Hi !

I’m Frédéric BISSON, a french engineer. I work for the city of Rouen (Normandy).

My interest for the Minitel started when my employer decided to give away its old french little boxes.

Before that I had nearly never touched a Minitel.

Collecting for collecting would be meaningless if I did nothing with them.

SUMMARY

- How France conquered the world
- How it worked
- HTML5 and ES6 to the rescue
- Creating a VideoTex page [live demo]
- Surfing on Minitel [live demo]

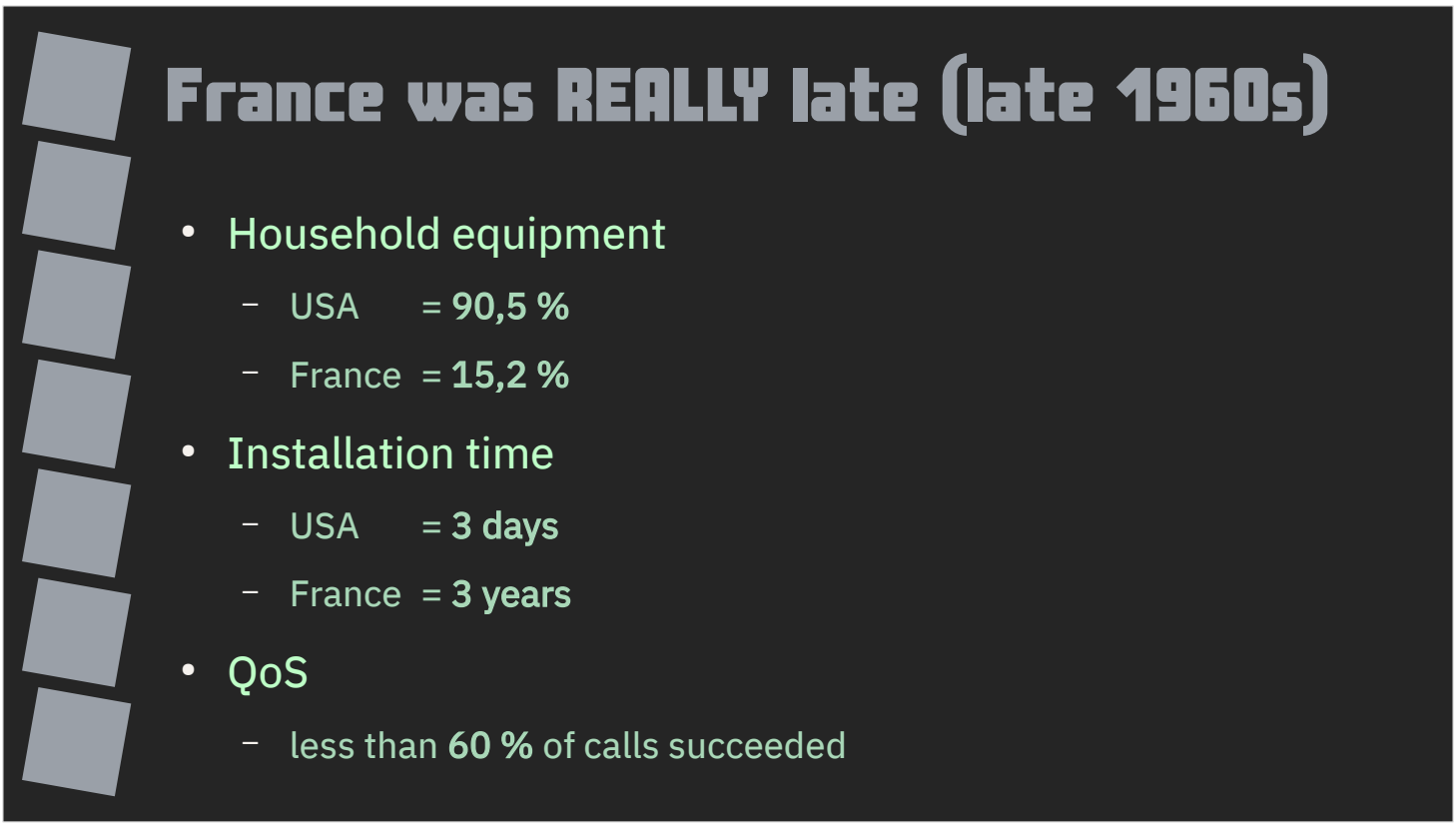
We’ll start with a brief history of Le Minitel and how France conquered the world.

Next, you will have a glimpse of how it worked and how it can be emulated in a standard web browser.

I'll end this presentation with two demos : how to create a Minitel page and how to surf on Minitel services nowadays

How France conquered the World

Yes France nearly conquered the World!



Late 1960s, France was really, really late on telephony.

At this time, only 15% of french households were equipped while 90% of their American counterpart where.

You needed 3 years, no joke, to get a phone line at home.

And quality of service was so low that more than 40% of calls did not succeed.

