Google

chrome enterprise

Samba and Chrome OS

the Start of a beautiful Friendship

Lutz Justen
ljusten@google.com

sambaXP, Göttingen
June 06, 2018

Topics

Chrome OS and Chromebooks

Active Directory Integration

How it works, management, Android apps, certificates, file shares

Under the Hood

D-Bus interface, Samba usage, Kerberos integration, Sandboxing

Summary and Future Plans

Chrome OS

Chrome OS is a **Linux-based OS** built around **Chrome**

Designed based on the 3S: **Simplicity**, **Security** and **Speed**

Chromebooks - History

First Chromebooks shipped in 2011

Today more than 50 models, different form factors

Popular in US schools with ~60% market share*

* Source: https://www.zdnet.com/article/windows-pcs-gain-share-in-k-12-in-the-u-s-but-chromebooks-still-dominate/

Chromebooks - Evolution

First Chromebooks

“Laptops running Chrome”

Today’s Chromebooks

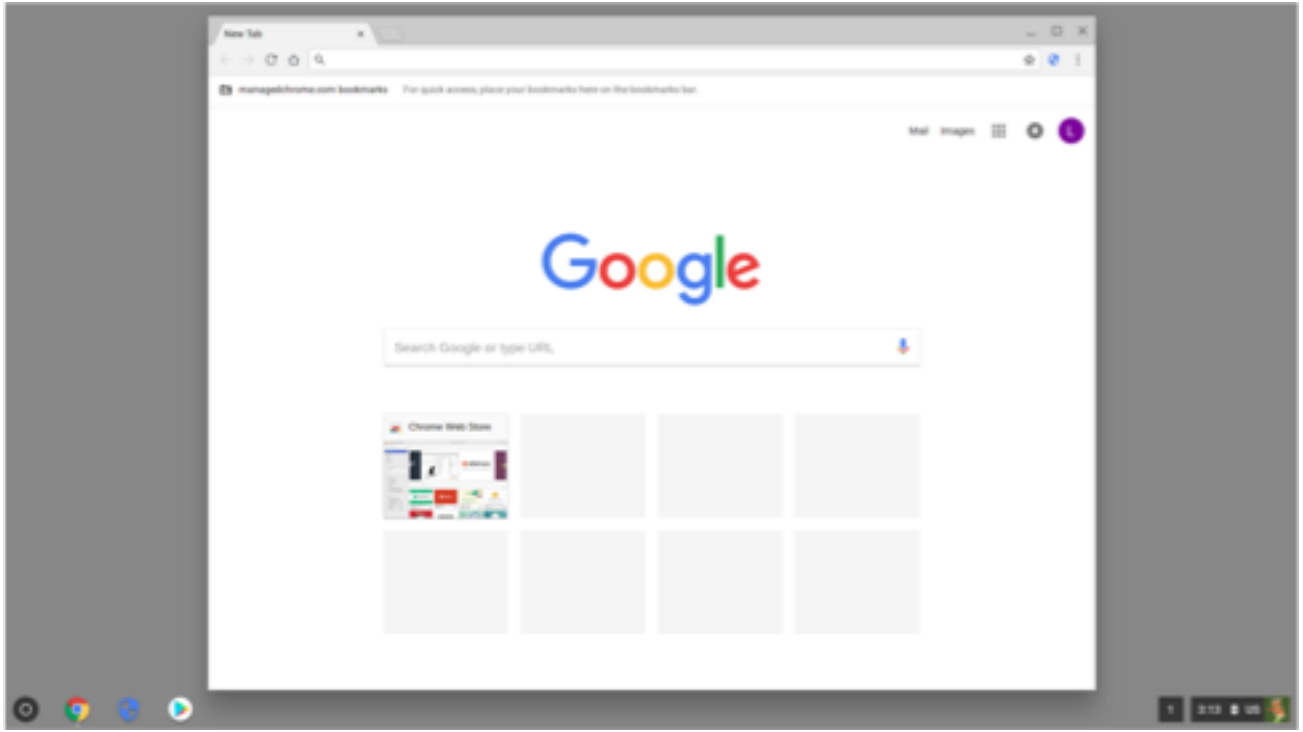
Run Android apps (ARC++)

Run Linux apps (Crostini)

Run Windows apps (CrossOver)

