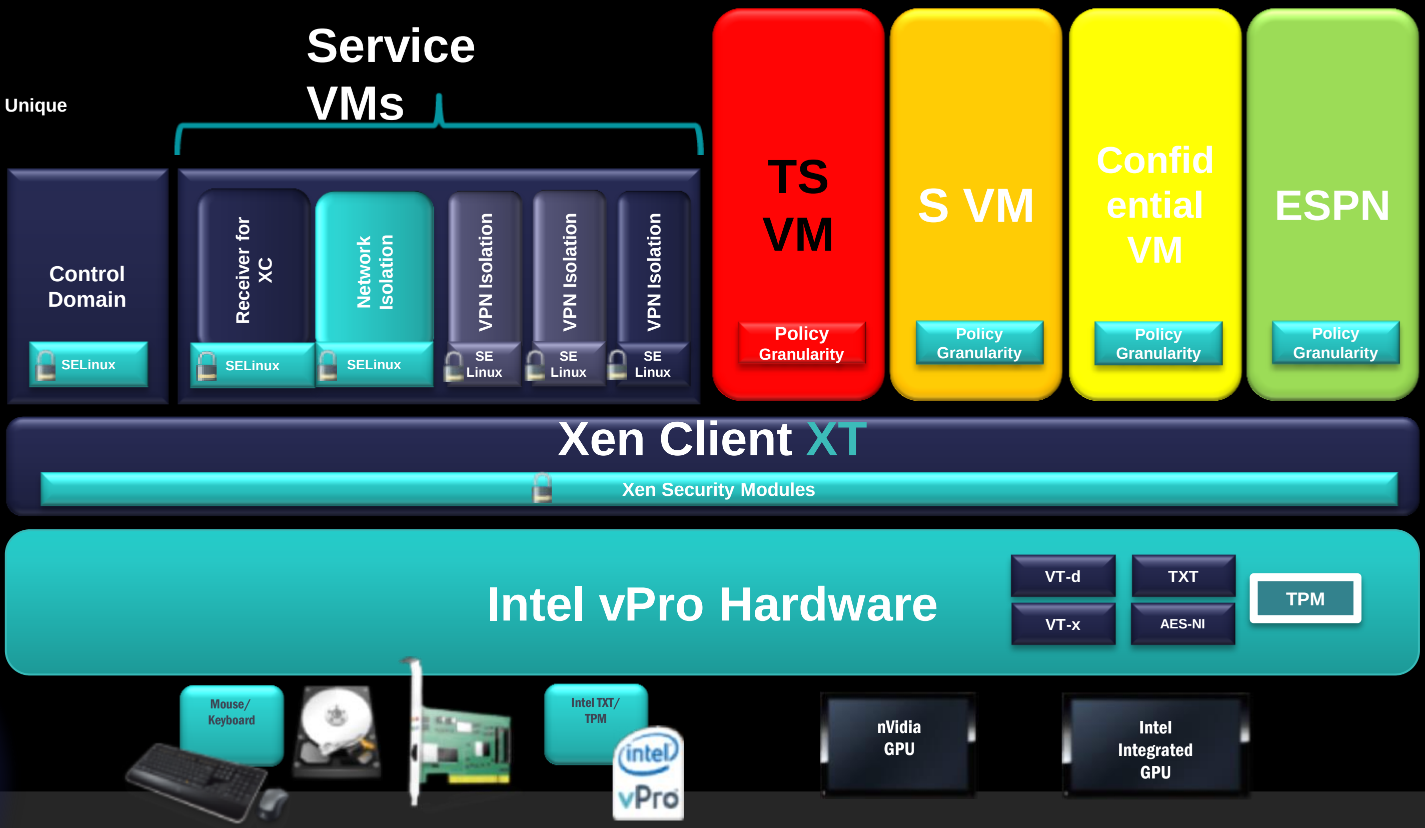
Platform trust can be reported

http://embedded.communities.intel.com/servlet/JiveServlet/showImage/38-5763-5040/Fig5.png

