



# **Empowering the next billion with OSTree, Flatpak, NDN, and the cloud**

**Srdjan Grubor**  
**Sr. Sw. Engineer @ Endless**  
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The background is a dark blue gradient, transitioning from black at the top left to a lighter blue at the bottom right. A bright, curved white line starts from the bottom left and curves upwards towards the top right, resembling a comet's tail or a light leak. In the upper right quadrant, there is a small, isolated blue star.

It's all about perspective...



It's all about perspective...



A little closer...

## Illusion vs Reality

- Average GDP is \$14,971 (PPP)
- Massive technological disparity
- Only 51% of global population is on the Internet





**49% of the world  
does not have access  
to the Internet**

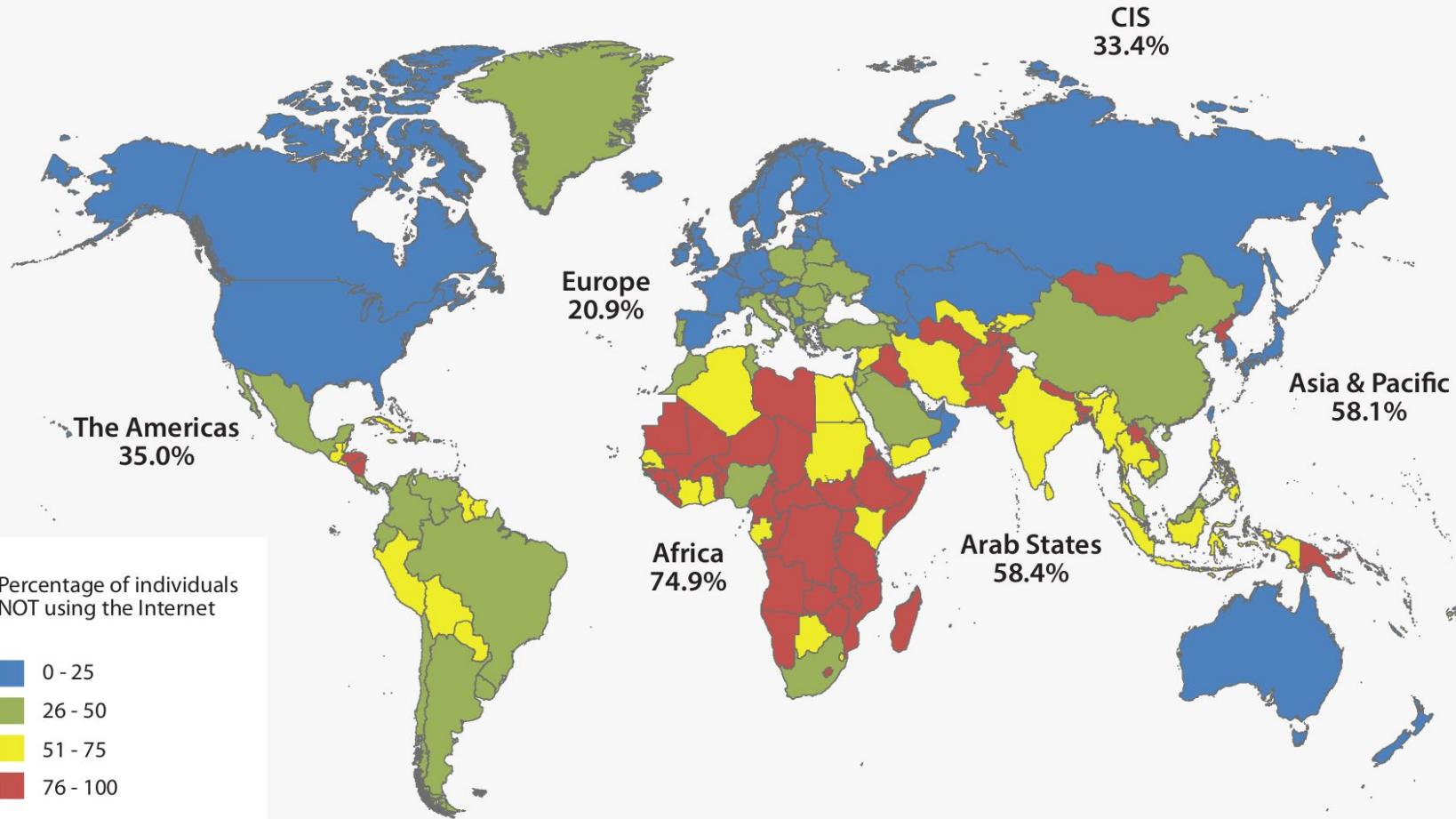


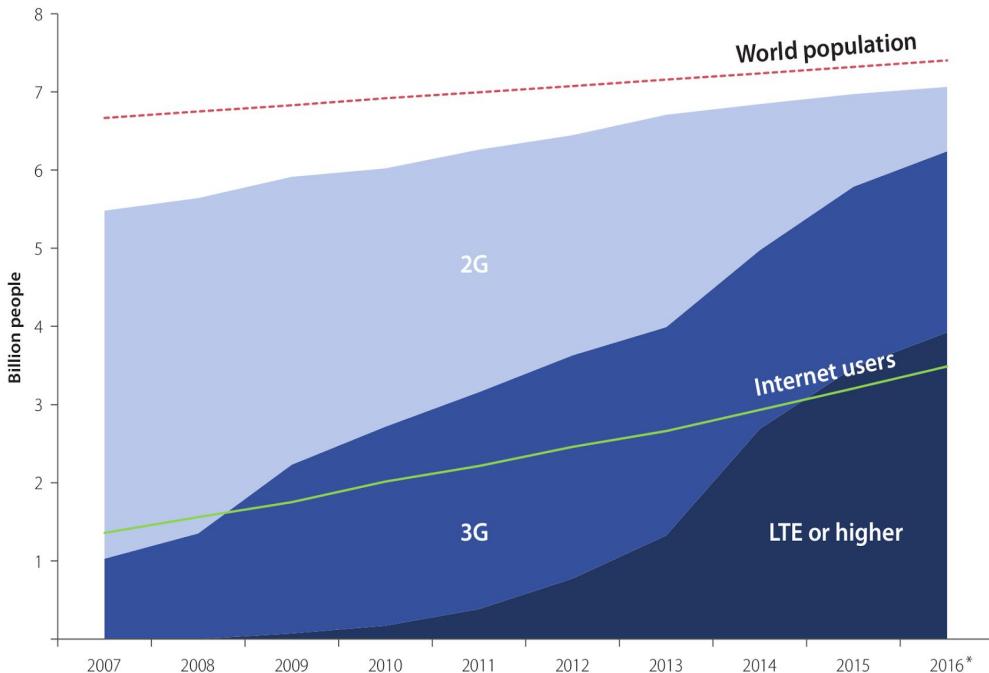
Chart courtesy of ITU

Arthur C. Clarke was onto something...



## Where are we?

- 95% of global population live in an area that is covered by a mobile network.
- Internet use is growing but not as quickly as expected..
- Without action, the **technological divide is growing**.



**Even with Internet access, many are on metered connections.**

Biggest gains in Internet penetration have been in the mobile sector and in most countries those connections are metered.

## Opportunities

There is hardly any perspective from which solving this problem is not something we want.

