



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

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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 single small, bright 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**

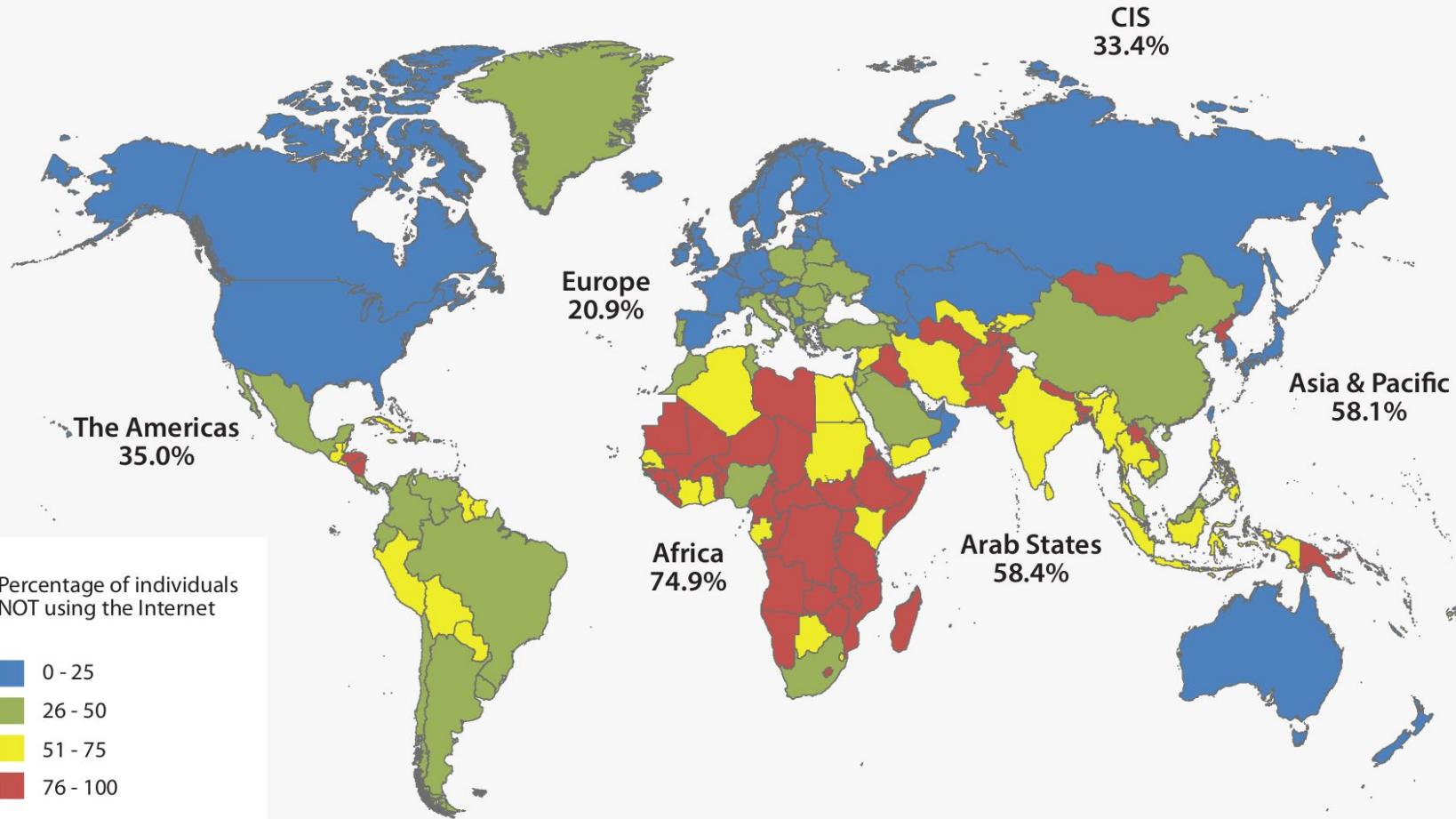


