



Understanding screen contents for effective screencasting

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ScreenCast:

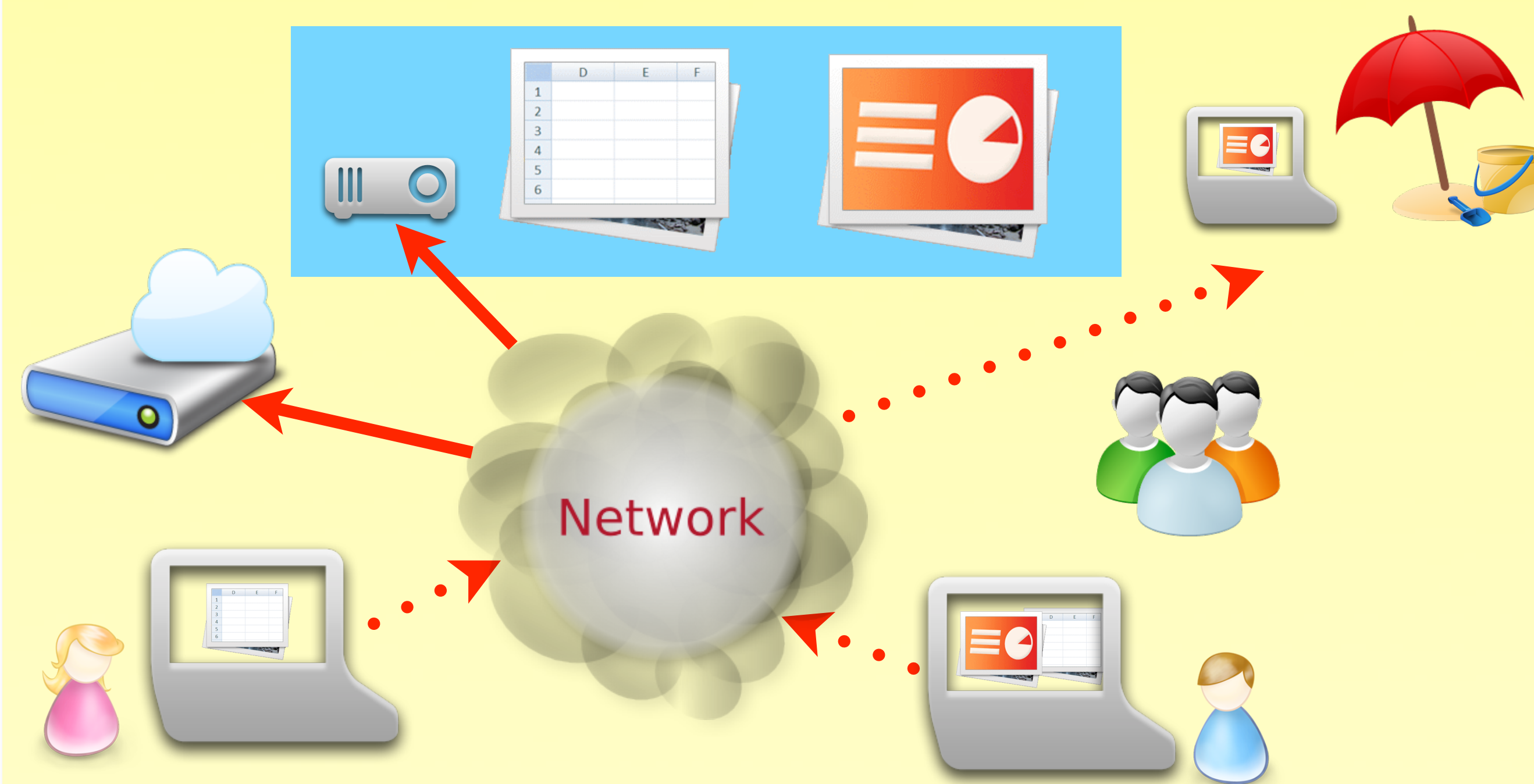
- Capture and compress pixmaps of screens
 - Screencasts watched and archived by remote users for many-to-many sharing

Prior Approaches:

- VNC is client initiated and low performance (~5 fps); server can only ignore requests.
- RDP redirects audio, GPU, FS, printer, pointer, port, aero glass, Media player and pixmaps. Not portable (e.g., Win7 and XP)

Goal:

- ScreenCast with light resource footprint
 - fast network: high performance
 - constrained network: choose pixmaps



Research Challenge:

- Quantify typical screen behavior
 - Rate of screen updates
 - Compression behavior of screen updates
- Develop effective screencast strategies