Chrome OS and Chromebooks

Google Pixelbook



Chrome OS and Chromebooks

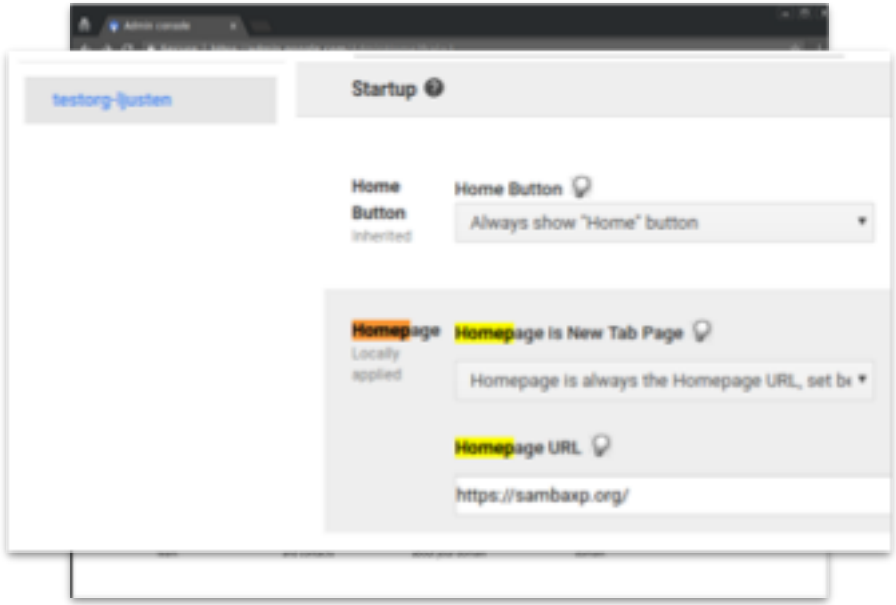
Requires a **Google account**

Can be unmanaged (private) or managed (enterprise, schools)

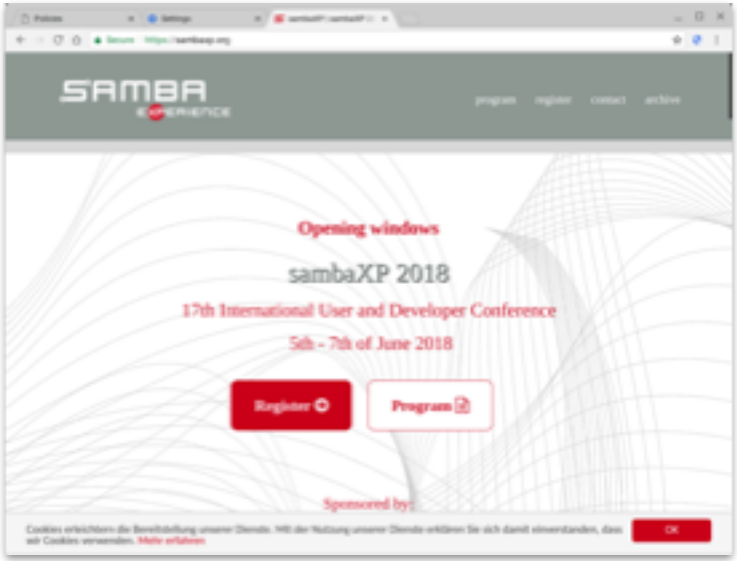
Management via **cloud-based console**

Cloud-Based Management

Management Console



Chromebook



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Chromebooks in Enterprises

I'm an Active Directory admin and
I want to try out Chromebooks in my company

Requires a Google account

- Not tied to enterprise identity
- Could use sync tool to create Google accounts for employees and sign in with SAML
- Admins might not want to/be able to share employee data with Google

Separate management (Active Directory GPO + Google Cloud)

Companies might not want all/any Google services

Large up-front investment!

Active Directory Integration

Goal: Make it easy to use Chromebooks in Active Directory environments

No Google account necessary

Management via Active Directory Group Policy

Launched Aug 2017 as part of Chrome Enterprise

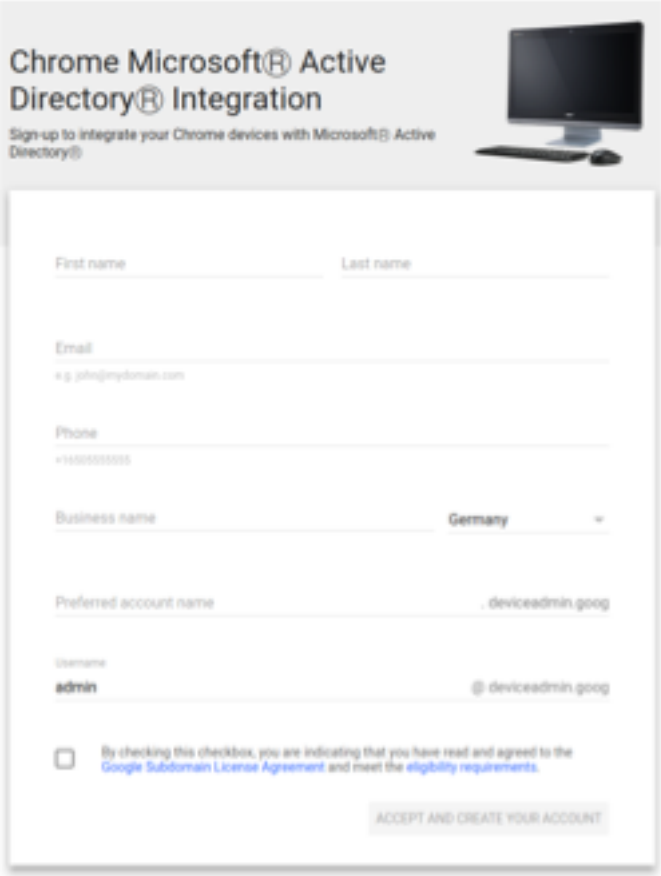
Under the hood: **Samba** in sandboxed system daemon