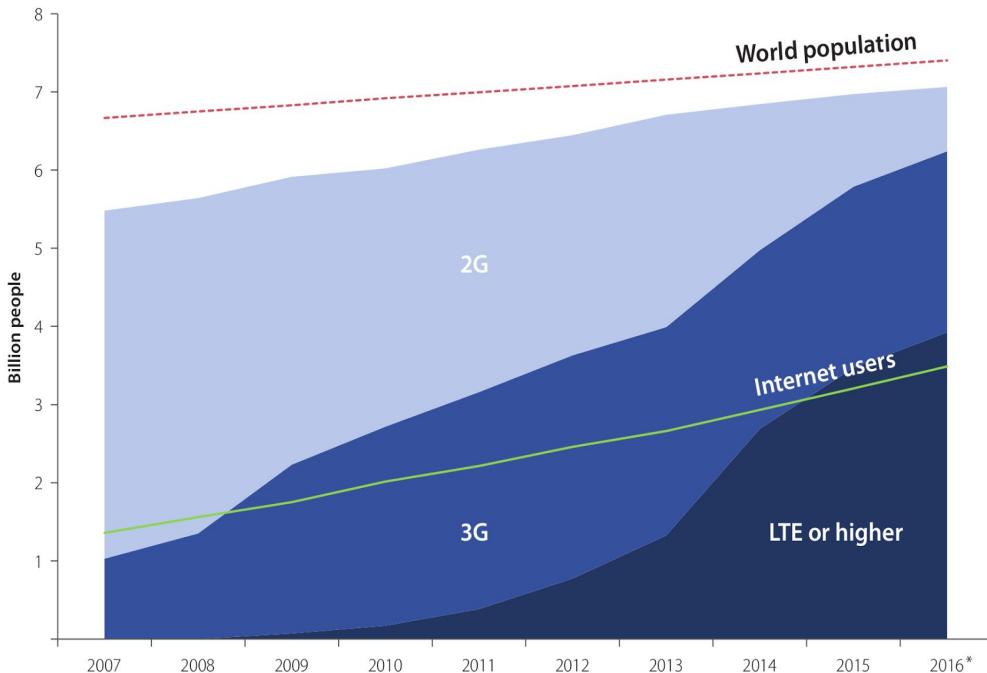
Chart courtesy of ITU

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

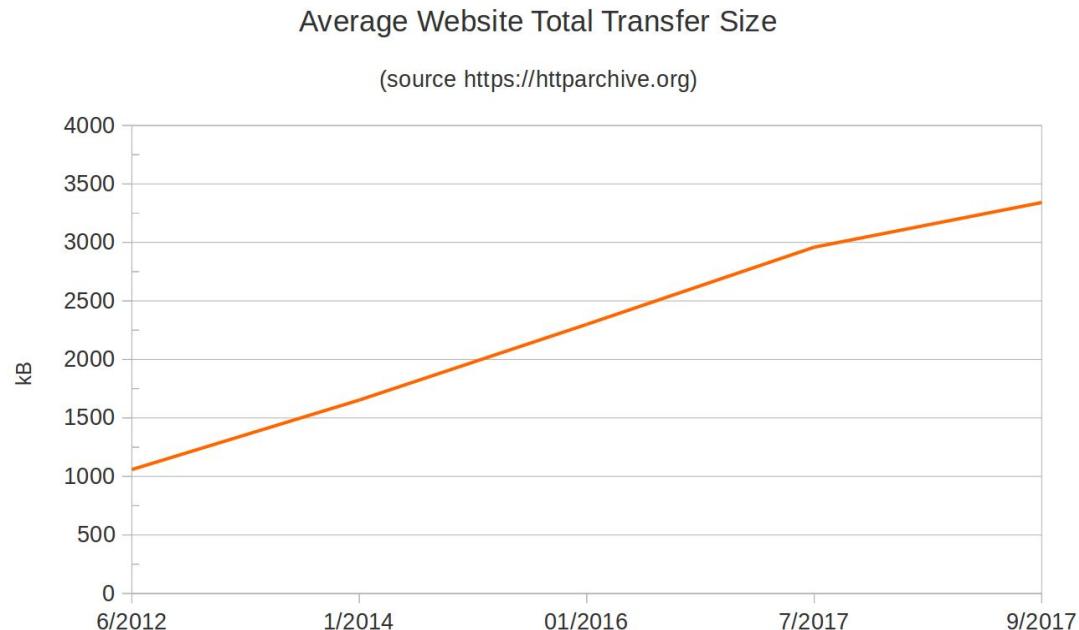


So what are we doing about it?

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?

