

# WHY DOES TECHNOLOGY **FEEL FAST, SLOW,** SMOOTH, OR UNSTABLE?

A public, self-guided mini-lesson about what people feel and what systems measure.

EXPLORER

BUILDER

ENGINEER / RESEARCHER

Paper-only path included • Phone optional • No prior experience

[gunnchos.com](https://gunnchos.com)

# How to use this public deck

Start anywhere. Read one slide at a time. Pause when a question or activity appears.

## EXPLORER

Understand the idea using familiar experiences. No math or special vocabulary required.

## BUILDER

Draw the system, test an idea, and suggest a small improvement. Coding optional.

## ENGINEER / RESEARCHER

Investigate variability, measurements, assumptions, bottlenecks, and evidence.

**YOU NEED** A pencil and paper—or nothing more than your own observations.

**SUGGESTED ROUTE** Core lesson 1–14 → Activity 15–21 → Deep cut 22–24 → Wrap-up 25–26

**Your goal: leave with an answer, an artifact, a next step, or a better question.**

# Have you felt any of these?

A familiar symptom is the best place to start investigating a system.

**“I tapped it, but nothing happened.”**

A button takes too long to acknowledge the input.

**“The video keeps buffering.”**

Playback stops while the system waits for enough data.

**“The game is choppy.”**

Pictures appear unevenly or controls feel inconsistent.

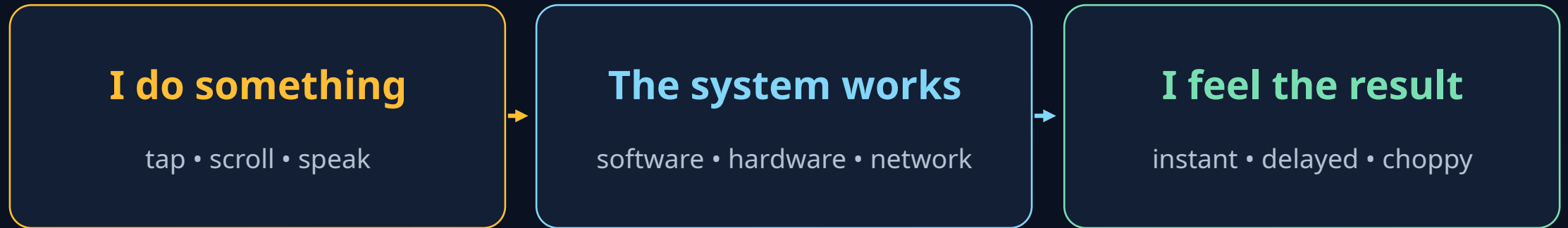
**“The call keeps cutting out.”**

Sound or picture arrives late, unevenly, or not at all.

**One word—“slow”—can describe several different problems.**

# Begin with the human experience

Week 1: see the whole system. Week 2: follow one tap. Week 3: ask how well it performs.



**The question is not only “Did it work?” It is “Was it usable for the person?”**

**A green connection icon is not the same thing as a good experience.**

# Four words for four different feelings

No need to memorize yet—connect the term to an experience.

## RESPONSE DELAY

How long until the system reacts?  
EXAMPLE: Tap → a visible response

## CAPACITY

How much useful work or data can move?  
EXAMPLE: Video loads without stopping

## CONSISTENCY

Does the delay stay steady?  
EXAMPLE: Call audio arrives evenly

## SMOOTHNESS

How evenly are pictures updated?  
EXAMPLE: Gameplay does not stutter

**Next we learn what engineers measure—and what each measurement can and cannot prove.**

# Meet the measurements

Each metric answers a different question. Better experience often requires more than one.

**LATENCY**

How long does one action or message take?

**THROUGHPUT**

How much data completes a trip per second?

**JITTER**

How much does delivery delay vary?

**PACKET LOSS**

How much expected data fails to arrive?

**FRAME TIME**

How long does it take to show the next picture?

**Related, not interchangeable: a fast download test cannot prove every app will feel responsive.**

# Latency: how long until something responds?

A tap may be detected immediately while the final result takes much longer.

**TAP**

**VISIBLE  
RESULT**



**How much time passed between those two events?**

**SHORT WAIT**

Can feel immediate.

**LONG WAIT**

May require clear feedback.

**Important: “fast enough” depends on the action and person.**

# Throughput: how much can get through?

A wide road can carry many cars, but that does not promise one car arrives immediately.

