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Overview of Ferret Project

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Ferret Project Presentation Outline

- Problem, objectives, method, accomplishments
- Background
  - Workflow
  - Event Characterization
  - Insider Threat Analysis
  - Policy Gap and Risk Analysis
  - Ferret Architecture
  - Ferret Metrics
- Example Scenarios
- Summary

Insider Attack on Manageability

- Ferret addresses insider attack on Manageability of high-value systems
- Oversight Groups
  - Peer group and immediate manager
  - Upper management
  - Inspectors, Auditors, Counter-Intelligence
- Spies
  - Robert Hanssen, spy at FBI for Russia, didn't play by the rules and was senior enough in management chain to avoid stricter scrutiny.
  - Anna Montez, spy at DIA for Cuba, only indication was from peer review of work.
- Automated policy compliance gives visibility and situational awareness to the management chain of activity.

Impact to Insider Threat Problem

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- Identify and track misuse by authorized individuals of applications and services by automatic validation of compliance or variance from approved standard operating procedures in applications and processes
- Uses domain specific multi-sensor fusion of external observables of arbitrary workflows in structured and composable distributed systems (like document control systems) to produce strongly typed audit meta-data characterizing individual behaviors within a context
- Identify system and software failures and specification non-conformance that can lead to system or information compromise

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Ferret Methodology

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- **Spy's Are Rare**…
  - Public information on details of intelligence information systems and the techniques to subvert them are rare
  - Frequently had disdain for established procedures
  - Colleagues did not report anomalous behavior
  - Spies are risk adverse, for obvious reasons
  - If we build a spy catcher, how would we test it?
- … **Fraud Is Not**
  - Ideas from fraud detection techniques employed by internal audit departments.
    - Stable production oriented processes.
    - Complex, arbitrary, business logic/rules.
    - Perspective of a possible financial crime.
    - Accounting is highly structured: system, procedures, and data.

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Accomplishments to date

- Workflow Audit Model (WAM) Language
  - Flexible, adaptable way to describe audits of workflows
  - WAM Schema
  - WAM Language compiler and validating parser
  - Flexible API accessible to wide range of computer languages
  - Started process of specification standardization
- Reference Implementation prototype
  - Event Collection
  - Event Normalizer
  - Workflow audit analysis
  - Management console
  - Reporting module
- Use in both formal specified & legacy systems
  - Prototype anomaly detector (12m - Complete June 3rd)
  - 1st generation anomaly detector (18m – TBD December 2004)

Background

A female ferret is called a “jill”

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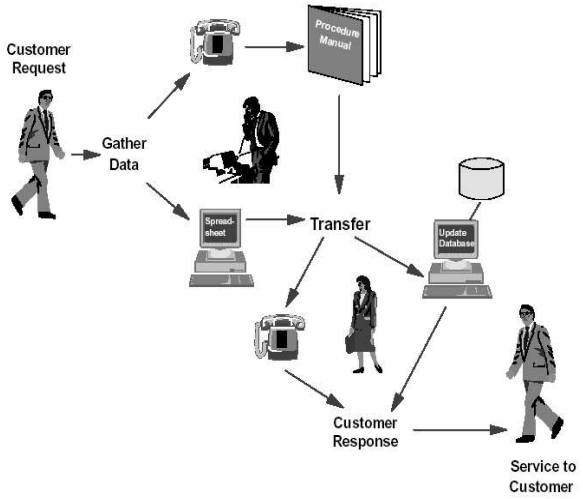
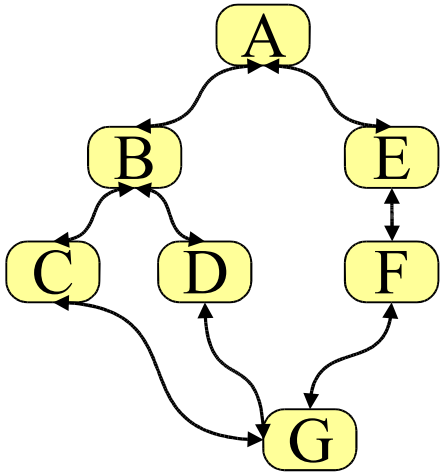
Workflow

- Process
- Procedure
- Set of steps to accomplish a goal
- Workflow Domains
  - Content/Document Management
  - Asset or Resource management
  - Knowledge management
  - Issue and Bug tracking
  - Project management
  - Lifecycle management
  - Call center, CRM
  - ERP

- Trend to moving away from special purpose to generalized, flexible platforms.
- One way we can restate Ferret from negative form: Workflow Anomaly Detection to positive form: Policy and Procedure Compliance Validation
- Ferret is general purpose compliance checking, not special purpose.

