Summary of Breakout Sessions
and
Wrap-up Discussion

CREDC Industry Workshop

March 27-29, 2017

CYBER RESILIENT ENERGY DELIVERY CONSORTIUM

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Breakout Topics

Cyber Supply Chain Provenance and Protection – Dennis Gammel, SEL

Engineering Secure EDS – Zach Tudor, Idaho National Lab

PKI in Current and Emerging EDS – Sean Smith, Dartmouth College

Supply Chain Security

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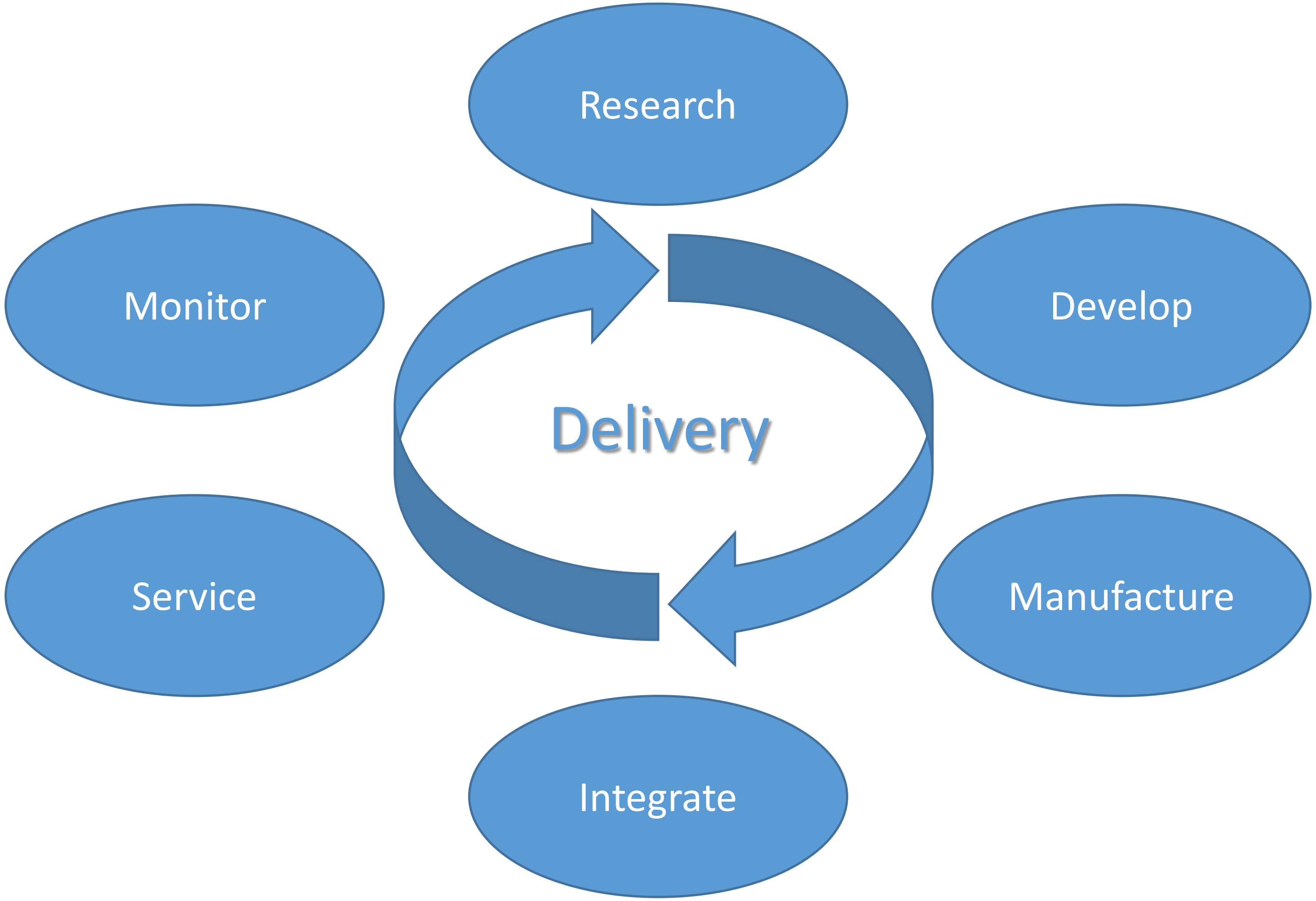
Product Development Life Cycle Stages



