2006-09

An Experiment with CC Version 3.0 Migration

Nguyen, Thuy D.; Irvine, Cynthia E.; Harkins, Richard M.

An Experiment with CC Version 3.0 Migration

Thuy D. Nguyen, Cynthia E. Irvine
Department of Computer Science, Naval Postgraduate School
Richard M. Harkins
Department of Physics, Naval Postgraduate School

7th International Common Criteria Conference

Lanzarote, Spain
September 19-21, 2006

Discussion Topics

- Motivations
- Project background
  - Draft Multilevel Print Server (MPS) PP
- CC Version 2.2 → CC Version 3.0
  - Objectives and Approach
  - Before and After
- Observations and Conclusion

Motivations

Why we did it …

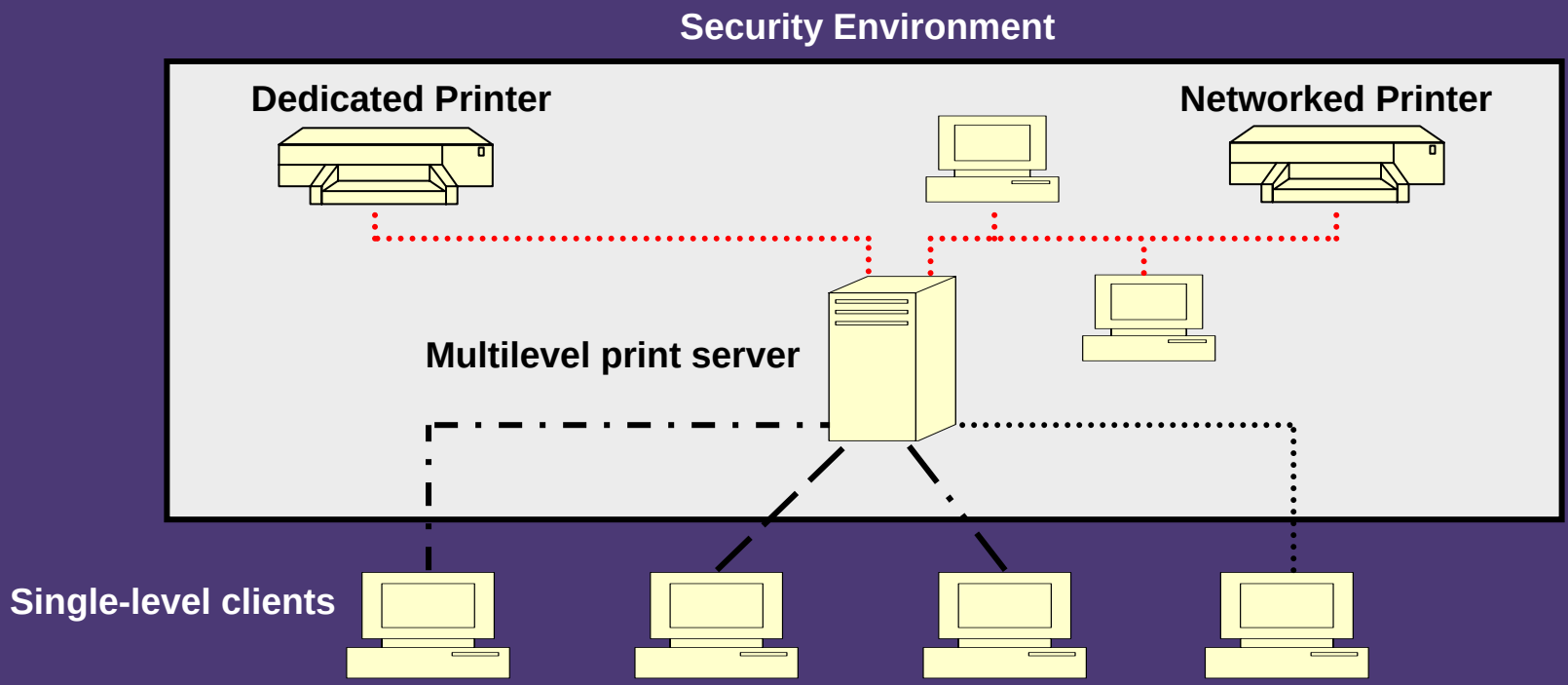
- Stay current on latest CC developments
- Prepare for a new course on security requirements engineering
- Determine effectiveness of learning-by-doing as applied to the CC
- Meet sponsored program requirements