AD Integration - How it works

Step 1: Register domain with Google

One-pager

Mainly for license counting, config



All steps on Help Center

AD Integration - How it works

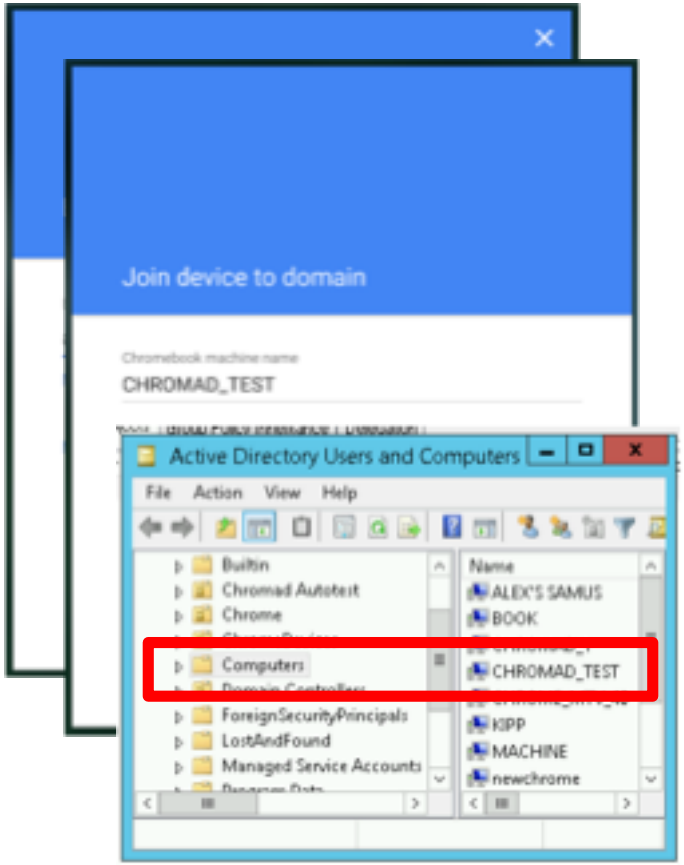
Step 2: On fresh Chromebook

Press CTRL+ALT+E to enroll

Enter Google domain credentials

Enter Active Directory credentials + computer name

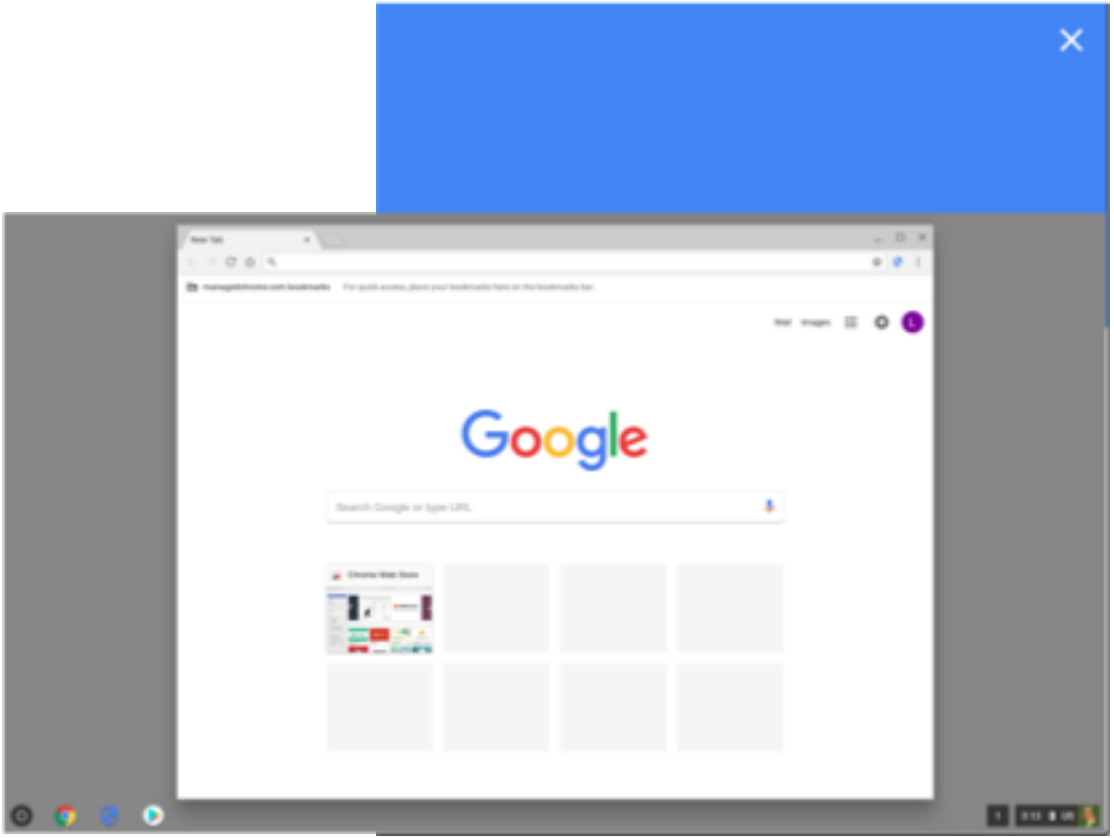
Computer shows up in Active Directory



All steps on Help Center

AD Integration - How it works

Step 3: Log in with Active Directory credentials