# AFRL’s SecureView 1.2 Architecture

■ XenClient

■ XenClient XT Unique



The integrity of blue components is validated Intel HW and the TPM

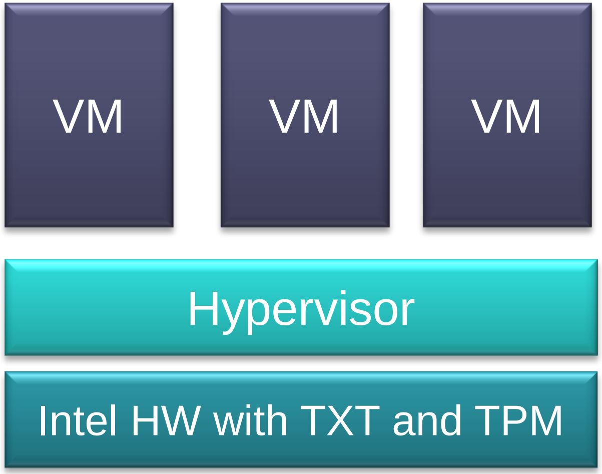
TPM enabling high security and isolation on a PC

# TPMs and the Cloud

## Applying the SecureView Model to Cloud Servers

- SecureView uses Intel TXT and the TPM to validate BIOS and the Hypervisor at start
  - You always know you started a trusted Hypervisor and all of its services
  - If one of those services continuously validates runtime integrity, you know the hypervisor remains trusted
- If VMs are also integrity checked at start, then the VM is also trusted
  - Same deal – if one of the services in a VM validates runtime integrity, you know the VM remains trusted
- Defense against zero-day attack: Integrity validation is focused only on detecting ANY  uncontrolled change – not any specific change