- Philanthropic
- Socialist
- Capitalist
- Libertarian

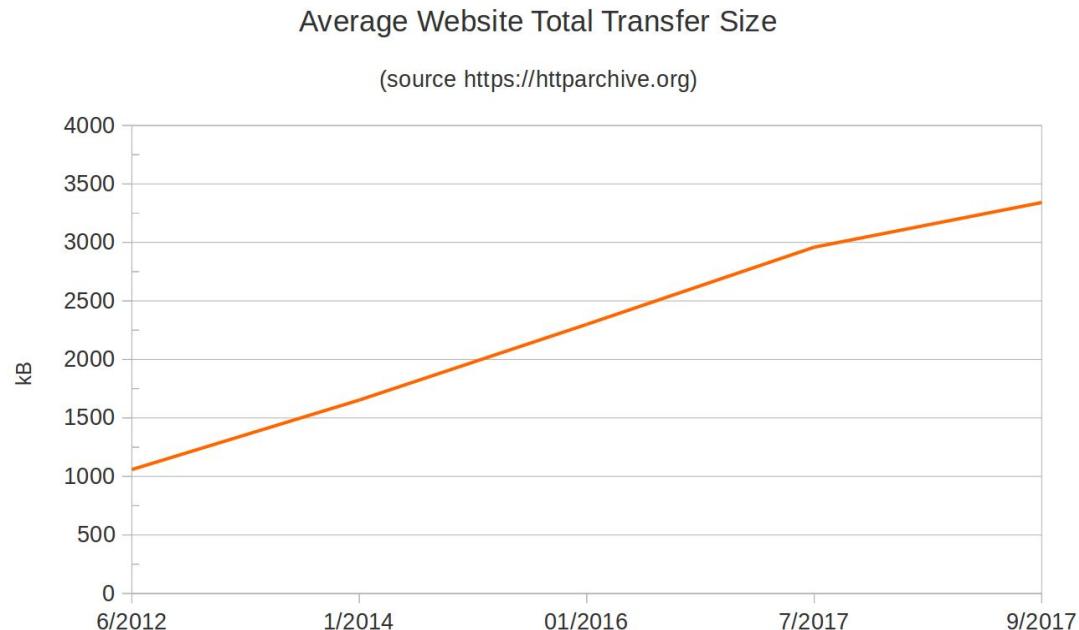


**So what are we doing about it?**

## We are making it worse

Average size for a website has grown over **300%** during the last 5 years and is now at around **3.34MB**.

Growth of transfer sizes is keeping pace with global connectivity speed growth.









## **What can we do about it as engineers?**

- Reduce transfer volume
- Reduce bandwidth usage
- Increase data locality
- Provide off-line capabilities

# OSTree

Content addressed object store meant to be used as a tool for tracking whole filesystem trees.

- GNOME Project (Colin Walters)
- Git-like object storage
  - Metadata and blobs
- Bootloader chain
- Three-way configuration merges
- Hardlinks

## Common Filesystem Layout

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- `/boot` for boot files (i.e. EFI)
- `/ostree` for .. well .. OSTree
- `/var` for system state data
- `/home` for user state data
- `/etc` for configuration
- Everything else under OSTree

**Does this look familiar?**



Working on updates 91%  
Don't turn off your PC. This will take a while.

Your PC will restart several times.

If we have enough space to keep both states, what is going on here?



Your PC will restart several times.

## Advantages

- Atomic updates and upgrades
- Content de-duplication
- Binary deltas
- Rollbacks
- Multiple trees capability
  - Release versions
  - Release branching
  - OS versions



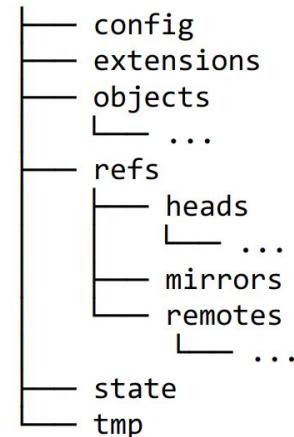
## OSTree CLI

Very similar to Git

- **ostree init** - Initializes the repo
- **ostree commit** - Commits the changes
- **ostree checkout** - Checks out the FS tree
- **ostree pull** - Pulls the refs from remote
- **ostree refs** - Shows available remotes
- **ostree gpg-sign** - Signs a commit
- **ostree static-delta** - Creates a single-package delta between two commits

## OSTree Repo Layout

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# DEMO

**Crazy thought:  
What if we use the same  
system for application  
delivery?**

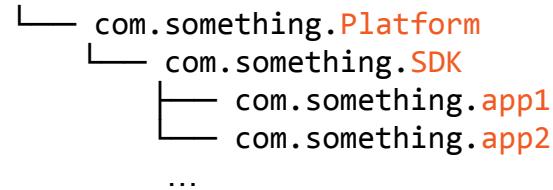
# Flatpak

System for app isolation, packaging,  
delivery, and running.

- GNOME Project (Alex Larsson)
- App portability
- Backed by OSTree
- Appstream metadata
- Single-file bundles (flatpaks)