Project Background

Multilevel Print Server

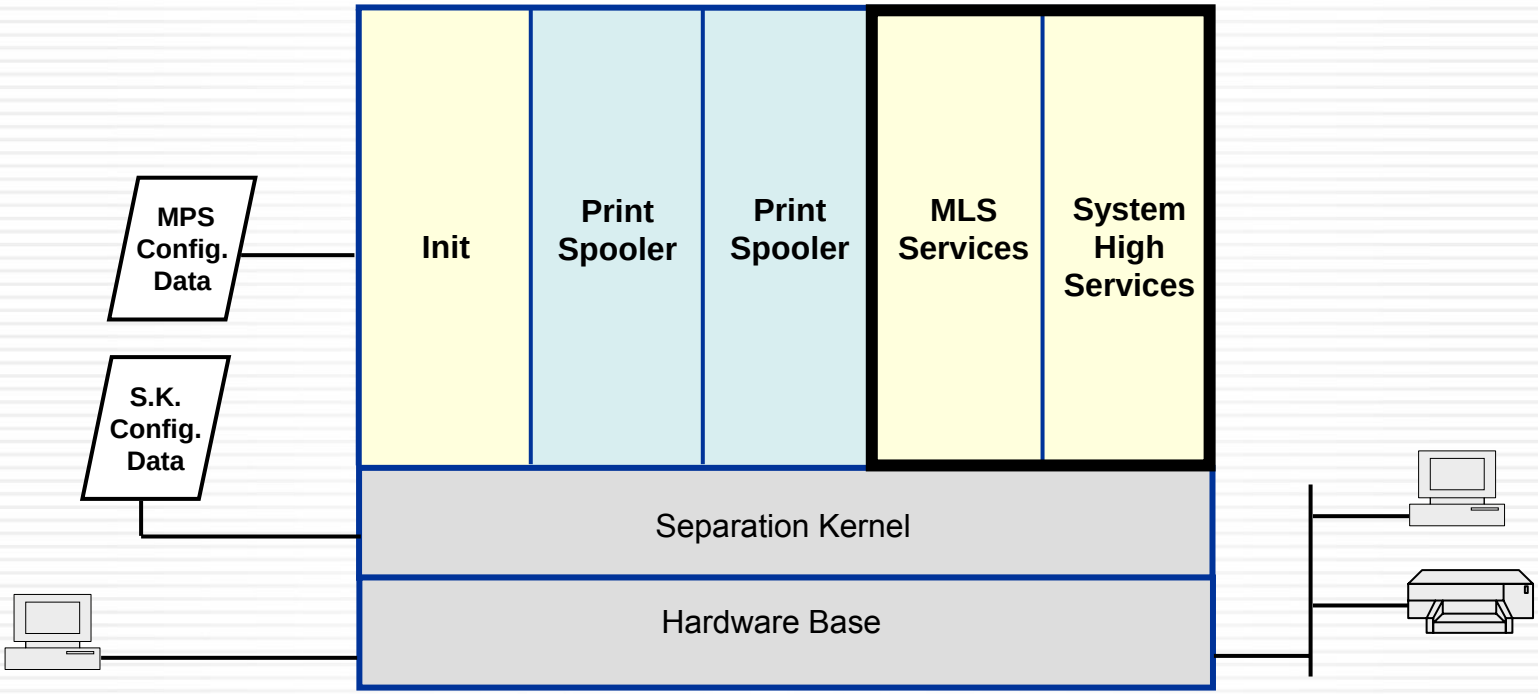
- Sponsor needs shared printing capability in multilevel environment
- Use CC framework to establish security requirements for dedicated MPS
  - Draft PP based on CC Version 2.2 – Masters thesis
    - TOE description
    - Threats (16), assumptions (8), OSPs (6)
    - Security objectives – TOE (24), IT environment (9)
    - SFRs – TOE (9 Classes), IT environment (1 Class)
    - SARs – EAL4 with augmentation
  - Draft PP lacks
    - Traceability analysis & rationale description

TOE Description



- MLS Print Server — Handle print jobs of different sensitivity levels
  Utilize Separation Kernel technology
- Single-level clients — Sensitivity levels determined by attached interface
- Printers — Located on system high network, physically protected

TOE Components



- Trusted base — Hardware, Separation Kernel
- Trusted partitions
  - Runtime (TSF) — MLS Services, System High Services
  - Initialization
- Single-level partitions — Print spoolers, one per input port

CC Version 2.2 → CC Version 3.0

Objectives, Approach & Progress

Objectives
- Complete translation of SFRs
- Partial translation of SARs
- Provide hands-on experience for team member unfamiliar with CC