- 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

- `/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

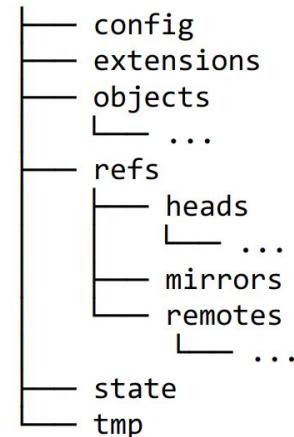


OSTree CLI

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



DEMO

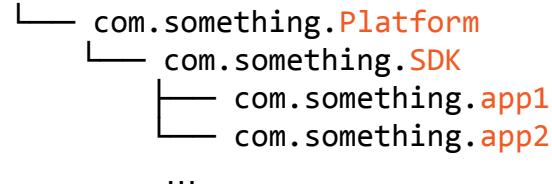
**Crazy thought:
What if we use the same
system for application
delivery?**

Flatpak

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

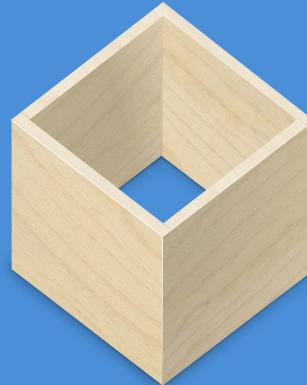
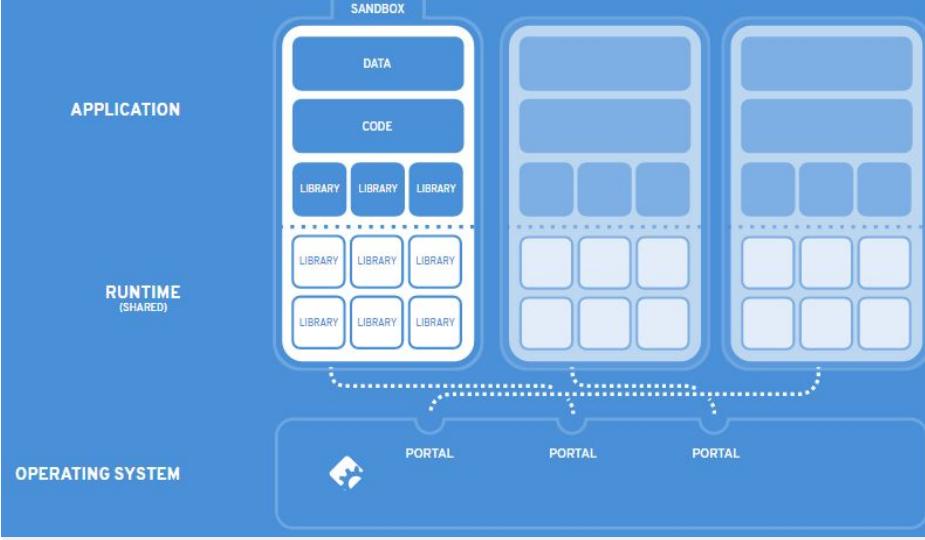
- GNOME Project (Alex Larsson)
- App portability
- Backed by OSTree
- Appstream metadata
- Single-file bundles (flatpaks)