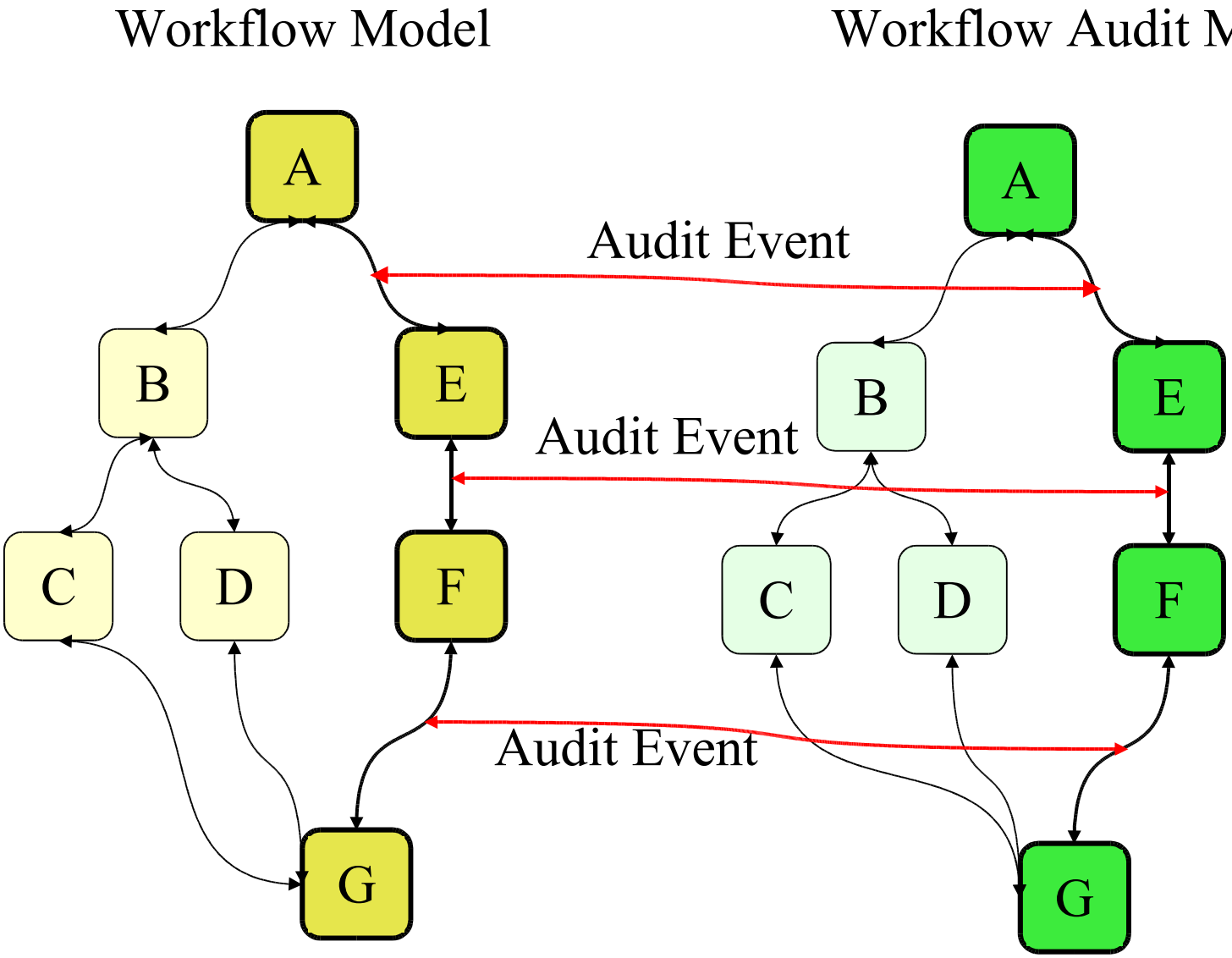
Workflow Model Characterization



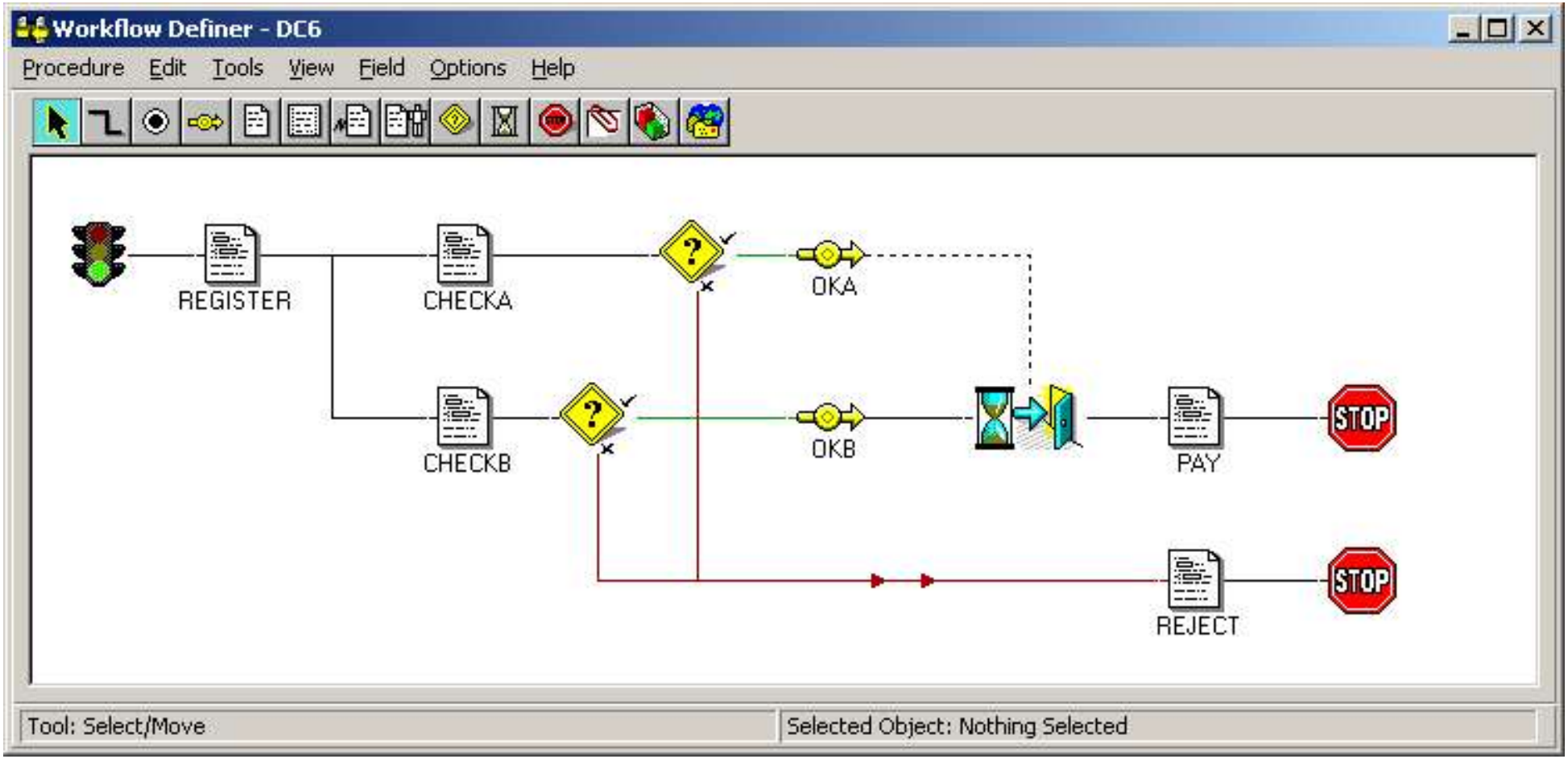


- Workflow Meta-Languages
  - PIF (Process Interchange Framework)
  - PSL (Process Specification Language)
  - GPSG (Generalized Process Structure Grammars)
  - Unified Modeling Language (UML)
- Business Process Expression Language (BPEL)
  - Defining the actions to be carried out in each possible state
  - Pre- and post-conditions of states
  - Transitions between states
  - Defining automated states and states requiring user input
- Finite state machine
  - Σ with initial state of σ_i and final state σ_f
  - P with $\rho_1,\rho_2,\rho_3,\ldots,\rho_n$
  - E with $e_1,e_2,e_3,\ldots,E_n$
  - $P1 = (e_{11},e_{12},e_{13}, \ldots ,e1_n)$