Approach
- “Rote port” -- Focus only on requirements
- Supervised practice
- Weekly assessment

Progress
- First pass only – translated requirements still sketchy
- Stopped early due to CC V3.1 news

Security Functional Requirements
CC Version 2.2

MPS Security Functional Requirements				
Security Audit	Cryptographic Support	User Data Protection	Identification Authentication	Security Management
FAU_ARP	FCS_BCM	FDP_ETC	FIA_AFL	FMT_MOF
FAU_GEN	FCS_COP	FDP_IFC	FIA_ATD	FMT_MSA
FAU_SAA		FDP_IFF	FIA_SOS	FMT_MTD
FAU_SAR		FDP_ITC	FIA_UAU	FMT_SAE
FAU_SEL		FDP_RIP	FIA_UID	FMT_SMF
FAU_STG			FIA_USB	FMT_SMR

Protection of TSF	Resource Utilization	TOE Access	Trusted Path/Channels	SFR for TOE Environment
FPT_AMT	FRU_RSA	FTA_MCS	FTP_TRP	FDP_SDI
FPT_FLS		FTA_SSL		
FPT_RCV		FTA_TAB		
FTP_RVM		FTA_TAH		
FPT_SEP		FTA_TSE		
FPT_STM				
FPT_TST				

Translation of FAU
Summary

V2.2		*V3.0*
FAU_ARP	→	FAU_ARP
FAU_GEN	→	FAU_GEN
FAU_SAA	→	FAU_SAA
FAU_SAR	→	FDP_ACC, FAU_SAR_EXP
FAU_SEL	→	FDP_ACC, FAU_SEL_EXP
FAU_STG	→	FDP_ACC, FAU_STG_EXP

- FAU_ARP, FAU_GEN, FAU_SAA
  - Translation was straightforward
- FAU_SAR, FAU_SEL, FAU_STG
  - Required more work
  - Used FDP_ACC to control ability to review data, select auditable events, protect audit trail
  - Defined extended components for specific security functions

Translation of FAU *Sample Components*

FAU_SAR.1.1: The TSF shall provide the security administrator with the capability to read all audit information from the audit records

FAU_SAR.1.2: Refinement: The TSF shall provide the audit records in a manner suitable for the security administrator to interpret the information using a tool to access the audit trail.

FDP_ACC.1.1: Access control for audit review

The TSF shall allow an operation of a subject on an object if and only if all of the following hold:

a) The role attribute of the subject is security.

b) The type of the object is audit record in the audit trail.

c) The subject has read access to the object.

FAU_SAR_EXP.1.1: Security audit review support

The TSF shall provide the audit records in a form suitable for the subject with the role attribute of security administrator to interpret the information.

Translation of FDP
Summary

V2.2		*V3.0*
FDP_ETC	→	FCO_ETC
FDP_ITC	→	FCO_ITC
FDP_IFC	→	FDP_ACC
FDP_IFF	→	FDP_ISA
FDP_RIP	→	FPT_RIP

Challenges with FDP_IFC and FDP_IFF translation

- Separation Kernel enforces both information flow and MAC policies
  - Kernel configuration data defines policies
- MLS Services enforces MAC supporting policy for print job labeling
  - Map sensitivity level of jobs based on level of spooler partition
  - Label jobs with human readable markings

Translation of FIA
Summary

V2.2		*V3.0*
FIA_AFL	→	FIA_AFL, FIA_URE
FIA_ATD	→	FDP_ISA
FIA_SOS	→	FIA_QAD
FIA_UID	→	FIA_UID
FIA_UAU	→	FIA_UAU
FIA_USB	→	FIA_USB

- Mostly straight forward translation
- A lesson on indirect dependencies
  - E.g., FIA_AFL indirectly depends on FIA_URE because of FIA_UAU
- Dependency tables in Annex A were utilized
  - Per-class tables in V3.0 are easier to use

Translation of FMT
Summary

V2.2		*V3.0*
FMT_MOF	→	FDP_ACC
FMT_MSA	→	FDP_MSA
FMT_MTD	→	FDP_ACC, FDP_MSA, FPT_RSA
FMT_SAE	→	FDP_ACC, FDP_MSA
FMT_SMF	→	FDP_ACC, FDP_MSA
FMT_SMR	→	FDP_ACC, FDP_MSA, FIA_USB

- No FMT in V3.0 -- Most dreaded part of the exercise
- General mapping rules
  - Use FDP_ACC for restricting ability to perform certain function
  - Use FDP_MSA for managing functions related to security attributes
- FMT_MTD, FMT_SMR require other families

Translation of FMT
Sample Components (1)

FMT_MTD.2.1: The TSF shall restrict the specification of the limits for print jobs sent to the printer to the security administrator.