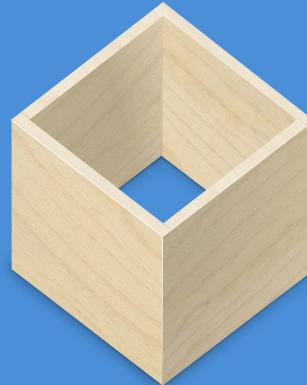
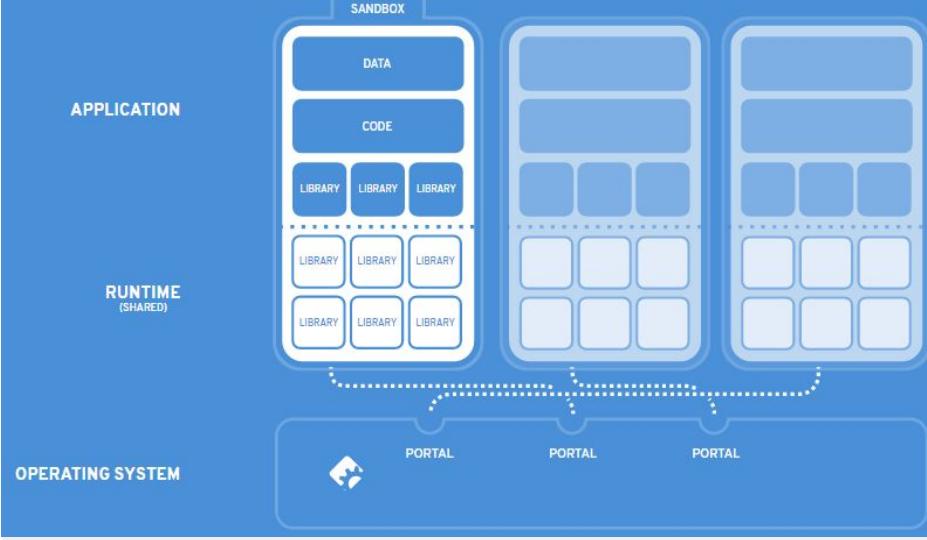
## Flatpak Layering

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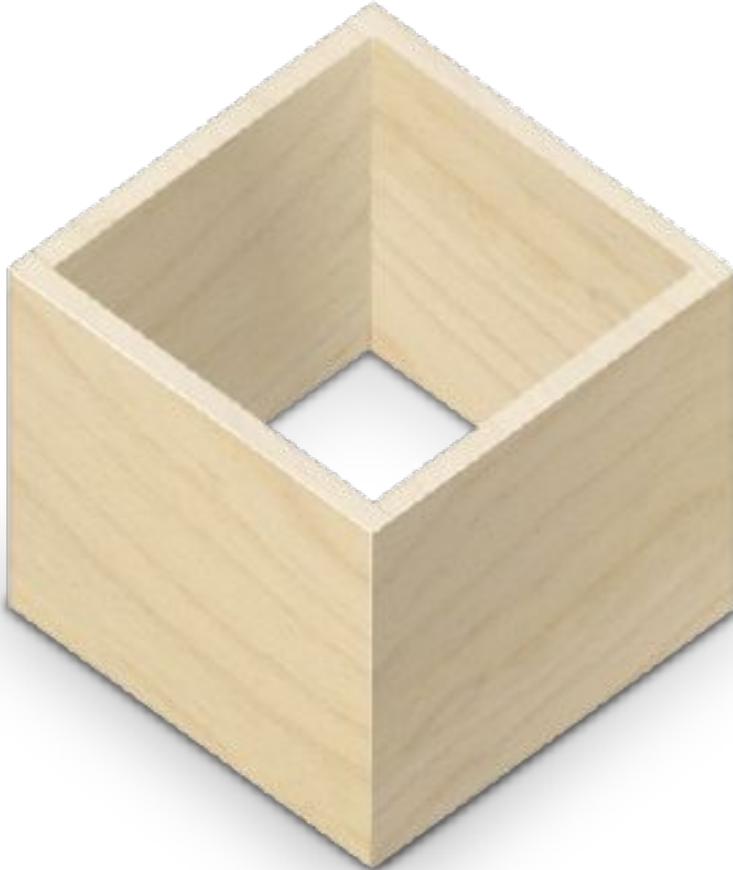


## Flatpak Basics

- OSTree-backed
- Bubblewrap (namespaces)
- Unprivileged sandboxing
- Mobile-like app permissions
- Standardized API (dbus, audio, etc)
- GPG commit signing



**FLATPAK**



## Building Flatpaks

- flatpak-builder CLI
- Input
  - Manifests
  - Manual context builds
- Produces
  - OSTree refs
  - Flatpak bundles
- Cross-compilation

# EXAMPLE

<https://github.com/flathub/org.gnome.gedit/blob/master/org.gnome.gedit.json>

# FlatHub

- Centralized “app store”
- Automatic builds
- Community supported
- GNOME Software support

The Flatpak website homepage features a large, abstract background with a blue-to-white gradient and a subtle wood-grain texture. At the top, there is a navigation bar with links for FLATPAK, FEATURES, GET FLATPAK, APPLICATIONS, HELLO WORLD, FAQ, and ABOUT & CONTACT. The main title "THE FUTURE OF APPLICATION DISTRIBUTION" is centered in large, bold, white capital letters. Below the title, a paragraph of text describes Flatpak as a next-generation technology for desktop applications. A "LEARN MORE" button is located at the bottom right of the page.