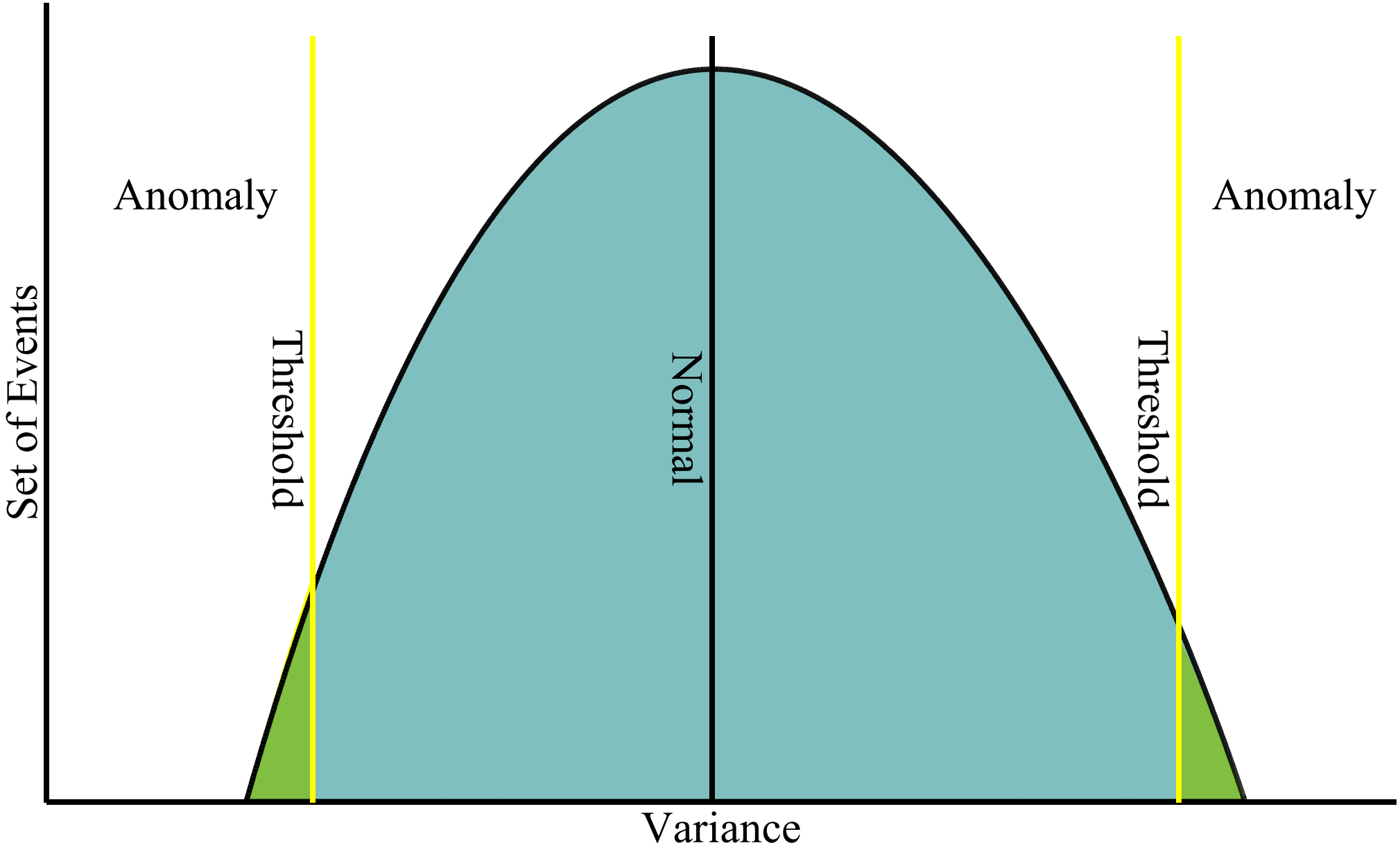
Workflow Audit Model



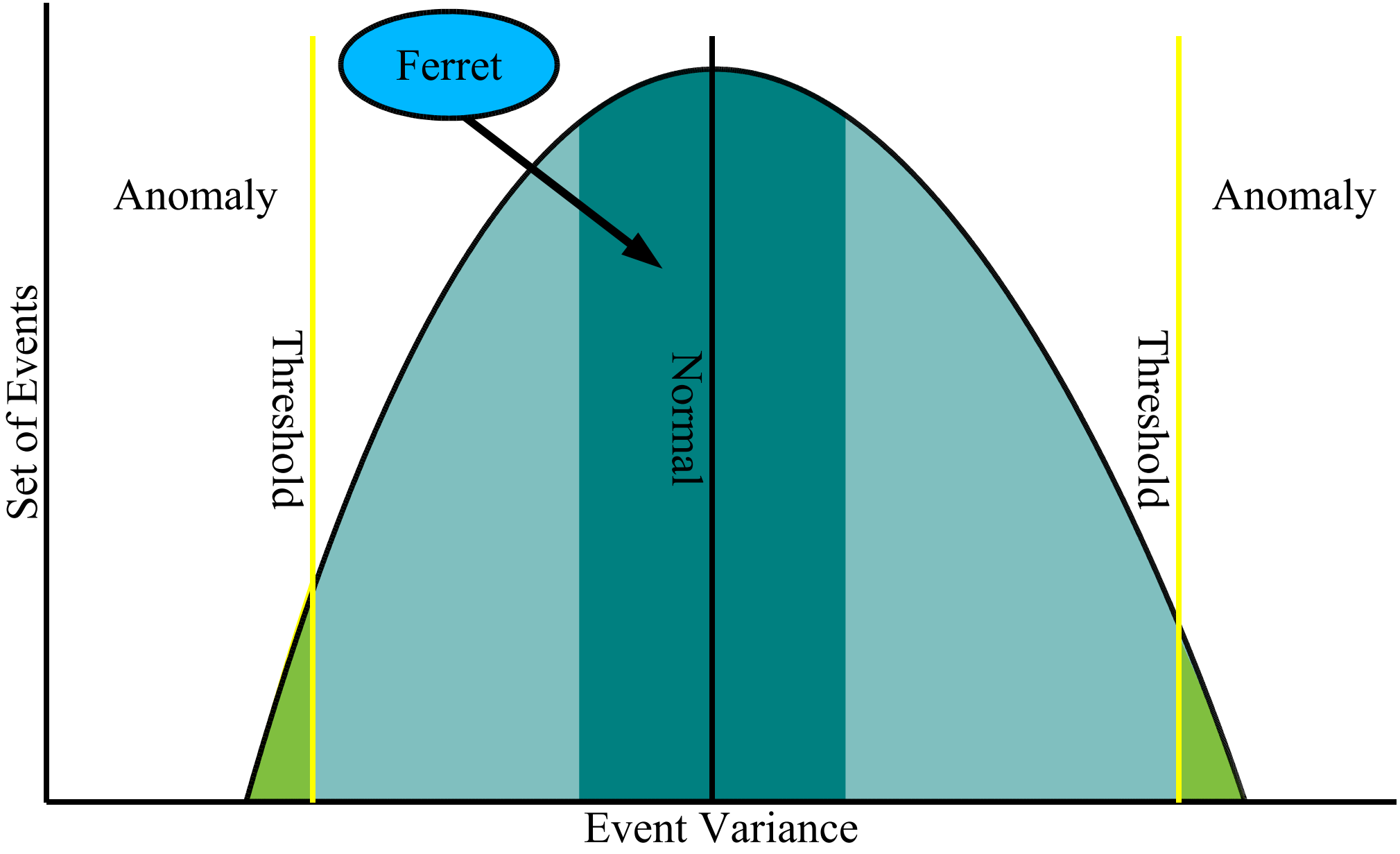
Generate Audit Models



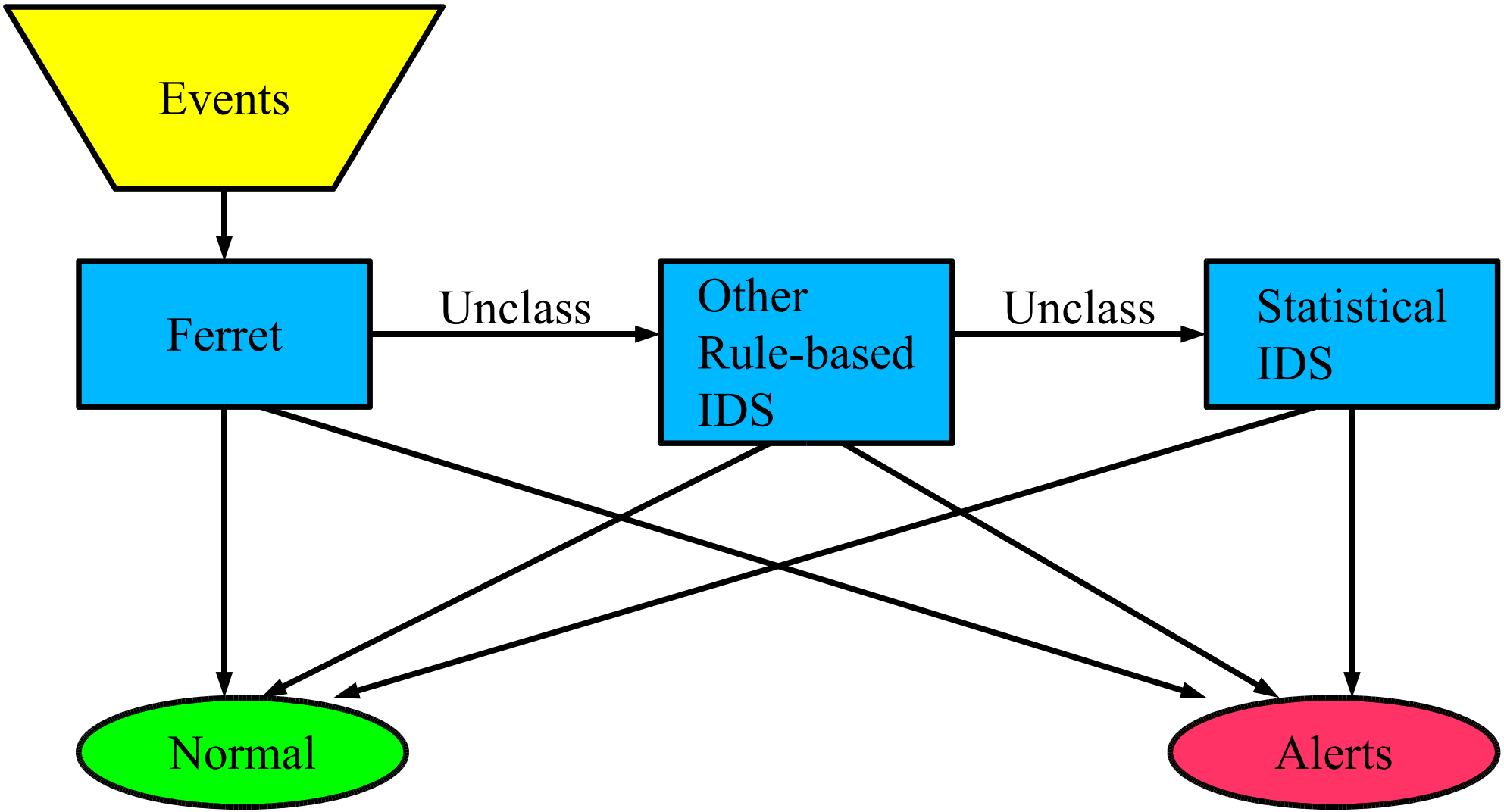
Event Characterization



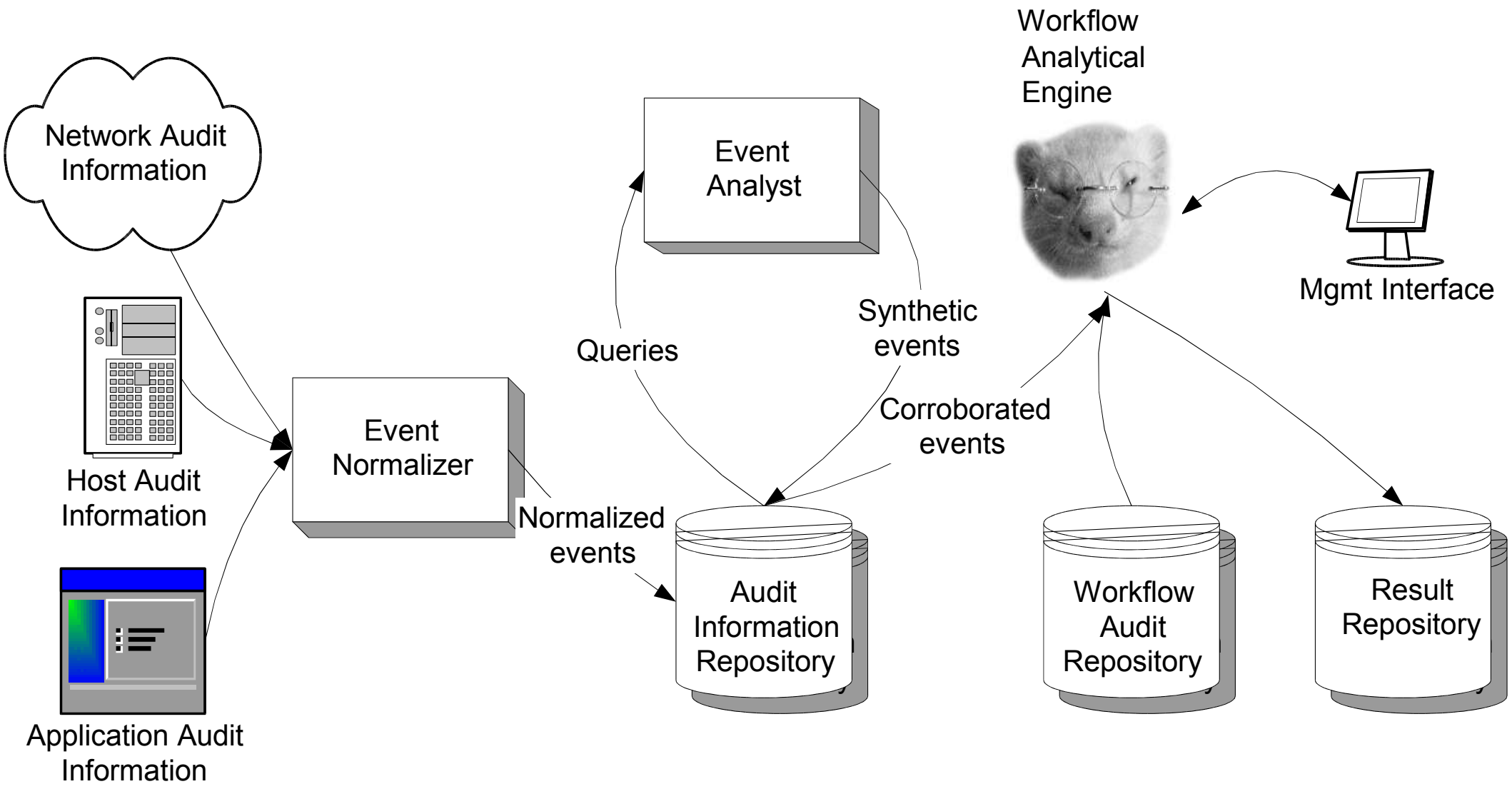
Ferrets Sweet Spot



Event Processing Chain



Ferret Architecture



Metrics

- Anomaly Detection rate
- Observability
  - Can the system be observed by a third party?
- Auditability
  - Can the system be audited? Are there gaps?
  - Integrity: It information reliable? Has it been tampered with?
  - Can you track usage by authorized individuals?