FDP_ACC.1.3: Management of print job limits

The TSF shall allow an operation of a subject on an object if and only if all of the following hold:

a) The role attribute of the subject is security administrator.

b) The type of the object is print job.

c) The operation is to specify the limits for print jobs sent to the printer.

FDP_MSA.1.3: Management of print job limits

The TSF shall determine if a subject is allowed to change the limits of print jobs sent to the printer or not, as follows:

a) The role attribute of the subject is security administrator.

b) The values of the new print job limits are valid.

Translation of FMT
Sample Components (2)

FMT_MTD.2.2: The TSF shall take the following actions, if the TSF data are at or exceed, the indicated limits: <list of actions>

FPT_RSA.1: Resource allocation (print job limits)

FTP_RSA.1.1: The TSF shall enforce maximum quotas for print jobs that a subject can use over a specified period of time.

FPT_RSA.1.2: The TSF shall take the following actions when a maximum quotum for print jobs is surpassed: <list of actions>

Assurance Requirements

Security Assurance Requirements
CC Version 2.2

- Base requirements for EAL 4
- Extended requirements include
  - Flaw remediation procedures
  - Assurance maintenance plan
  - Administrative guidance regarding proper setting of configuration data
    - MAC enforcement: SK configuration data
    - MAC supporting: MPS configuration data
  - Administrative guidance regarding proper handling of printed material

SARs for V3.0

- No specific translation
  - Project stopped before getting to SARs
- V3.0 ADV requirements were reviewed for a different project (SKPP)
  - Provided comments to US scheme
- TOE relies on evaluated separation kernel
  - Composition challenge: Allocation of mandatory and supporting policies among TOE components
- US Precedent PD-0117 facilitated several decisions in original PP
- Class ACO is not as expected
  - Only address composition of evaluated TOEs

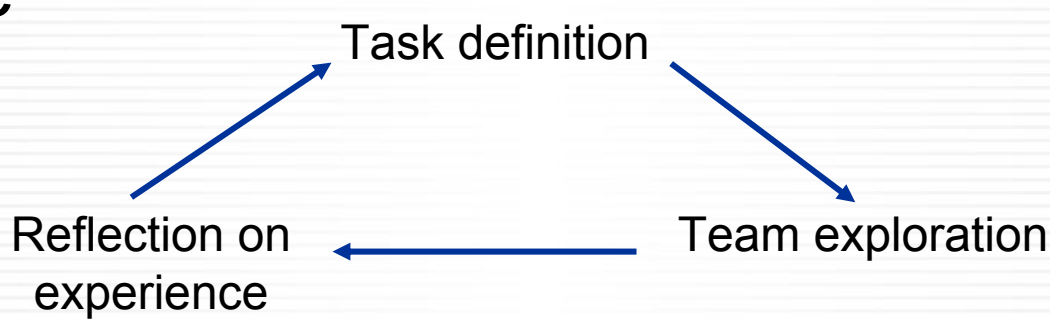
Observations and Conclusion

Observations

- Validated general assessments of CC V3.0
  - New functional paradigm not ready for general use
  - Difficult to express TOE security behavior
  - Correct usage of FDP_ACC was difficult to determine
- Ordering of classes/families was hard to navigate if not already familiar with CC
- "V3.0 transition" document was helpful
  - Example of translated PP/ST would be better

Other Observations

- Team lost momentum/interest after CC V3.1 news
  - Part 2 is back to V2.3 with minor changes
- Project took longer than expected
  - Conducted as a teaching exercise
  - Steep learning curve for novice team member
  - Worked as time allowed → high overhead revving up
- 20/20 hindsight: high-level translation might be better than rote
- Cyclical learning-by-doing methodology was effective



Conclusion

- 3 out of 4 objectives met

√ Stay current on latest CC developments

√ Prepare for a new course on security requirements engineering

√ Determine effectiveness of learning-by-doing as applied to the CC

- Future work to meet sponsored program requirements
  - Full CC V3.1 migration under consideration

Contacts

Thuy D. Nguyen

Center for Information Systems Security Studies and Research
http://cisr.nps.edu
Department of Computer Science
Naval Postgraduate School
Monterey, California, USA

tdnguyen@nps.edu