Flatpak Layering

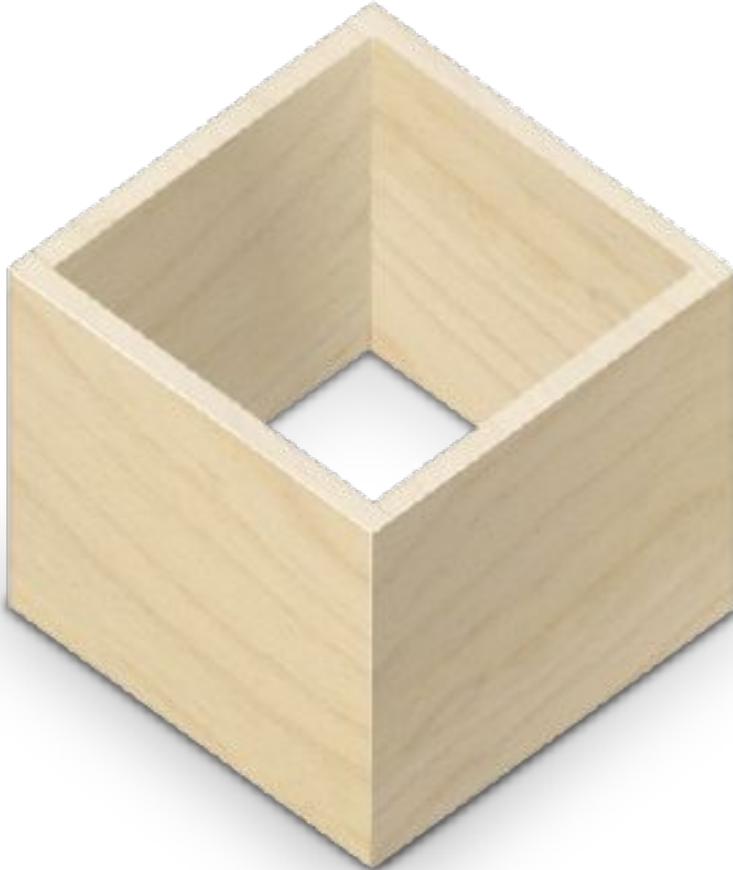


Flatpak Basics

- Based on OSTree commits
- 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 screenshot shows the official Flatpak website. At the top, there is a navigation bar with links for FLATPAK, FEATURES, GET FLATPAK, APPLICATIONS, HELLO WORLD, FAQ, and ABOUT & CONTACT. Below the navigation is a large, abstract background image featuring a blue-to-yellow gradient with diagonal stripes. In the center, the text "THE FUTURE OF APPLICATION DISTRIBUTION" is displayed in a large, white, sans-serif font. A thin horizontal red line is positioned below the main title. To the right of the title, there is a white call-to-action button with the text "LEARN MORE". At the bottom right corner of the page, the number "28" is visible.