## LOWER DATA RATE



Fewer data pieces delivered per interval

## HIGHER DATA RATE



More data pieces delivered per interval

**A high download rate can help video streaming while a tap still feels delayed.**

# Jitter: when the wait is unpredictable

These are made-up numbers for learning, not measurements from a real network.

## STEADIER ARRIVAL TIMES



### STEADY

Updates arrive at fairly regular intervals.

## MORE VARIABLE ARRIVAL TIMES



### UNSTEADY

Some arrive quickly. Others arrive much later.

**Ask: Which pattern would make a live conversation harder to follow?**

# Loss: when expected information never arrives

Networks may retransmit, conceal, or tolerate missing data differently.



**Expected: 8 packets**

**Received here: 7 packets**

**Missing: 1 packet**

Missing data does not always look the same: it may cause a retry, glitch, pause, or nothing visible.

# Smoothness: it is not only a network question

A game or animation has to produce pictures at a steady pace.

## STEADY FRAMES



### 60 frames per second

About 16.7 milliseconds per frame (a target, not a guarantee).

## IRREGULAR FRAMES



### 30 frames per second

About 33.3 milliseconds per frame. Steady timing matters too.

**The picture can stutter even if the internet connection is fine.**

# Speed is not one number

Different experiences care about different constraints.

## VIDEO CALL

steady timing • low enough delay • clear audio

## DOWNLOADING A FILE

enough sustained throughput

## ONLINE GAME

responsive input • stable updates • smooth rendering

## SHOPPING CHECKOUT

correct state • trust • clear confirmation

**The correct goal is: what does this particular person need the system to do?**

# The Stability Contract

An idea from The Technology Landscape: connected is not the same as usable.

**The experience continues only while enough conditions stay within acceptable bounds.**

**ACCEPTABLE** delay

**CONSISTENT** delivery

**SUFFICIENT** data and compute

**RELIABLE** service and power

**What counts as “acceptable” depends on the activity, the person, and the context.**

# Troubleshoot what you can observe

A symptom is evidence; it is not automatically a diagnosis.

## OBSERVATION

## POSSIBLE EXPLANATION

## ONE SAFE COMPARISON

**ONE website is slow**

Site-specific service or app issue?

Compare other sites on same device.

**EVERY site is slow**

Shared local/network/device issue?

Compare on another device or connection.

**Game stutters offline**

Rendering or local workload?

Compare a simpler scene or setting.

**Call cuts out sometimes**

Variable delivery or service issue?

Check whether it happens on another call.

**Observe → Compare → Test → Learn. Do not claim a cause from one symptom.**

# Activity: become a performance detective

Paper-only option: choose an experience and make a simple investigation card.

**CHOOSE ONE: delayed button • buffering video • choppy game • broken-up call**

- 1 What did you try to do?
- 2 What did you actually notice?
- 3 Which measurement might matter?
- 4 What is ONE safe comparison you could make?

**Write “?” for things you do not yet know. That is part of the exercise.**

# Worked example: “My video keeps stopping”

See how a complete beginner can use the activity without guessing.

## 1 HUMAN GOAL

Watch an online video without unexpected pauses.

## 2 OBSERVATION

The image freezes and a loading indicator appears.

## 3 POSSIBLE MEASURES

Throughput, buffering, latency, server response, device load.

## 4 NEXT SAFE TEST

Compare a downloaded video versus streaming, if both are available.

**Conclusion: not enough evidence yet to say “the Wi-Fi is broken.”**

# Paper experiment: which experience feels steadier?

Synthetic observations: no computer, stopwatch, or calculations are needed.

## TAP FEEDBACK DELAY — five trials (milliseconds)

**APP A**

45 ms

50 ms

48 ms

46 ms

52 ms

**APP B**

45 ms

52 ms

220 ms

42 ms

48 ms

**Q1 Which app has the more consistent feedback times?**

**Q2 Why might “average speed” miss something important here?**

**Pause here and answer on paper. The explanation is on Slide 23.**

# Phone path (optional): observe without special apps

You may skip this entirely and still complete Week 3.

1

## TRY A SAFE LOCAL ACTION

Tap play/pause on media already saved, if available.

2

## TRY A NETWORKED ACTION

Only if you choose and already have connectivity; do not buy data.

