Making India digitally 'inclusive'
On the connectivity hindrance

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Disclaimer

- Author has enough functional and theoretical knowhow on several aspects addressed in this presentation. However, author has used knowledge from different available online resources/ personal experiences/ observations to draw inference on some of the aspects.

- Opinions and inferences are all absolutely personal.

Digital India : Expectation

- Participative society through digital empowerment
- Availability of multitude of services at the finger tips of the citizen
  - Transparency
  - Responsiveness
  - Improved quality of life across social strata
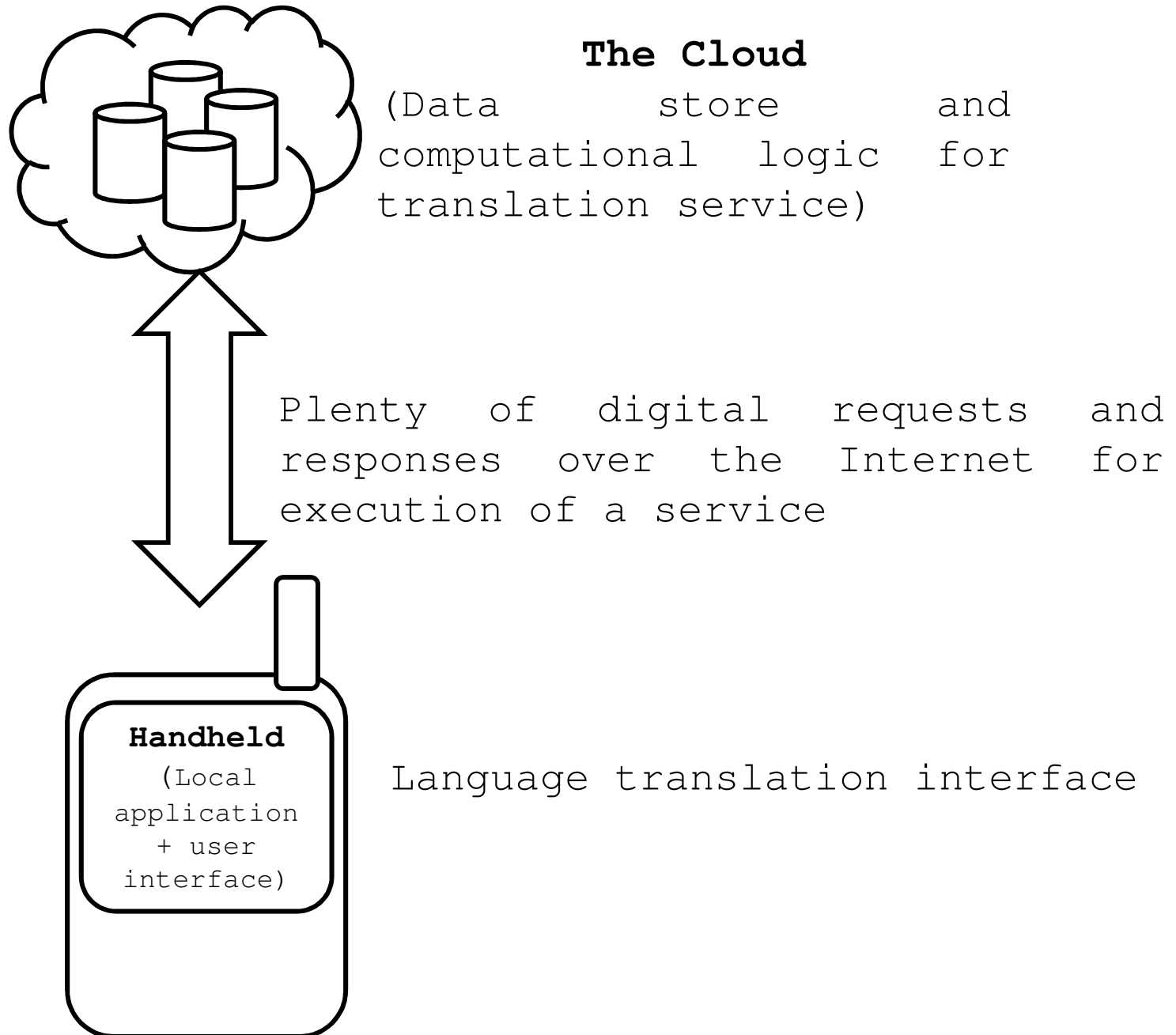 - Create an inclusive society

A key enabler: Internet connectivity

- Why connectivity is important?
  - The 'smart' services work in a distributed fashion
  - The handheld unit (e.g. mobile phone) is usually with constrained resources
    - Battery powered, low memory and processing capacity
    - Modern applications (including AI based ones like the language translation services) need high computing and memory capacity to perform the requested task in a time bound manner
  - The main computation logic runs in a remote server or a collection of interconnected servers (which we fondly call 'the CLOUD')
    - End user is agnostic of the existence of the physical servers/cloud
  - The communication between handheld and the Cloud happens over Internet