  - Does the audit contain too much information?
    - Useful in subverting the system
    - Sensitive information leakage
- Separation of Duty
  - Are multiple steps in process controlled by some identity? Same individual?
- Exception paths
- Audit computation cost reduction
    - Ratio of useful data for audit

Scenarios

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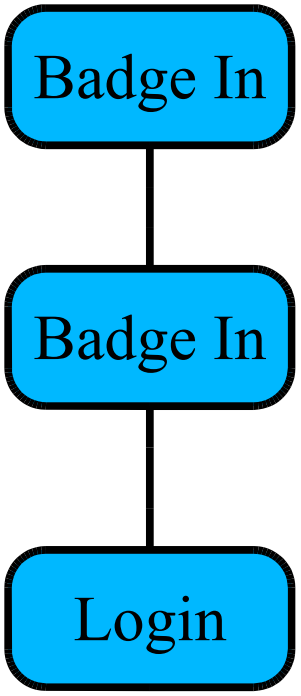
Bridge the policy gap

- High level security policy
  - •Keep secrets from our enemies
  - •Share secrets with our friends
  - •Know the difference between our friends and enemies
- Low level security policy
  - • readme.txt should have 0640 filesystem permissions
  - • network port 80 should be only opened by application apache.
- Ferret occupies middle ground in security policy
  - Between the executive level through the department level, human oriented security policies and the low level network or operating system level policies.
  - The middleground is the ability to express some structured standard operating security procedures (SOP) in terms of workflows in the digital domain.
  - Conformance to these SOP can be assessed automatically by Ferret.