# Example Cloud Stack at System Start



VM

VM

VM

Hypervisor

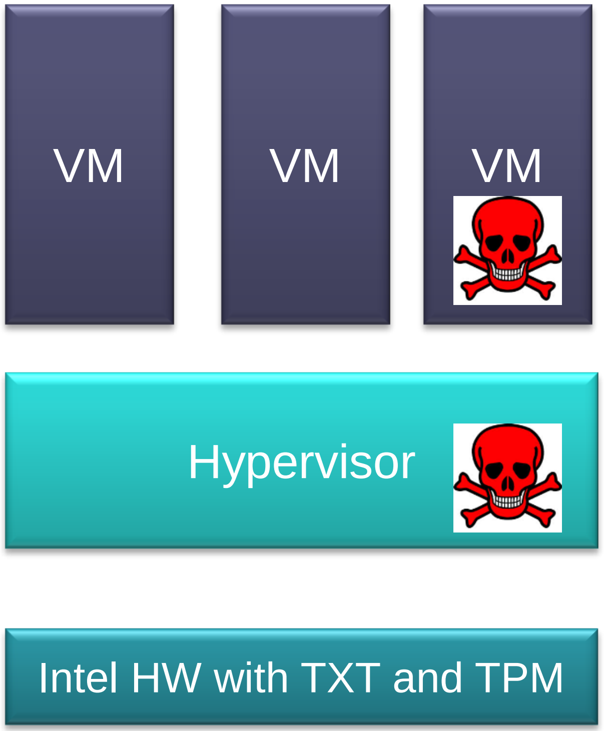
Intel HW with TXT and TPM

**Integrity of VM measured at start and runtime integrity validated as for hypervisor**

**Runtime integrity validated by Trapezoid or the like**

**TXT and TPM validate integrity of Hypervisor**

# Protection of the Cloud Stack in Execution



VM

VM

VM

Hypervisor

Intel HW with TXT and TPM

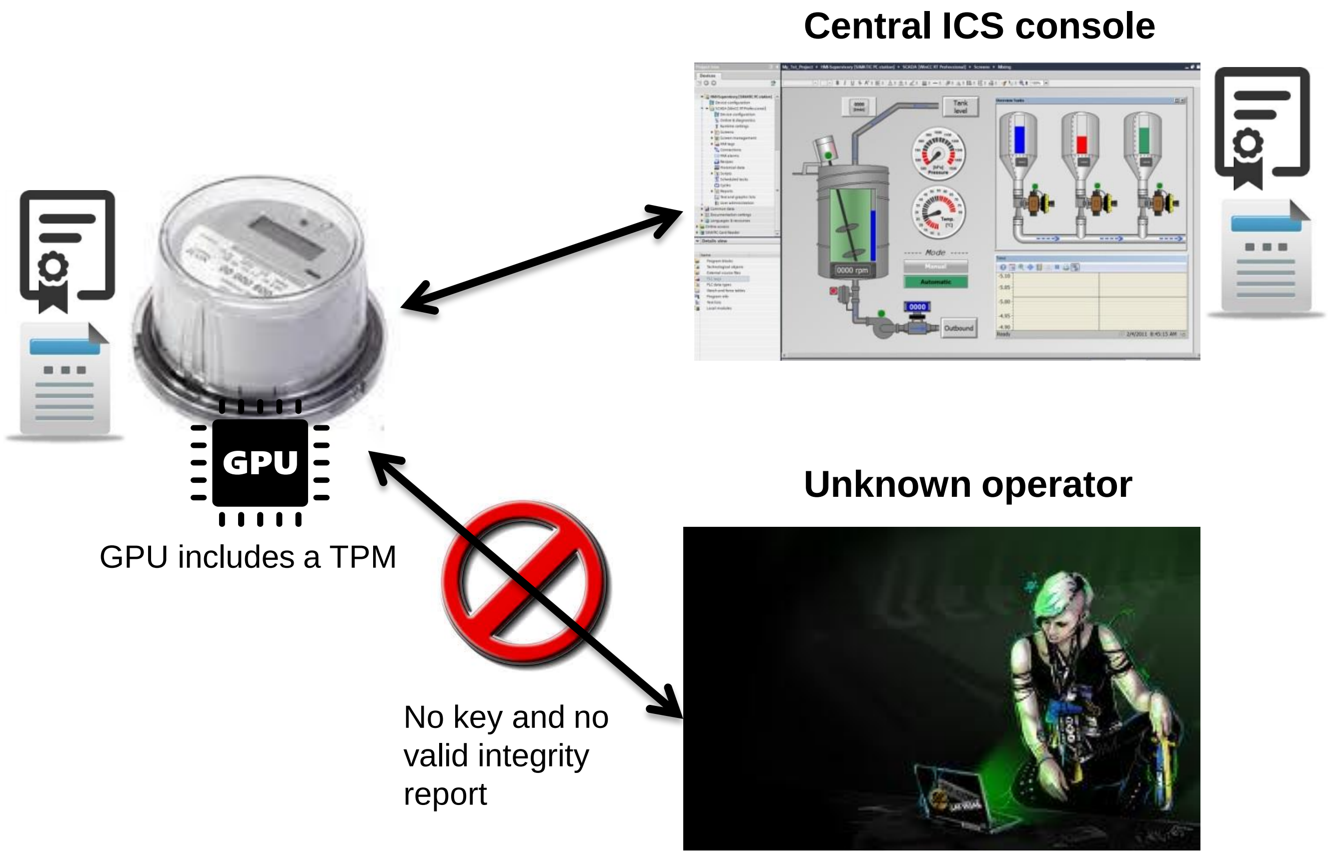
**Runtime integrity validation monitors uncontrolled changes to processes in execution – any change is seen, therefore we have (limited) Zero-Day defense**

- **Continuous integrity validation gives no insight into the nature of the change.**
- **Operationally, that is generally unimportant.**
- **The rapid discovery that uncontrolled change occurred, IS important.**

**The HW is mostly out of the loop during runtime (until TCG's DRTM spec is implemented**

# Intel Trusted Compute Pools

# Teaching Embedded Systems About Stranger Danger



Central ICS console

Unknown operator

GPU includes a TPM

No key and no valid integrity report

Design:

- Authentication protocol enhanced to require
  - Certificate exchange
  - Integrity report exchange
- At session start, each side
  - Signs a nonce and their integrity report using a HW protected key
  - Validates the provided report
- No match, no session
  - No session, no hack

# Questions?

TRUSTED COMPUTING GROUP™

www.trustedcomputinggroup.org

scannady@cisco.com

cisco