THE UNIVERSITY OF UTAH

SeaCat: an SDN End-to-end Application Containment ArchitecTure

Enabling Secure Role Based Access To Sensitive Healthcare Data

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Motivation

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- **"Everything" is networked**
  - Nearly all business applications assume network availability
- **Also true in healthcare**
  - Accessing patient records
  - Remote diagnoses and consultation
  - In-home monitoring
  - Healthcare analytics
  - Plus "regular" vocational applications
    - HR/payroll functions, accessing domain specific literature

Problem

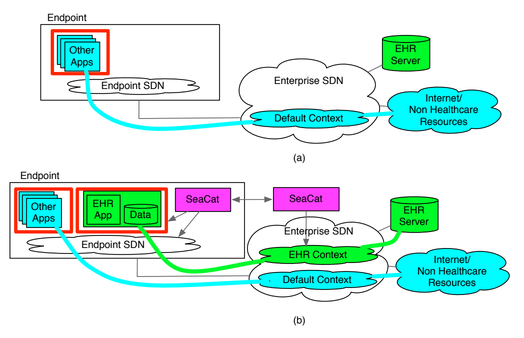
- **Individuals act in different roles**
  - Often using same device
- **Apps have different security and performance constraints**
  - Healthcare records: stringent privacy and security requirements
  - In-home patient monitoring: privacy, security needs + reliability and soft real time guarantee
- **Devices increasingly mobile**
  - Often unmanaged and untrusted
- **Generalizes to broad range of sensitive data access/management**
  - HIPAA, FERPA, FISMA, PCI-DSS

Current Approaches

- **Scan device when attaches to network**
  - Device with up-to-date patch levels might still contain malware
- **Thin clients**
  - Application servers with thin clients constrain the type of applications that can be used
- **Complex network and server access control polices**
  - Access control policies only deal with access
  - No protection once data is accessed

SeaCat Approach

- **Combine SDN and application containment:**
  - End-to-end application containment
- **Treat mobile device as "semi-trusted" SDN domain**
  - Inter-domain SDN interaction to tie in
- **Non-healthcare apps:**
  - Default context: endpoint container and separate network
- **Healthcare app:**
  - Dynamic app specific context
  - App and data contained in this end-to-end context



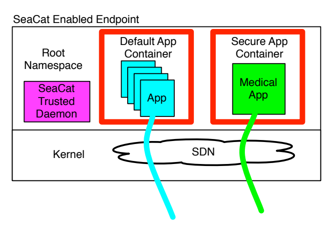
Threat Model

- **Concern: security and performance of health care applications**
  - Including apps on mobile devices
- **Assume healthcare applications can be trusted**
- **Specific concerns:**
  - Unauthorized access
  - Data leakage
  - Resource guarantees
  - Denial of service

SeaCat Architecture

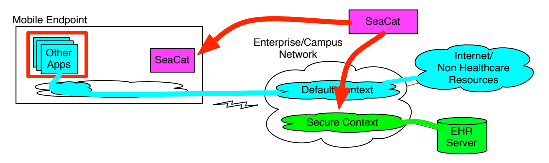
Endpoint Containment

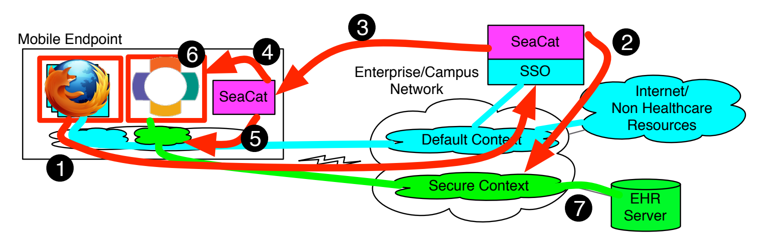
- Uses lightweight containers
- "Regular apps" in default container
- Minimize trusted computing base in root namespace
- SeaCat Trusted Daemon:
  - **Dynamically creates secure app container(s)**
  - **Manages endpoint SDN domain**



Enterprise Network Containment

- SeaCat Server:
  - **Manages enterprise SDN domain**
  - **Interacts with SeaCat trusted daemon in endpoint**





End-to-end

- Mobile endpoint: semi-trusted SDN domain
- **SeaCat server integrated with SSO**
  - Successful authentication triggers:
    - Creation of app specific SDN context in enterprise
    - Signaling to endpoint SDN to:
      - Create secure container
      - Create endpoint app specific SDN context
- App and data remains in secure context
- When app exits:
  - Complete context is destroyed