All steps on Help Center

AD Integration - Features

Identity tied to Active Directory

Handles password change

Management via Group Policy

Kerberos SSO

Android apps

Support for certificates, file shares, printing

AD Integration - Management

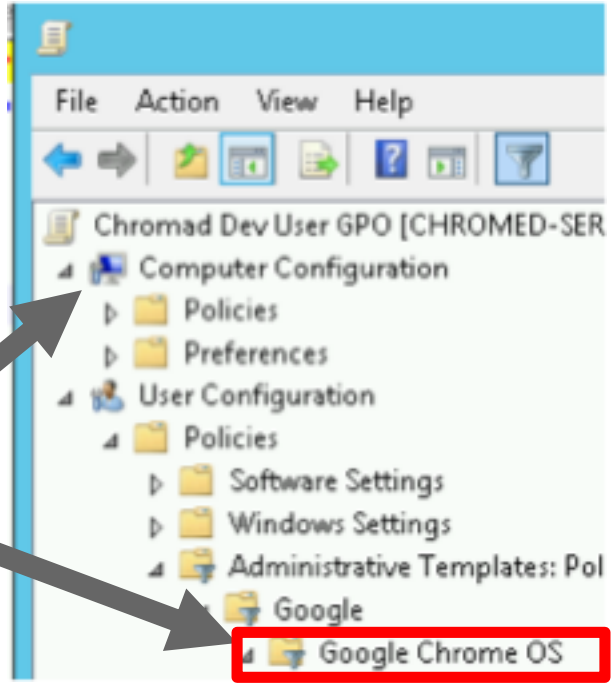
Managed by Group Policy

Download and install Chrome OS ADMX templates

Edit policies in Active Directory
Group Policy Object (GPO) editor

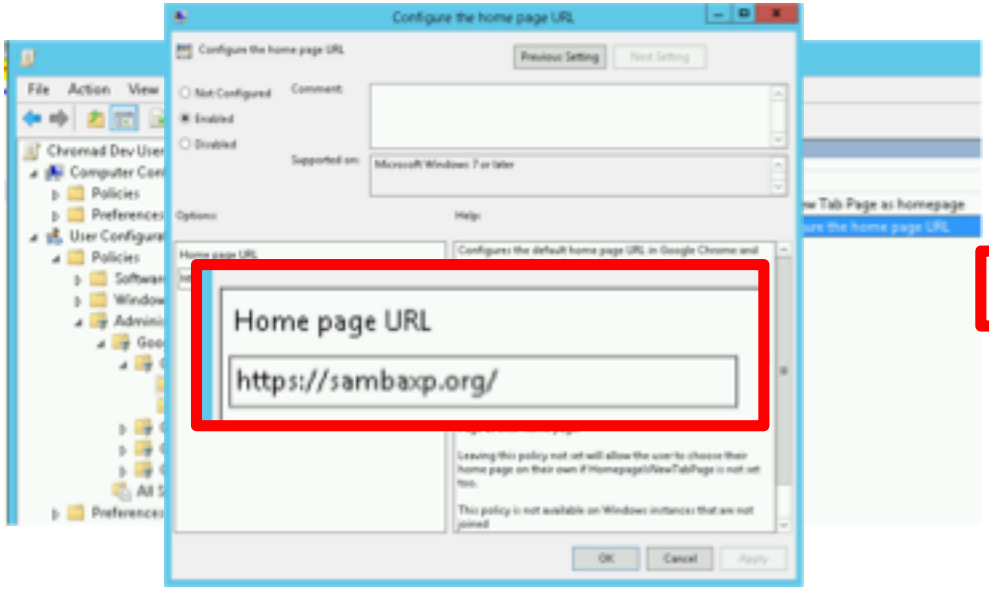
applies to device account (Chrome OS device policy)

applies to user accounts (Chrome OS user policy)