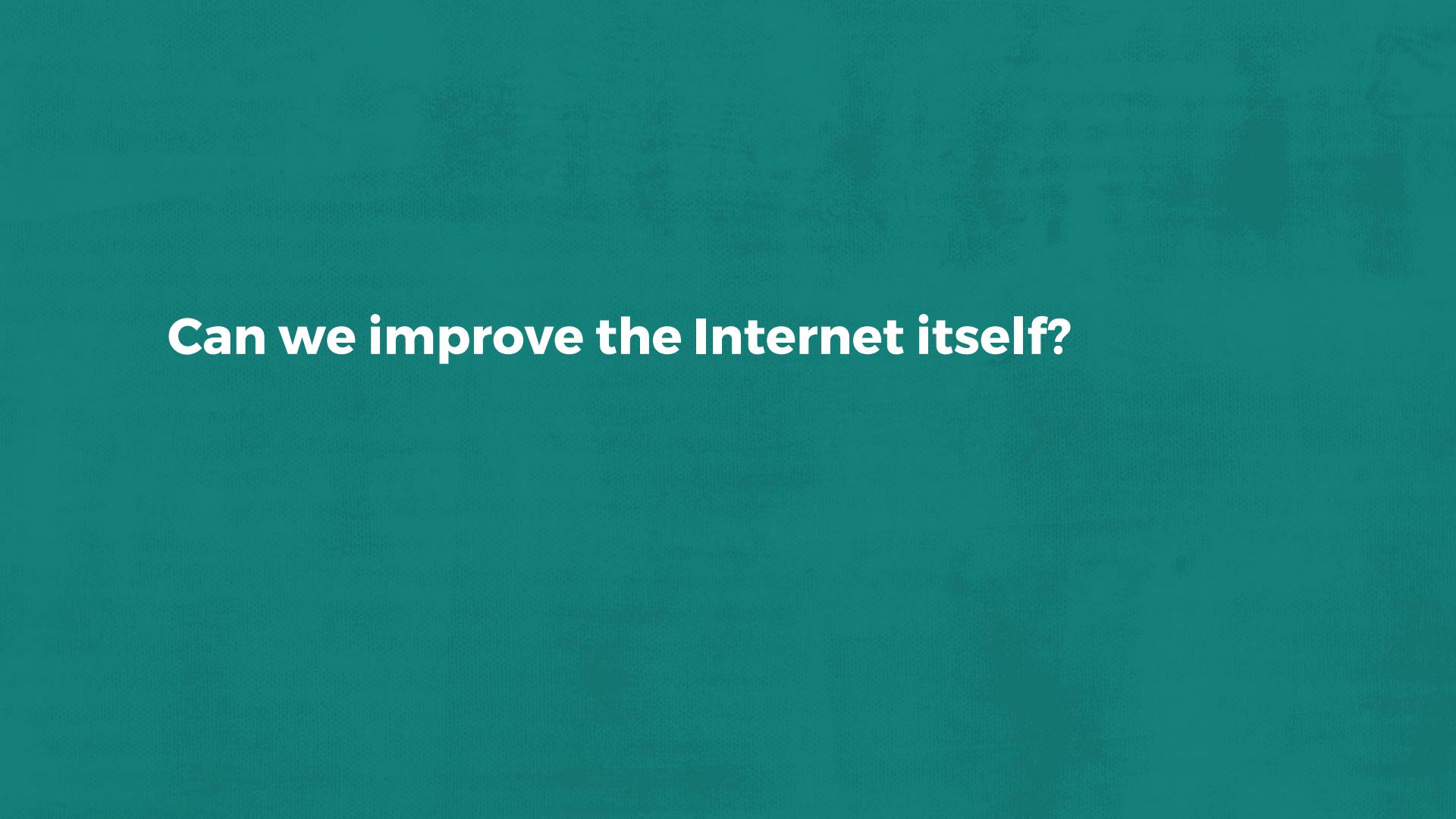
FLATPAK

FEATURES GET FLATPAK APPLICATIONS HELLO WORLD FAQ ABOUT & CONTACT

## THE FUTURE OF APPLICATION DISTRIBUTION

Flatpak is the next-generation technology for building and installing desktop applications. It has the power to revolutionize the Linux desktop ecosystem.