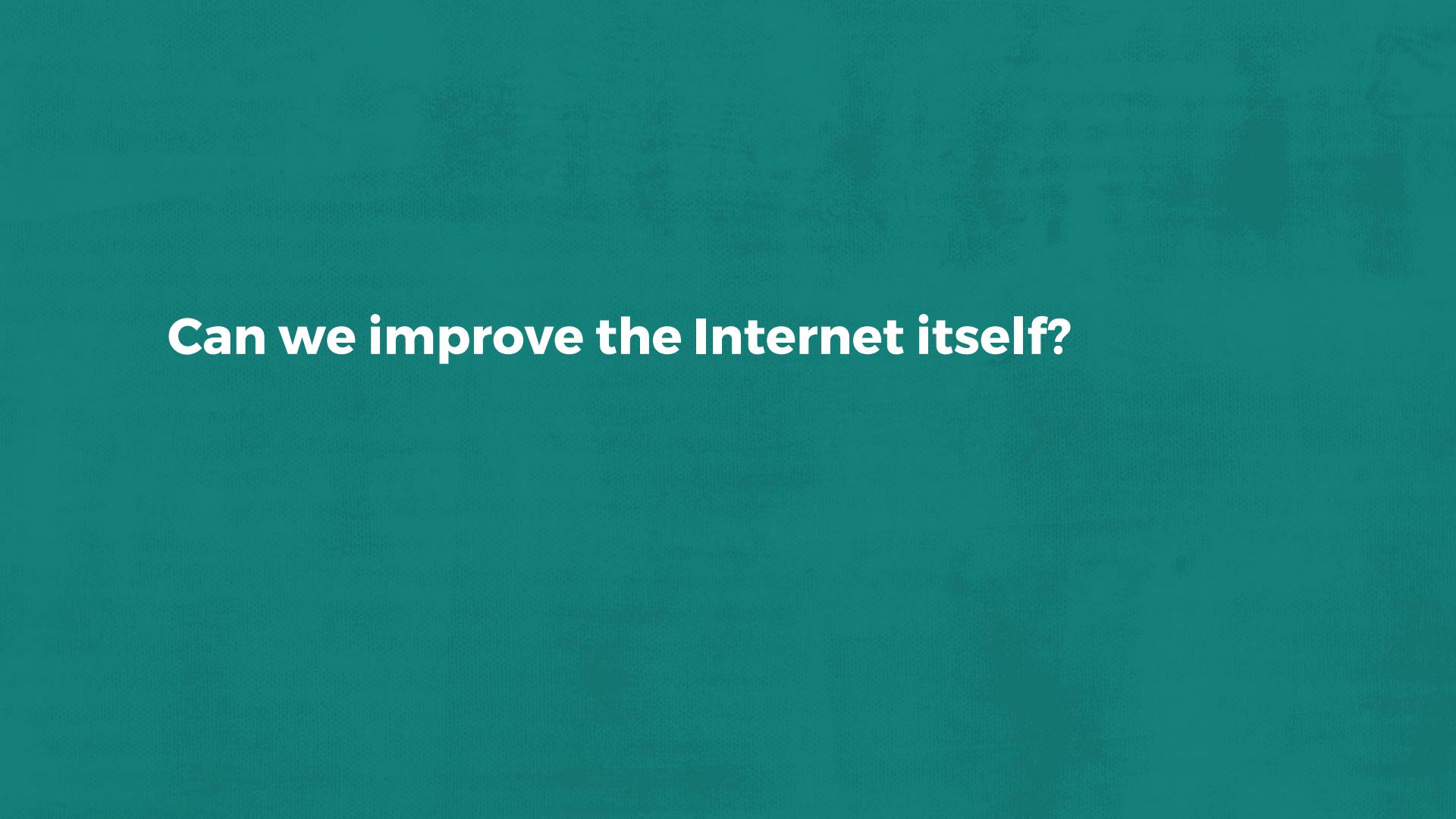
FLATPAK

FEATURES GET FLATPAK APPLICATIONS HELLO WORLD FAQ ABOUT & CONTACT

THE FUTURE OF APPLICATION DISTRIBUTION

LEARN MORE

28



Can we improve the Internet itself?

NDN (Named Data Networking)

Overlay network based on content-centric addressing.

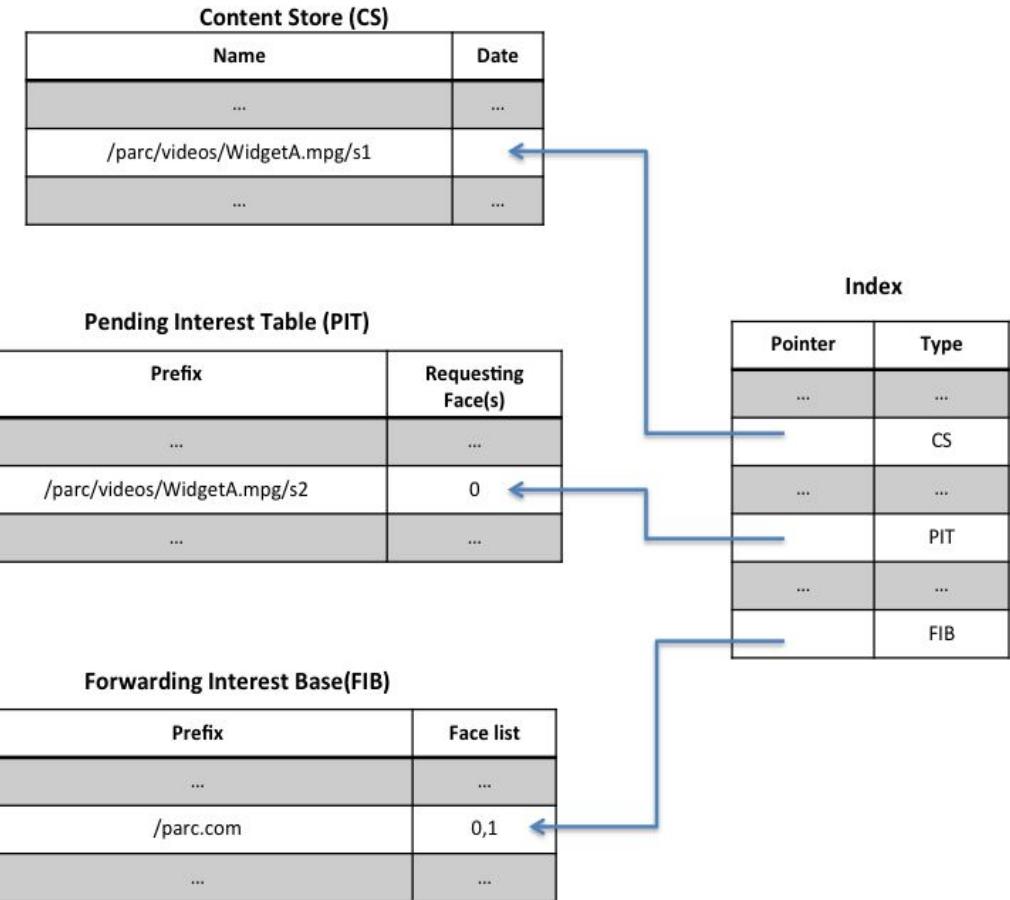
- NSF Future Internet Architecture Project
- Focus on content instead of locations
- Data trust instead of host trust
- Security and caching built-in
- One of many projects in this space