- Personnel
- Complexity & Cost
- Crossover Technology

Supply Chain Risks to Consider

- Environmental
- Economic
- Poor Communication
- Unreliable Delivery
- Inconsistency
- Labor Disputes
- Political Instability
- Obsolescence
- Interdiction
- Counterfeit
- Cover Functionality

Assessing Supply Chain

- Evaluate Suppliers
  - Reputation
  - Documented Features
  - Development Process
- Assess Products
  - Product Tracking
  - Certifications
- Assess Chain of Custody
  - Supply Chain Length
  - Personnel Trust
  - Delivery Time
  - Packaging

Areas of Research

- Supplier Assurance Matrix
  - Certifications
  - Reputation
  - Process
  - Stability
  - Disclosure Process
- Diversity Versus Standardization
- Tools for the Product Life Cycle Stages including Delivery Tracking
  - Blockchain
  - Product Diagnostics

Discussion

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Engineering Secure EDS

Zach Tudor, INL
Tim Yardley, Illinois

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Session Summary

- Great attendance and participation
- Passionate discussions, not always involving new engineering methods
- Identifying transformational technologies or methodologies
  - (Zach comment) Does any inventor foresee the transformational nature of their invention?
- Industry needs a motivating event

Path to Session Outcomes

- Overall Themes
  - Investigate **fragility** to help re-enforce resiliency
  - Make **enabling tenets** rather than restricting requirements
  - Must consider **all-hazards** approaches
  - Some **current initiatives** are moving the ball forward
  - **Secure (resilient) systems need to evolve resiliently**
- Develop tenets
  - Ten Commandments of resilient engineering
- R&D Questions

Key Comments

- Features or convenience go against security
- Railway priorities (don’t kill anyone, keep trains running, efficiency – stay in business)
    - Efficiency goes counter to reliability and security, so how do you fine a happy middle ground
- Cyber security is not an end point, its something that we operate in
    - It’s impossible to take every risk off the table
    - Need good recovery mechanisms
- Moving from physical to cyber is difficult to grasp. Physical world is a bit easier to understand as the inject vector is physical proximity, not varied like cyber is
- Third party connections are essential, and they often cannot be decoupled/cut off for various reasons (support, warranty, etc)

More Key Comments

- Managing vendors is increasingly difficult and giving them secure the connectivity to the system
  - There’s too much stuff out there (Zach)
- Consider the protection of the system from the operators of the system itself
- Having a methodology that allows me to evaluate a secure system in relation to its deployment in a particular domain
- Missions can conflict
- Designing a system is a separate discipline from deploying it, maybe there needs to be two approaches (and they would need to be complementary)
- Power people use power tools for planning/operations, but there aren't any “design tools” that assist you in designing the systems based on particular constraints

Major Take-Aways

- Tenets
  - Control actions should be verified based on system state before acting
  - Safety engineering constraints must be adhered to in order to have a secure EDS
  - Isolate/segment trusted and untrusted components from each other
  - The system should not be allowed to take an action that harms itself
  - You must be able to trust the sensors
  - Design systems so that unacceptable consequences are physically impossible
- Lack of appreciation for attack techniques
  - People focused on malware or known vulnerabilities rather than on the full range of techniques available to accomplish the end goal
- Tactical vs strategic thinking causes more problems down the road

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Breakout Session Summary:

PKI in Current and Emerging EDS

Sean Smith, Dartmouth College

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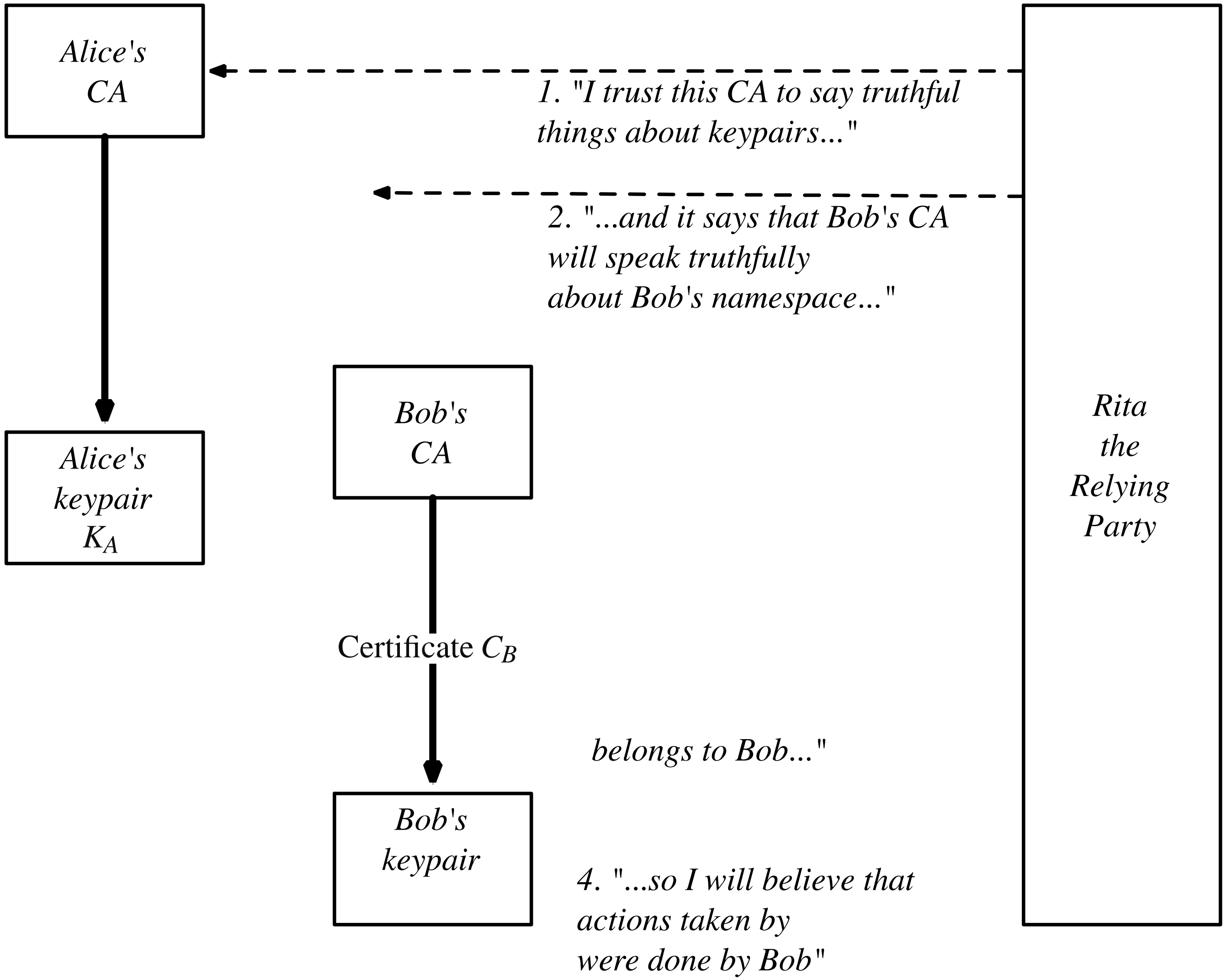
Setting the stage