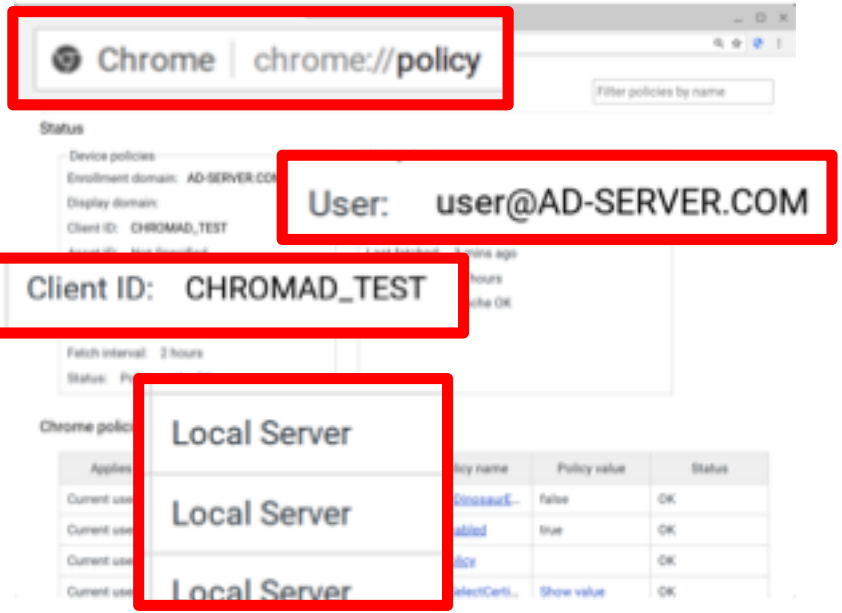


AD Integration - Management

GPO Editor

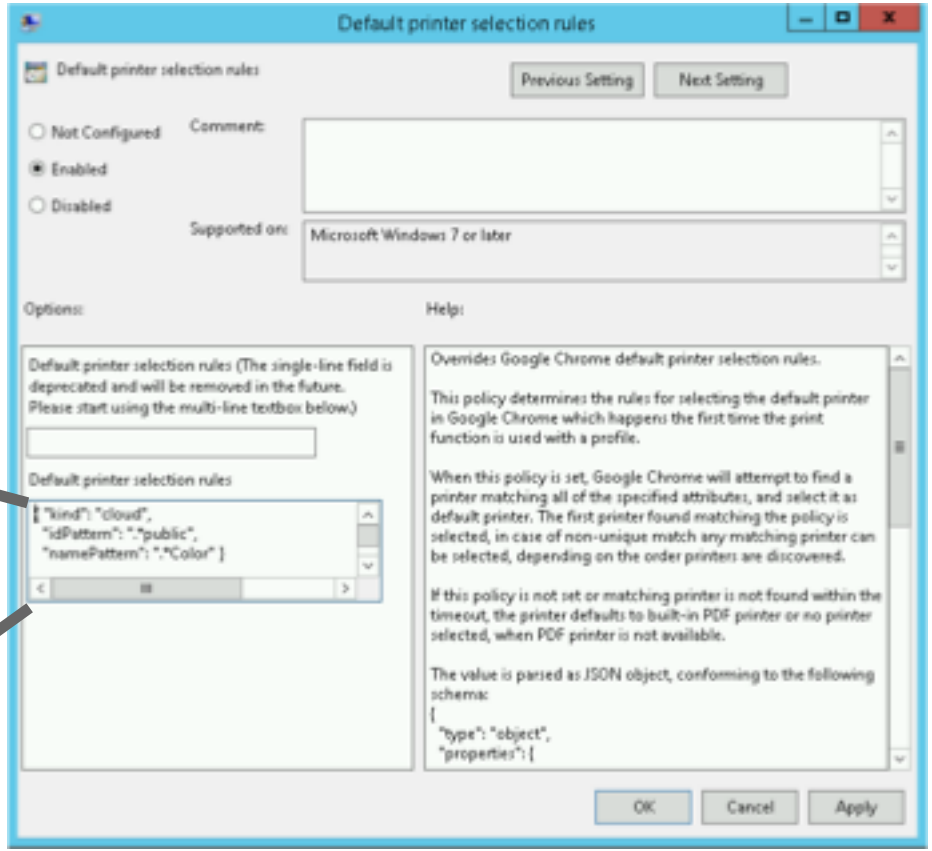


Chromebook



AD Integration - Management

JSON for complex policies, e.g.
Default printer selection rules

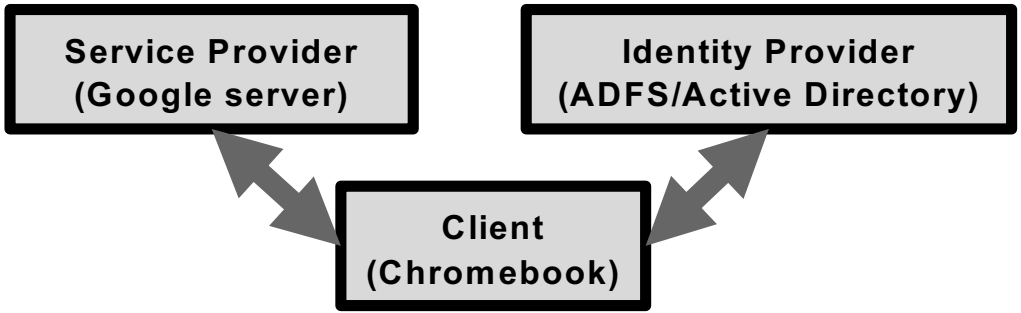


AD Integration - Android Apps

Android apps are per user

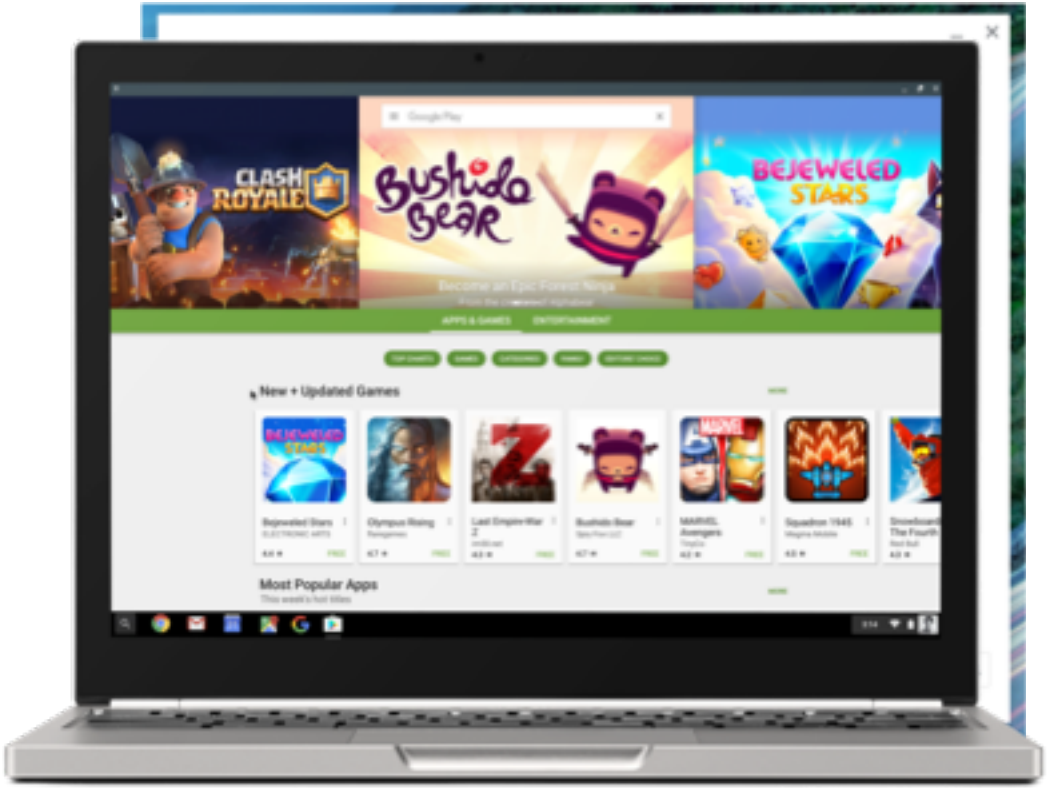
Requires SAML setup to prove user identity to Google

Google creates a shadow account with scope limited to Android apps



AD Integration - Android Apps

SAML sign-in page
appears on first login
(unless Kerberos SSO is set up)



AD Integration - Android Apps