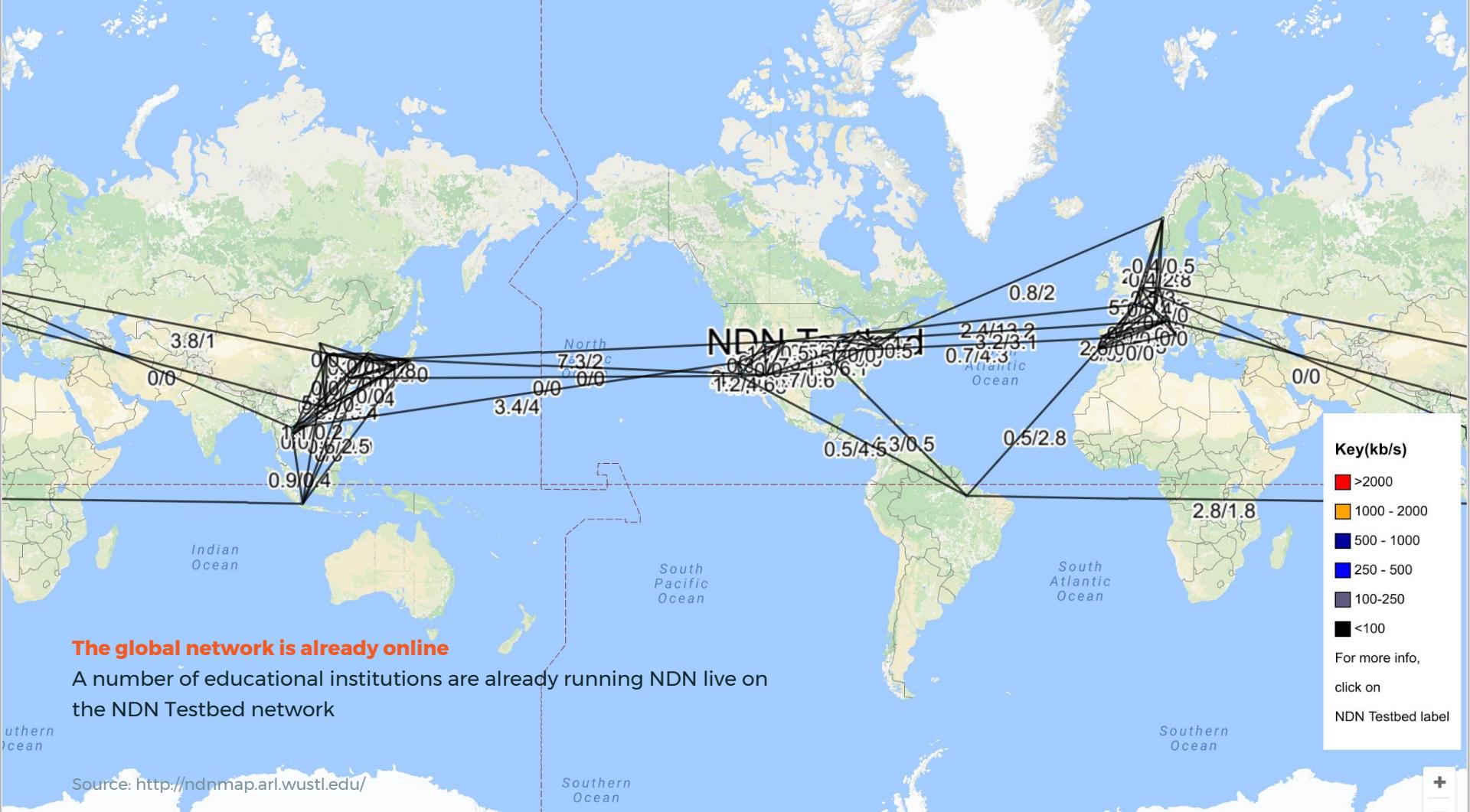
NDN Data Flow

- 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
- All data secured by default
- Anonymity*
- Can run over IP
- Still in early phases





Can we do even better?



Questions?

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Slide 13: Courtesy www.internetworkstats.com

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

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

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