- ***Goals***
  - Authentication/authorization of commands (and data?)
    - sent on channels that an adversary can manipulate
    - and where manipulation has big EDS consequences
  - Potentially: non-repudiation
  - Not likely: confidentiality
- ***Cryptographic tools***
  - public-key signatures seem the “obvious” solution, but
  - symmetric might work in many scenarios
  - (and in some settings, even quantum)
- ***Using these tools requires things have keys and know about the others***
- ***“EDS PKI”: the enabling glue***

X.509 and all that

- Trust roots
- Trust paths
- Certificates
- Revocation
- Key replacement
- The dances...



(Smith and Marchesini, *The Craft of System Security*)

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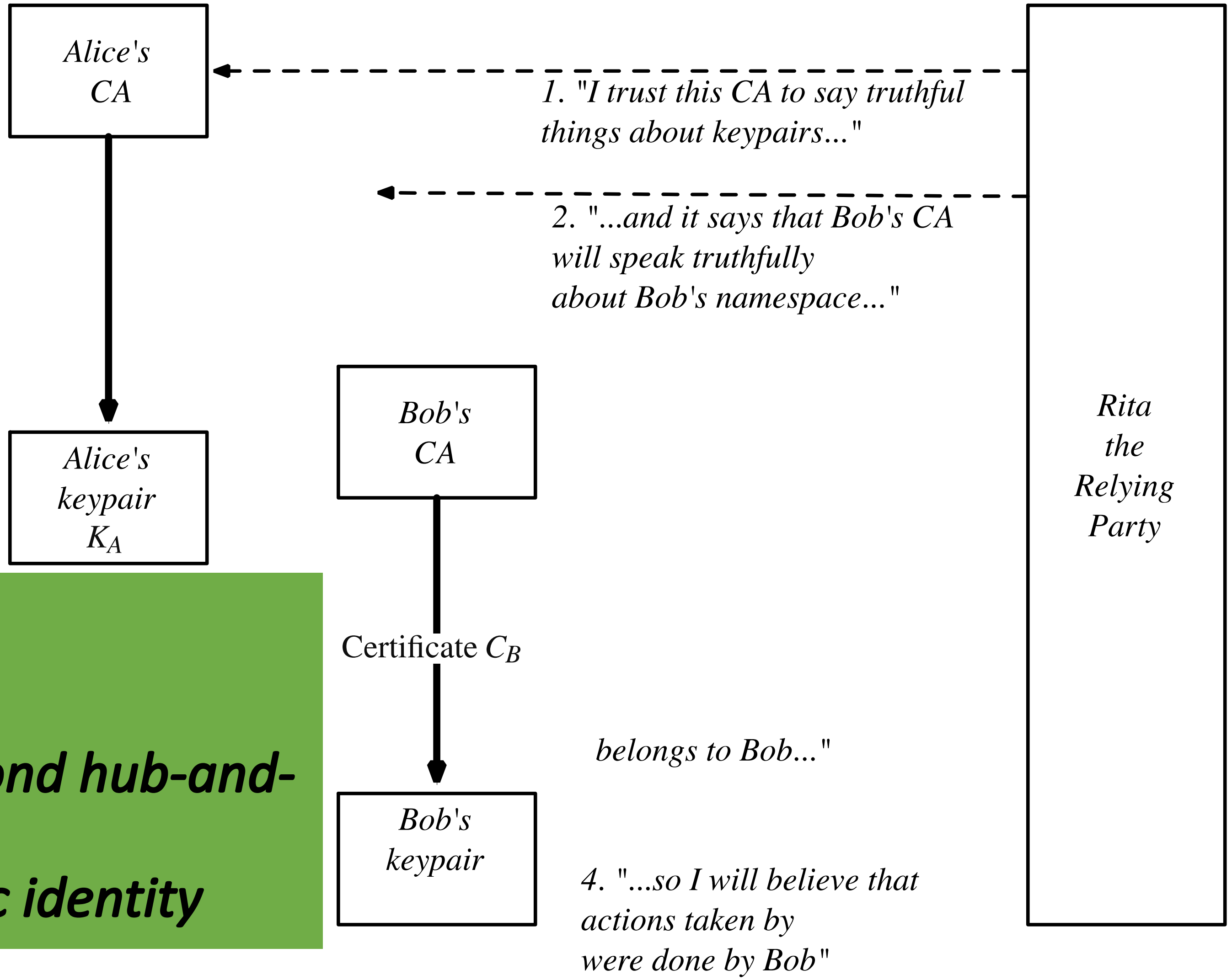