Admin can

- Pick apps that users can install
  → PlayStore admin console
- Force install or preload apps
  → ArcPolicy policy
- Pin apps to launcher
  → PinnedLauncherApps policy

AD Integration - Certificates

Server and Authority Certificates

→ OpenNetworkConfiguration policy (spec)

```
{
  "Type": "UnencryptedConfiguration",
  "Certificates": [
    { "GUID": "my_cert",
      "TrustBits": [ "Web" ],
      "Type": "Authority",
      "X509": "<base-64 encoded X.509 file>"
    }
  ]
}
```

AD Integration - Certificates

Client Certificates

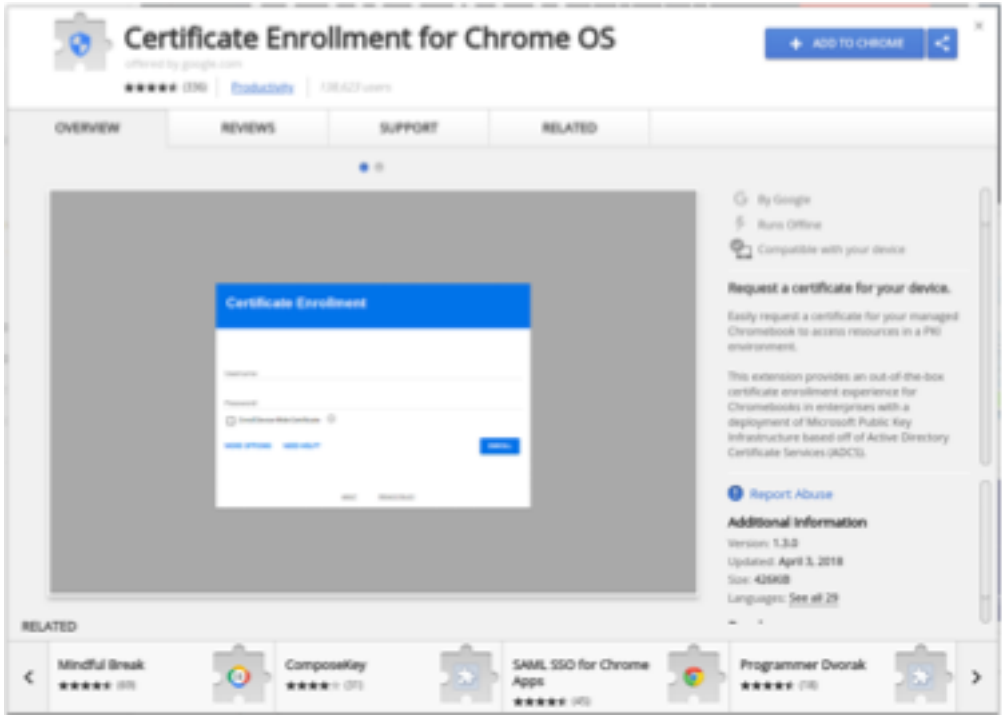
→ Chrome OS Certificates Enrollment Chrome Extension