3

## NOTICE THE FEEDBACK

Immediate change? Spinner? Wait? Missing or uneven update?

**No precise timing required. Do not record private screens, passwords, chats, or participant names.**

# Builder path: improve the experience

You can redesign feedback with a pencil before writing any code.

## BEFORE

You press "Submit."  
Nothing changes for 4 seconds.  
You press it again.  
Now there may be duplicate requests.

## AFTER

You press "Submit."  
The button shows "Sending..."  
A result then shows "Sent" or an error.  
The user knows what happened.

**YOUR TASK: Draw two screens—before and after. Mark one change that improves clarity.**

**Feedback can improve perceived usability even when the work still takes time.**

# Evidence card: turn a guess into a useful result

Copy this on paper, a document, or a whiteboard. One row is enough.

**OBSERVATION** I saw / heard / felt ...

**HYPOTHESIS** One possible explanation is ...

**SAFE TEST** I can compare ...

**RESULT** After the test, I observed ...

**NEXT QUESTION** The evidence still does not tell me ...

**Observation is not explanation. One test rarely proves a single cause.**

# Tell someone what you learned

Choose one pathway. All three count as completing the lesson.

## EXPLORER

Explain in two sentences why a device can say “connected” while a video call still fails.

## BUILDER

Draw a before-and-after interface that makes a delayed action less confusing.

## ENGINEER / RESEARCHER

Choose a measure and explain what it would show, what it would not prove, and what you would test next.

**Keep your artifact. You have evidence of thinking—not just a completed slide deck.**

# GO DEEPER: engineers measure the distribution

Optional. The core lesson and activity are already complete.

## AVERAGE IS NOT THE WHOLE STORY

A typical result can hide rare, very slow interactions.

## WORST AND TAIL RESULTS

Look at slow cases too: e.g., 95th or 99th percentile.

## MEASURE THE RIGHT THING

Input-to-feedback, packet round-trip, video frames: not the same metric.

## KEEP CONDITIONS FAIR

Compare the same workload, environment, and device conditions.

**Better measurement makes stronger explanations—not automatic certainty.**

# Experiment explained: App A vs App B

Return to Slide 17. What do the sample observations support?

## ANSWER 1 — CONSISTENCY

App A: 45, 50, 48, 46, 52 ms. Its observed delays stay close together.

## ANSWER 2 — OUTLIER

App B: 45, 52, 220, 42, 48 ms. One trial takes much longer than the others.

**WHAT WE CAN SAY:** In these five made-up trials, A is steadier.

**WHAT WE CANNOT SAY:** This proves A will always be faster for everyone.

# Three check-yourself questions

Pause, answer, then reveal the explanations below.

## **Q1** “High Wi-Fi bars prove the call is fine.”

EXPLANATION: Not necessarily. Signal strength alone cannot certify the full experience.

## **Q2** “A game can stutter even offline.”

EXPLANATION: Yes. CPU/GPU work and frame timing can still create uneven pictures.

## **Q3** “A loading spinner fixes slow service.”

EXPLANATION: No. It improves feedback, not the underlying completion time.

# You can now ask better questions

The goal was not memorizing acronyms. It was making ordinary experiences investigable.

- 1 "Slow" can mean delay, too little delivered data, irregular timing, or uneven frames.
- 2 A connected device may still give a poor human experience.
- 3 Observe first; compare and test before claiming a cause.
- 4 A paper diagram can become a useful engineering experiment.

**NEXT THURSDAY • OCT 22: What is actually inside your phone or computer?**

**Bring a question. Bring a problem. Bring an idea. Or just bring your curiosity.**

# Keep learning (and share this lesson)

Free public resources • learning works with pencil and paper

**gunnchOS3k company & ecosystem**

<https://gunnchos.com>

**WAIKE learning pathways**

<https://github.com/gunnchOS3k/waike-research-ops>

**The Technology Landscape**

<https://github.com/gunnchOS3k/gunnchos-technology-landscape>

**MDN: Animation performance and frame rate**

[https://developer.mozilla.org/en-US/docs/Web/Performance/Guides/Animation\\_performance\\_and\\_frame\\_rate](https://developer.mozilla.org/en-US/docs/Web/Performance/Guides/Animation_performance_and_frame_rate)

**web.dev: Interaction to Next Paint**

<https://web.dev/articles/inp>

Source note: synthetic example numbers are for learning; they are not real-world benchmark measurements.