Login prerequisites

- High level policy:
  - Use strong authentication for access control to sensitive facilities and systems
- Procedure
  - Use Photo ID Smart badge into building
    - Generate audit event
  - Use Photo ID Smart badge into secure rooms
    - Generate audit event
  - Badge/login to terminals
    - Generate audit event
- Workflow type: implicit resource management



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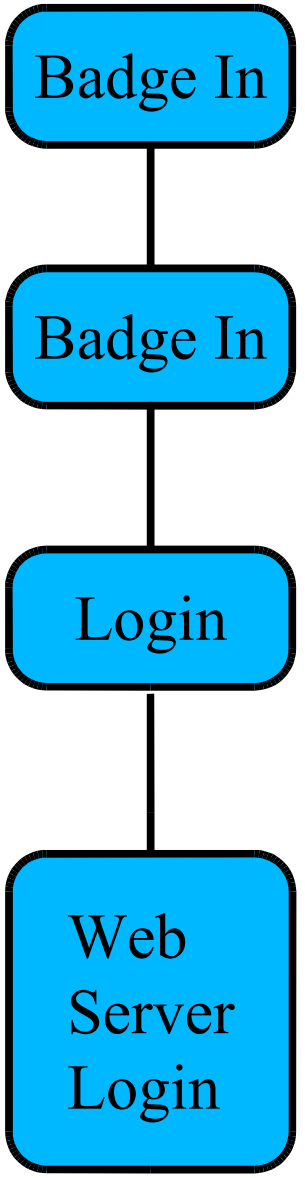
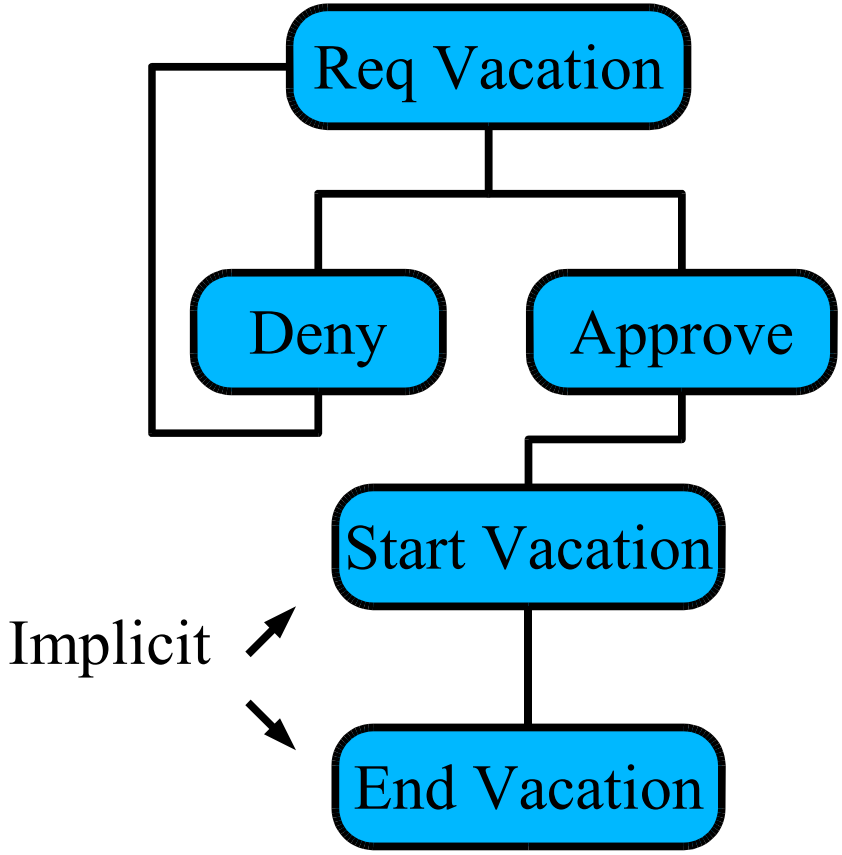