Typical screen behavior

Experiment setup

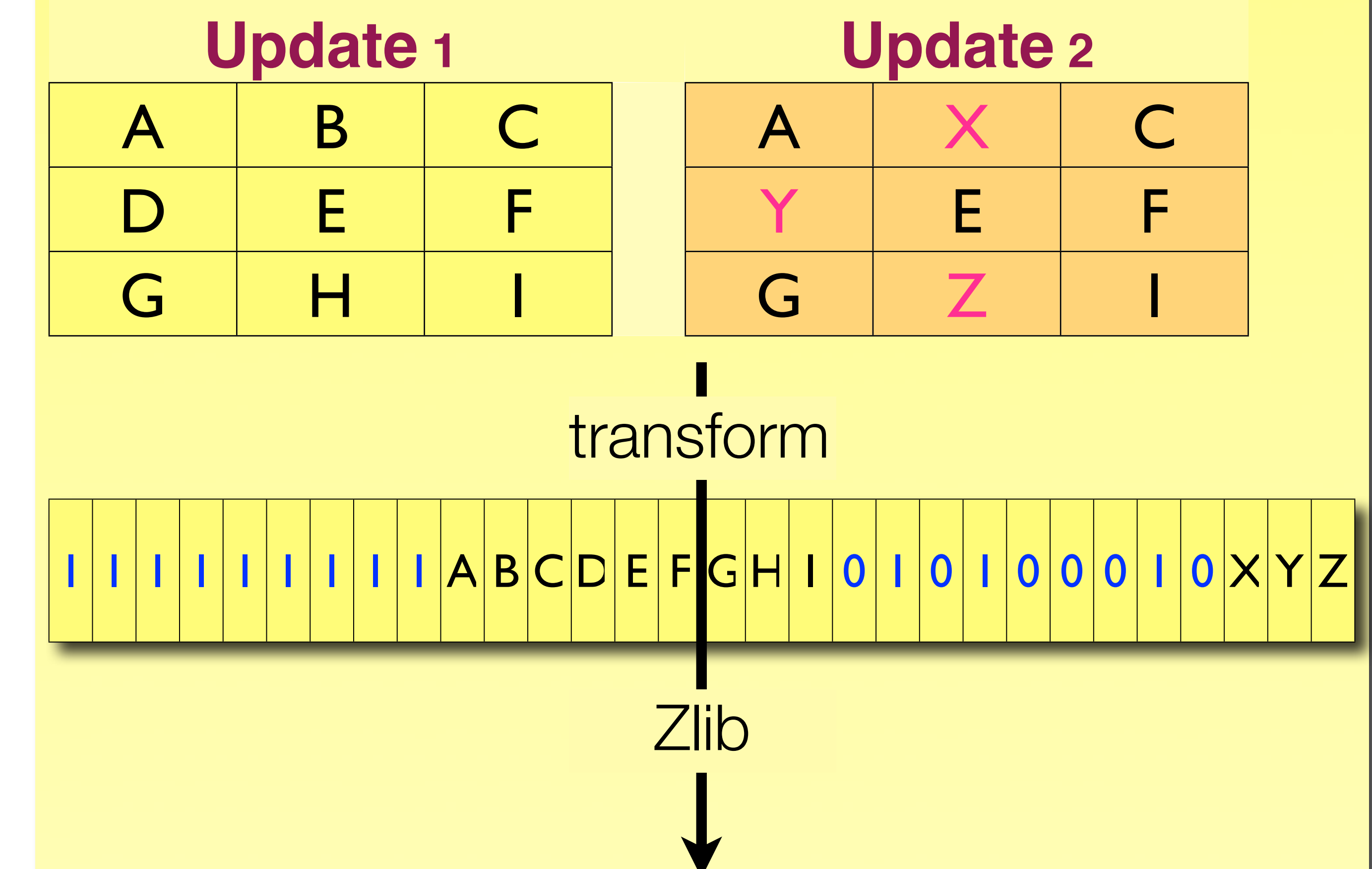
- C2D: 2.66 GHz Core2Duo (1440x900)
- I7: 2 GHz quad-core i7 (1680x1050)
- Dual boot to Mac OSX SL & Windows 7
 - DemoForge mirror driver in Win7
 - CoreGraphics callback in Mac OSX
- Watched movie (H.264, Adobe Flash), presentation (PPT, Keynote), cnn.com, game (Cityville) and IDE (VS, Xcode)

Observations

- Amount of pixels not high; rate can be high
 - Pixels per sec.:
 - C2D: 0.6 - 34.0 Mps, i7: 1.5 - 49.9 Mps
 - Updates per sec:
 - C2D: 9.6 - 50 ups, i7: 9.5 - 80.7 ups
- Visual Studio: 62 ups (σ : 114), ~1 Mps
- @24 fps, C2D: 31 Mps, i7: 42 Mps
- Mac/Win7 choose interactivity by immediately displaying contents
 - H.264 played back at twice fps in Win7
- Long inactivity duration, flurry of activity
 - Fixed rate screen capture inadequate
- Rendering rate depends on GPU
- Tablet inspired artifacts in OSX Lion and Win8 require high capture rates

Effective Screencast strategy

- Require high capture rates
 - 16 ms *good* interval for animation end
- Lossless Zlib compression CPU friendly
 - Compression ratio poor
 - Bytemap transformation incorporates intra-update redundancy into pixmap



Performance:

- Movie: Mac: 4.1 ups (50 Mbps), Win: 10 ups (94 Mbps)
- VS 2010: 49 ups (207 max) - 1 Mbps (12 Mbps max)
- Powerpoint: 3.6 ups (240 max) - 0.2 Mbps (4.6 Mbps max)
- VNC - 4.5 fps

Deployed at FXPAL

Being open sourced