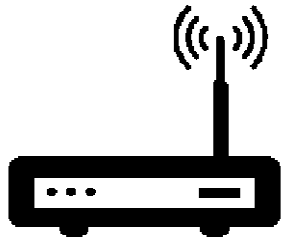# Ubiquitous connectivity + Adequate speed = Success of Digital India

- Ubiquitous connectivity → ensures digital reach to every strata of participants in the digital ecosystem

- Adequate speed → ensures the desired Quality of Service (QoS) and the Quality of Experience (QoE) for the end-user

- Without these the initiative becomes 'non-inclusive' and lacks 'responsiveness'

Let's take an example

The Cloud
(Data store and computational logic for translation service)

Plenty of digital requests and responses over the Internet for execution of a service

Handheld
(Local application + user interface)

Language translation interface

What are the options for public Internet access?

Community WiFi broadband

- Needs laying out fiber connectivity across geography

- Lot of infrastructural issues

- Progress in infrastructure creation lags behind the demand for infrastructure

- Not a feasible option for digital inclusiveness

Cellular Internet/ Mobile broadband(3G/4G)

- Can wirelessly connect over a wide area

- Service providers have laid the infrastructure since the era of 2G (GSM) deployment

- 3G/4G is rolled out

- The most accessible option for Internet connectivity
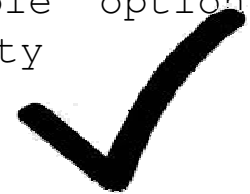
But what is the state of cellular broadband in India?

- Despite a claim of 84% 4G coverage India ranks 109th in terms of download speed
  - The practical speed received through 4G is around 2Mbps as country-wide average for download
    - upload speed is even less
  - In sub-urban and rural spaces the speed is awful in reality
    - The speed received is actually less than the theoretical maximum data rate for 2/2.5 G technology (GPRS)
  - The high frequency radio wave of 4G is unable to penetrate walls in many dense and covered urban areas
- Highly dependent on infrastructure created by private entrepreneurs driven by commercial viability
- ***Rural India has a mere 17% Internet penetration***

However….

- India has around 93% 2G (GSM) coverage
  - 2/2.5G has high penetration into society
  - Comparatively affordable
- But data rate is pre-historic
- Well, 4G is also not keeping its promise!

From solution design aspect

- Reality is
  - Solution architects mainly concentrate on the computing aspect
  - The computation responsibilities are distributed between cloud/ servers and end-user node for optimization of computation performance
  - But communication over Internet is essential for distributed computation
  - Computation designers take the Internet performance as 'given'
    - Many are agnostic about the connectivity problems

- Result : Many a times digital services fail to achieve the societal purpose
  - Connectivity status at the user-end fails to meet the benchmark required for ensuring QoS and QoE of the service
  - (This is actually a genuine problem for IoT deployment as well)

Few things that designers need to consider

- Design the solution such that the data volume required for essential digital request/ response exchange over the Internet is reduced
- Check if it is possible to install replica's of the cloud computation logic close to the end-user
    - Deploy in base stations if possible
    - Need help from cellular service providers
        - Govt. can be a mediator if it has a stake in the solution
- Use / design a communication protocol stack such that communication resource usage can be minimal
    - ***Can we design the communication exchanges such that even 2.5G connectivity proves sufficient (you need not care for 4G to make your service a success)***
    - Has direct impact on battery saving also

Caveat

- Many IT giants (including Microsoft) are investing in technology innovation keeping the communication constrains of India in mind
  - Alert: These solution may incur heavy licensing fees

- Good opportunity for indigenous innovators who identify there existence with the problems on this soil
  - The issue of technology license fees for a country with poor per-capita-income may not be a problem in such case

- Is the Indian academia and research fraternity doing enough?
  - Many are concentrating only on the computation aspects
  - Practical research for solving the Internet communication problems in India does not seem to be a primary research focus

- Has India surrendered her Internet needs to foreign innovations?
  - 2G/ 3G/ 4G/ WiFi/ LoRa → India is simply adopting
  - Note: These technologies are designed primarily for the prevailing conditions in Europe/ North America/ Japan, etc.
  - China has made a major inroad in last decade

While bidding adieu ….

- Should both the Union and State Governments univocally pursue Indian research community to create Indian standards to be deployed to solve the problem?
  - Some efforts are on but practical deployment of research outcomes is not yet in view
  - India specific standard organizations are mostly adopting global standards designed in other geographies
- May be it is good-time for kick-starting dedicated "Internet Research Lab (IRL)" with Government being an important stakeholder
  - Some folks from NIXI were vocal in this aspect in the past
  - But nothing has moved