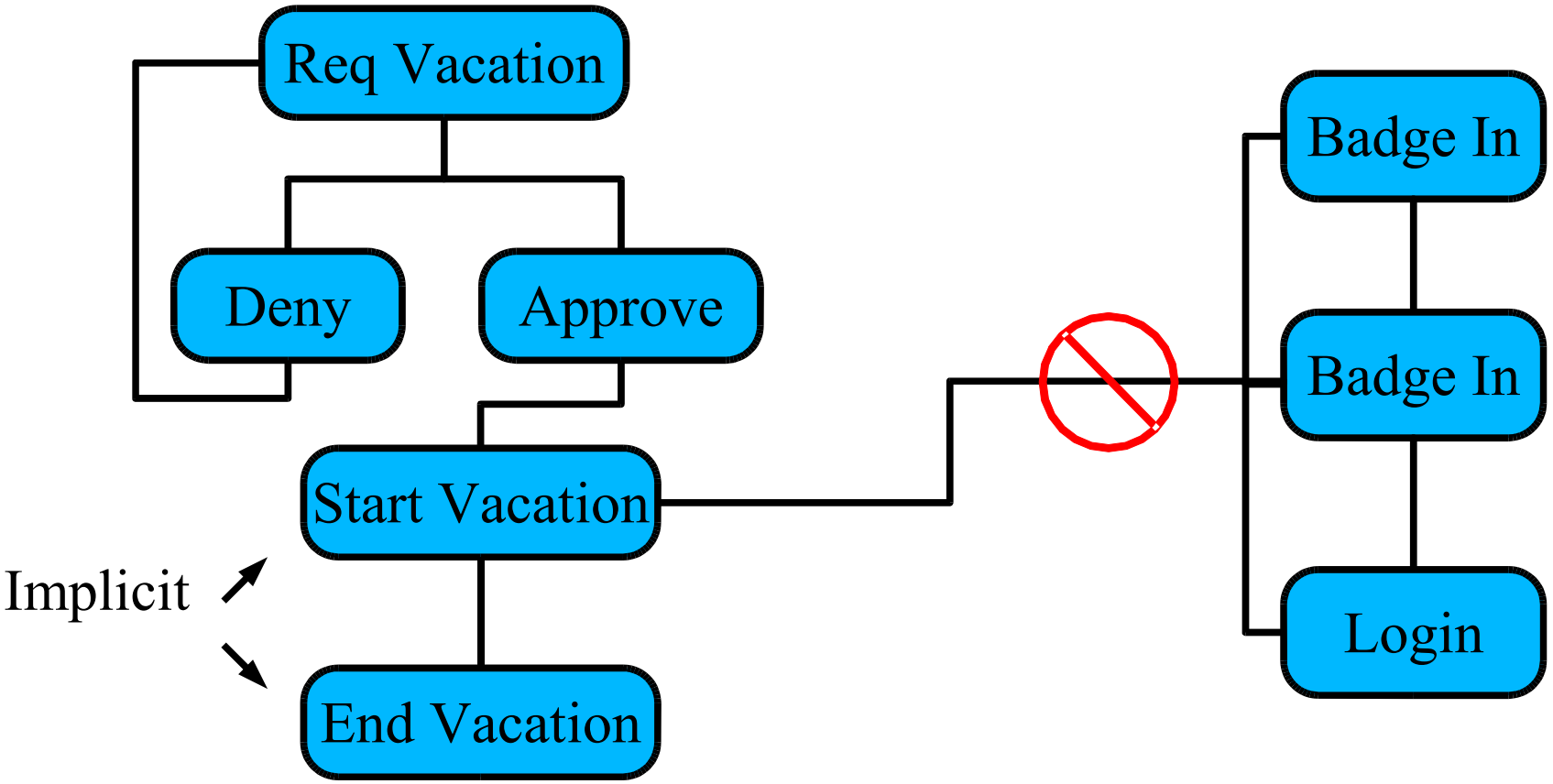
- High level policy
  - Employees request vacation
  - Managers should have awareness of employees vacation status



How to handle variance?

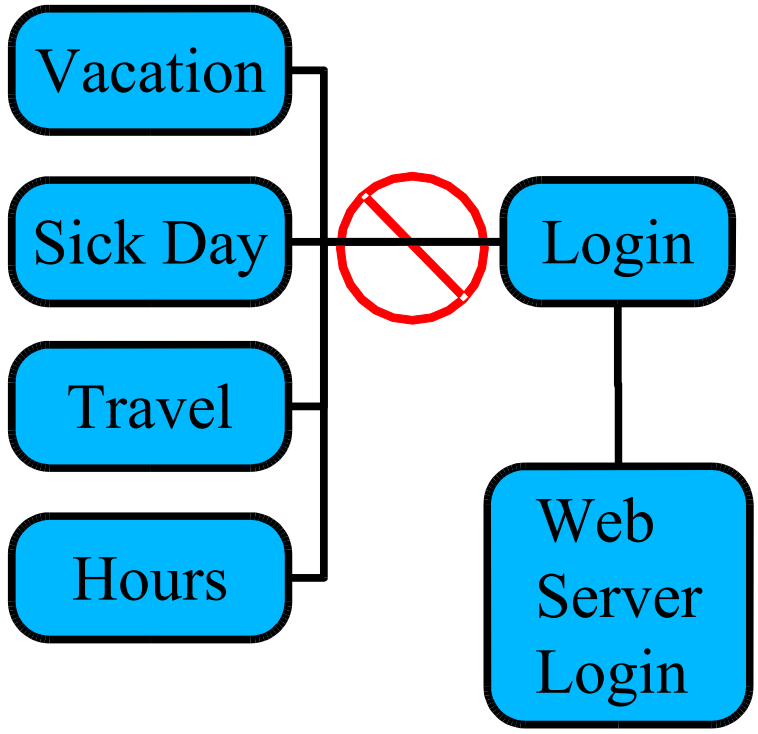
- Cash register model for correcting mistakes
  - Manager can override, this prevents escalation of indication & warning.
- Additional procedures for unusual situations
  - Crisis causes folks to work extended hours
    - Manager would be warned of working outside normal hours.
    - Manager could authorize extended hours for those working during deadline or crisis.
    - AWOL would greatly escalate anomaly with that identity.
- Subsidiary: places a control at the lowest natural and proper place in management chain.
  - The correction/prevention of false alarms is integrated into natural business relationships.
  - Makes organization processes more visible to management.

Vacation


Req Vacation
Deny
Approve
Start Vacation
End Vacation
Implicit
Badge In
Badge In
Login

Organic growth of policies

- Web of compliance procedures
- Composable Audit System
  - Integrates information from unrelated existing COTS/GOTS systems
  - Decoupled, with read-only capability from audit sources.
- Ferret turns 2-factor authentication into n-factor authentication
  - If you pull the badge, everything dependent would be shutoff.
  - User provisioning without O/S and application support
  - Vacation, sick days, travel, normal hours workflows as login prerequisite conditions.



Questions

Contact: tjsmith@mcnc.org
http://ferret.anr.mcnc.org

Security is mostly a superstition.
It does not exist in nature.
Life is either a daring adventure
or nothing.
- *Helen Keller*

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