Configured in GPO editor (needs ADMX templates*)

Requests certs from ADCS

Keys are hardware-backed

* Currently not publicly available, but we're working on it. Just ask for now!



AD Integration - File Shares

Currently (being deprecated)

→ Network File Share for Chrome OS Chrome extension

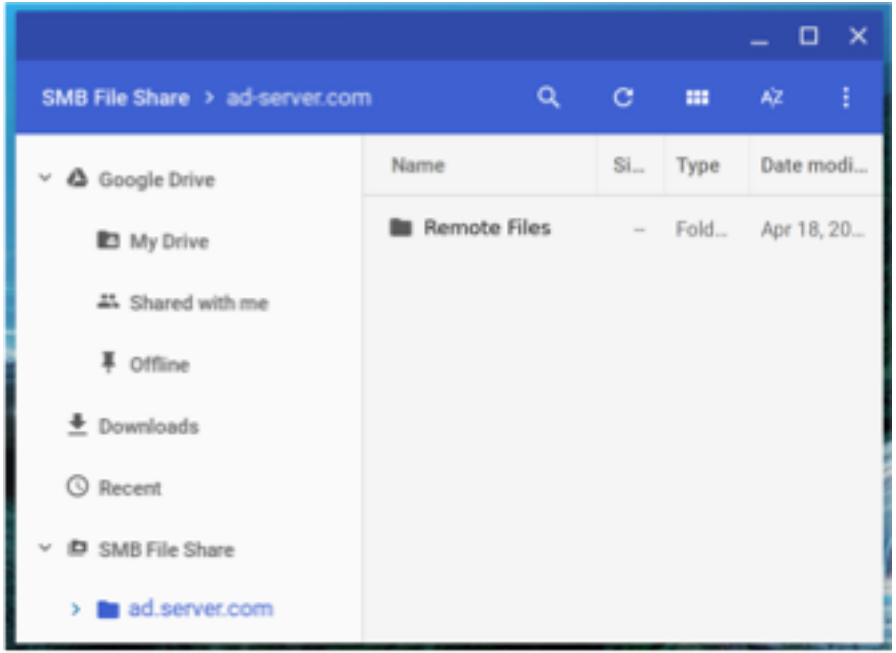
SMB file shares only

Uses Samba as well!

AD Integration - File Shares

Configuration in Chrome OS

Files App with SMB Share



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AD Integration - File Shares

File shares extension is being deprecated

- Slow
- Requires reauthentication every time

Under development: Native integration

- Chrome OS system daemon
- Fast
- Kerberos SSO
- Expected on beta channel in Q3

AD Integration - Under The Hood

Chrome OS system daemon with **D-Bus interface**

Calls Samba binaries **net, smbclient and kinit, klist, kpasswd**

Manages **Kerberos ticket**

Sandboxed with Minijail

AD Integration - D-Bus Interface

JoinADDomain

Joins machine to Active Directory domain

AuthenticateUser

Gets Kerberos ticket

GetUserStatus

Returns Kerberos ticket status, password status and user info

GetUserKerberosFiles

Returns Kerberos ticket and Kerberos configuration (krb5.conf)

AD Integration - D-Bus Interface

RefreshUserPolicy

Retrieves user policy from Active Directory and stores it securely

RefreshDevicePolicy

Retrieves device policy from Active Directory and stores it securely

SetDefaultLogLevel

Turns on debug logs, used by “crosh” command authpolicy_debug

AD Integration - Samba Usage

net ads join

Joins machine to Active Directory domain

net ads info

Looks up key distribution center (KDC) IP and server time

net ads lookup

Looks up domain controller (DC) name

net ads workgroup

Looks up workgroup

AD Integration - Samba Usage

net ads search

Looks up user information (first name, last name, sAMAccountName, …)

net ads gpo list

Gets list of GPOs that apply to user/device account

smbclient

Downloads GPOs from sysvol

AD Integration - MIT-KRB5 Usage

kinit

Gets Kerberos ticket

klist

Checks validity and lifetime of Kerberos ticket

kpasswd

Rotates machine password (every 30 days by default)

AD Integration - Native Kerberos integration

Daemon gets Kerberos ticket during sign-in

Handles ticket renewal

Provides ticket to Chrome

- **Kerberos SSO**
  Automatically signs in to pages requiring Integrated Windows Authentication through GSSAPI
- Controlled by policies for HTTP authentication

AD Integration - Sandboxing

As every large project, Samba has security flaws

Minimize impact of security issues by reducing attack surface

In case process is hijacked, hackers have less options

Limit what the process can do using Minijail

Pillars of Sandboxing I: Don’t run as root

Root can do anything!