LEARN MORE



**Can we improve the Internet itself?**

# NDN (Named Data Networking)

Overlay content-centric addressing network

- NSF Future Internet Architecture Project
- Focus on content instead of locations
- Data trust instead of host trust
- Security and caching built-in
- One of many projects in this space

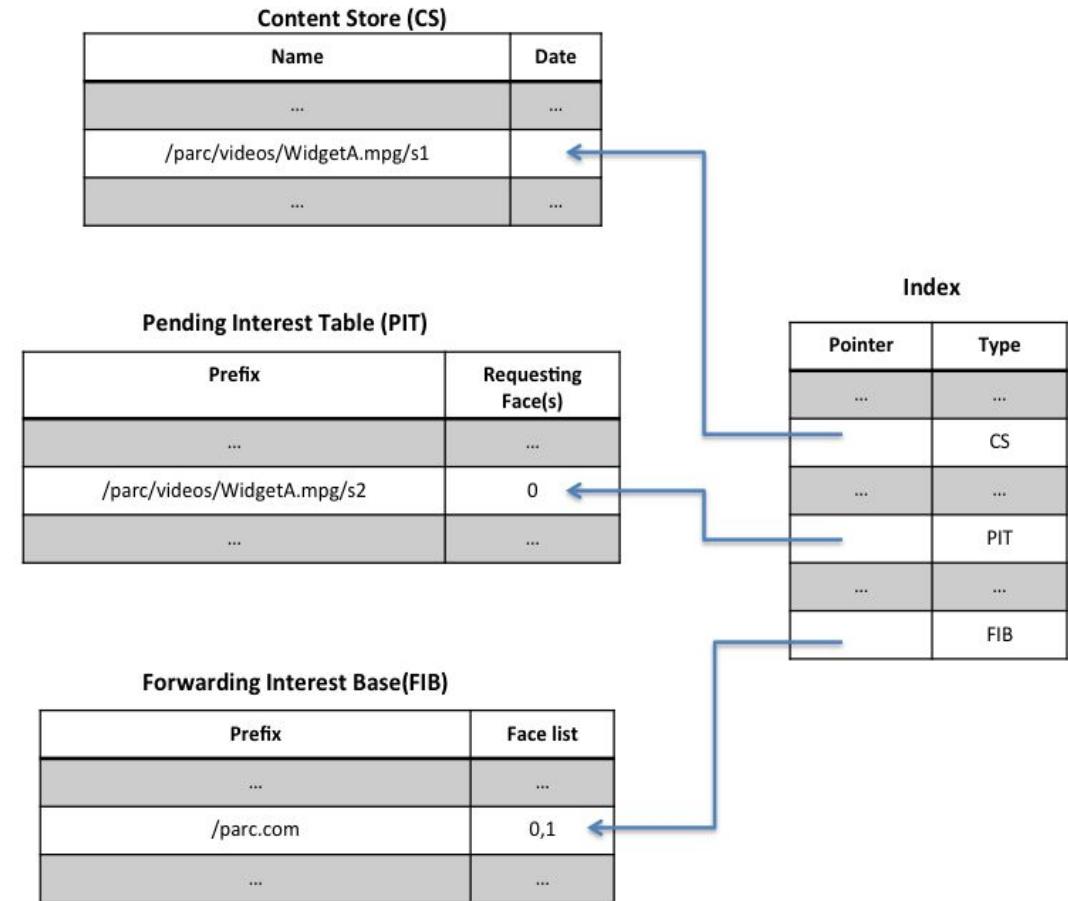
## NDN Data Flow

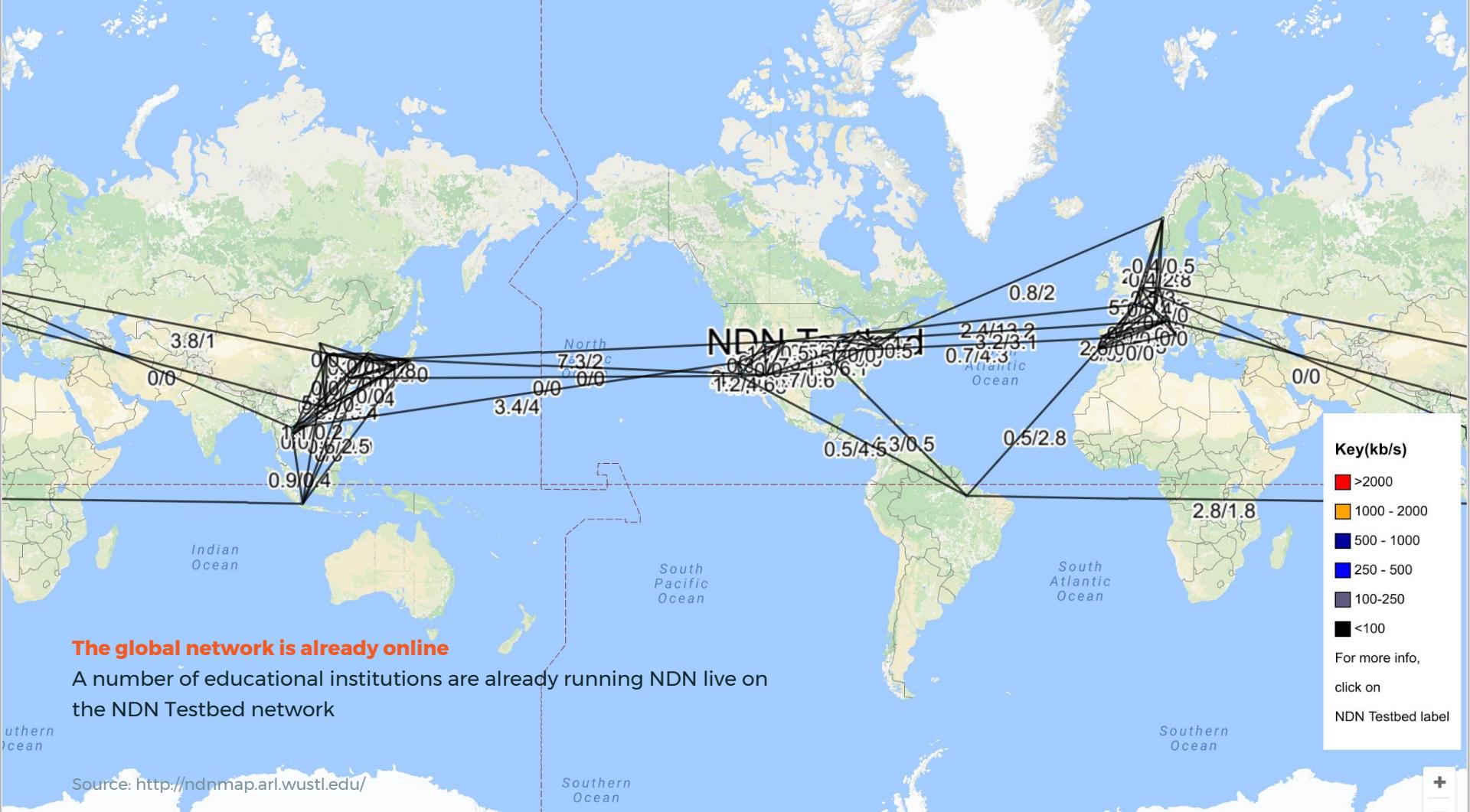
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- User sends interest packet
  - /com/site/video/rickastley/mp4
- Node checks if in cache
  - Forwards if not
- Repeat until content found
- Return data packet
  - Content ID
  - Signature
  - Data
- Follow return path

## NDN Advantages

- Data locality
- De-duplication
- Security on by default
- Anonymity\*
- Can run over IP
- Still in early phases





Can we do even better?



# Questions?

**Srdjan Grubor**  
**@sgnn7**  
**sgnn7@sgnn7.org**  
**srdjan@endlessm.com**

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Slide 25, 26: Courtesy <https://flatpak.org>

Slide 28: Courtesy <https://flathub.org>

Slide 32: Courtesy <http://ndnmap.arl.wustl.edu/>