- ***Overheads***
- ***Starts to get messy***
  - ***when trust structure goes beyond hub-and-spoke***
  - ***when we need more than basic identity***

(Smith and Marchesini, *The Craft of System Security*)

Initial questions

- ***Operation and administration***

- ***Non-trivial trust paths:*** Will "one CA issues certs for everyone" always work?
  - *Entities shared between different organizations*
  - *Mobile electric cars*

- ***Non-trivial "identity":*** Will one identity cert tell the relying party all they need to know?
  - *"I am a device of type X, but at substation Y"*
  - *"I have software S patched to level N"*

- ***Non-trivial communication patterns:*** Will it always be fairly static hub-and-spoke?
  - *Many-to-many*
  - *Things talking to things they've seldom talked to before.*
  - *Asymmetry of devices?*

- ***"PKI" in constrained devices***
  - *Insufficient entropy to generate unique keys*
  - *Insufficient computational power for modular math*
  - *Gear that lives much longer than the crypto?*

- ***"PKI" in constrained environments***
  - *Insufficient bandwidth for standard revocation/path discovery/etc*
  - *Lack of time synchronization*
  - *Latency requirements*

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- ***Does it get much beyond one hub-spoke?***
  - ***"administrative domains"***
- ***Constraints from EDS***

- ***"PKI" in constrained environments***
  - *Insufficient bandwidth for standard revocation/path discovery/etc*
  - *Lack of time synchronization*
  - *Latency requirements*

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Lively discussion: EDS crypto issues….

- ***Does it get much beyond "one hub-and-spoke"?***
  - (if so, does the EDS PKI need to handle it?)
  - One thing talking with things from more than one administrative domain
  - Many-to-many?
  - Do want the machines to be able to do what the human operators did over the phone in 2003?
  - IIoT?
- ***Legacy EDS***
  - long-life energy machines (and networks)
  - …vs. shorter-life crypto. (and vendors?)
  - separate planes
  - bump-in-the-wire?
  - design with headspace?
- ***Legacy PKI***
  - can the EDS PKI truly be independent?
  - rethink legacy "best practices" for EDS
  - rethink C-I-A tradeoffs

Lively discussion: EDS “PKI” requirements

- ***Who talks to whom?***
  - including rare but predictable scenarios
- ***Threat model***
- ***Is authorization non-trivial?***
  - If so, do the keys and certs need to carry the information?
- ***Is the important stuff always behind a protected physical perimeter?***
  - Do communications from end points need to be protected?
  - Do we care about smart homes…or smart buildings
  - What about electric cars?
    - mobile
    - potential for big consequences
  - Distributed energy resources?
- ***Do we always want to roll trucks? Or do want decentralized/remote…***
  - commission
  - software update
  - transfer of ownership
- ***Economic reluctance to change IT components. (Certification costs?)***
- ***Can we make relying parties smarter to reduce risk of bad messages?***
  - detect bad data from monitors
  - relays that won’t listen to crazy parameter setting commands
  - exploit physical properties----e.g., gas compresses

Towards an Industrial Key Infrastructure

- ***TCIP circa 2005: "Will you ever use the Internet?"***
- ***Usage scenarios***
- ***Interested parties and partners: please get in touch!***

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Discussion

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