Run as non-root user and group

```
minijail0 -u user -g group /path/to/mydaemon
```

Pillars of Sandboxing II: Only keep capabilities you need

Linux has over 30 capability flags to do root-y stuff

- CAP_SETUID, CAP_SETGID to set user/group
- CAP_CHOWN to change ownership of a file

Minijail lets you keep a subset of capabilities, e.g.

minijail0 -u user -g group -c c0 /path/to/mydaemon

CAP_SETUID | CAP_SETGID = Bits 6, 7 = 0xc0

Pillars of Sandboxing III: Filtering system calls

Linux has over 300 system calls

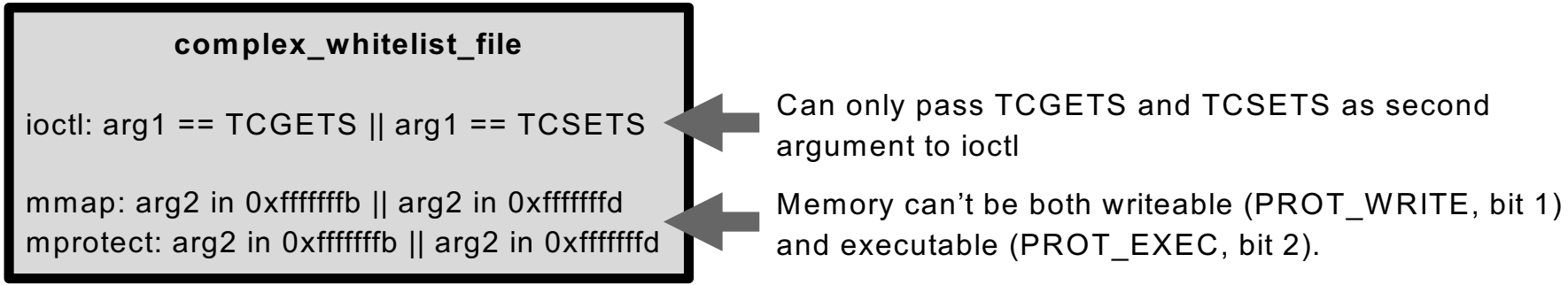
- **read**, **write** for file manipulation
- **connect**, **sendto** for networking

Can specify a whitelist (seccomp filter) for syscalls

minijail0 -S whitelist_file /path/to/mydaemon

mydaemon crashes if another syscall is executed

Pillars of Sandboxing III: Filtering system calls



Pillars of Sandboxing III: Filtering system calls

Generating a policy file

1) strace -f <cmd> 2>strace.log
2) generate_seccomp_policy.py strace.log > whitelist_file

Seccomp filtering caveats

- Syscalls are platform dependent! Need separate policy files.
- Did your strace hit all code paths? Might miss some syscalls.

Pillars of Sandboxing IV: Namespacing

Process ID namespace

- Hides other processes

Mount namespace

- Hides parts of the file system
- Makes parts read-only

Other namespaces: IPC, cgroup, network, user, UTS

Pillars of Sandboxing IV: Namespacing

Example: Process ID namespace

```
# minijail0 -p /bin/ps -A
  PID TTY          TIME CMD
    1 ?        00:00:00 minijail-init
    2 ?        00:00:00 ps
```

Pillars of Sandboxing IV: Namespacing

Example: Mount namespace

```
# minijail0 -v -P /tmp/my_root_folder \
        -b /bin,/bin /bin/ls /
bin
```

-v Enter mount namespace
-P Enters a pivot root (“unmounts everything”)
-b /bin,/bin Bind-mounts /bin only

Actual Daemon Startup

```
minijail0 -i -l -r -t -n -c 180 -p -v -P /tmp/authpolicyd_chroot
    -b /,/ -b /dev,/dev -b /sys,/sys -b /run,/run -b /var,/var
    -b /run/authpolicyd,/run/authpolicyd,1
    -b /var/lib/authpolicyd,/var/lib/authpolicyd,1
    -b /var/lib/metrics,/var/lib/metrics,1
    -u authpolicyd -g authpolicyd -G
    /usr/sbin/authpolicyd
```

Custom seccomp filters applied to net, smbclient etc. directly

Summary

Chromebooks can be joined to Active Directory domains

Easy for enterprises to try out Chromebooks

No Google user account necessary

Managed via GPO

Support for Android apps, certificates, file shares, printing

Sandboxed Samba

Future Plans

Shadow account with full capabilities (Docs, Drive, Chrome Sync etc.)

Native SMB file shares

Simplified policy management

Streamlined domain join

Kiosk and Public Sessions

Reporting

Questions?

Thank you!!!