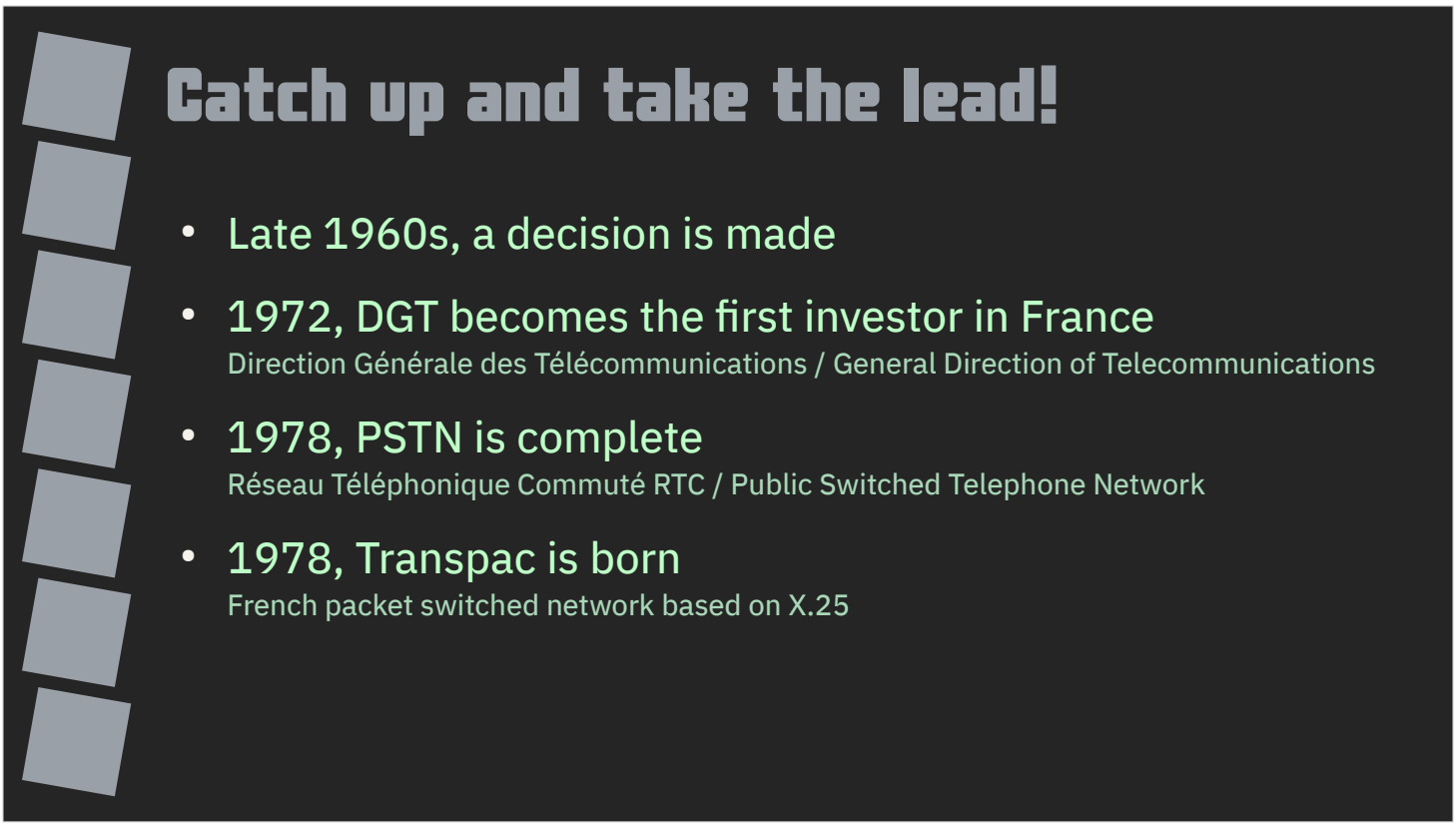
So what?

- Manual switching until **the late 1970s**!
  - First automatic switch was tested in 1912
  - France is completely automated in 1978
- Up to 30000 operators
  - ~100 subscribers / operator
  - < 400 calls / hour / operator
- But France has a super plan!

The last operator worked until 1978 thought the first automatic switch was tested in 1912, 66 years before!

Up to 30000 operators were employed, making each call much more expensive than everywhere else.

But, fear not my friends, France had a super plan!



We took over the world with the best technology of all time : French technology.

And that needed a lot of money. Telecommunications became the first investor in France.

In less than 10 years, the public switch telephone network was completely automated and Transpac was born.

Transpac is the french packet switched public network based on X.25, a technology so much better than TCP/IP.

Transpac

- A public network: RCP
  packed switched network, virtual circuit, X.25
- Variable rate
  50 bits/s to 64000 bits/s
- Heterogeneous
  direct access, modem, Telex...
- New pricing
  depends on rate and connection time, does not depend on distance

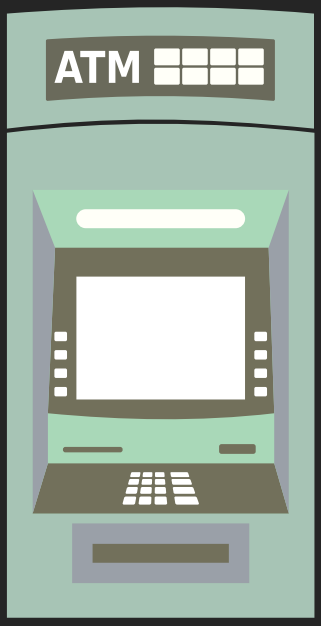
Transpac allowed from 50 bits/s (because of Telex) to 64000 bits/s.

It was heterogeneous, meaning you could access it directly, via a modem or with Telex.

Its pricing was really innovative at the time : it did not depend on the distance, only on rate and connection time.

What could you do with Transpac?

- B2B applications
  - Links between agencies (banks, insurance...)
  - ATM machine
  - Payment terminal
- B2C applications
  - Minitel



For B2B applications, you could link agencies across France, connect ATM machine, payment terminal for example.

For B2C applications, it was Le Minitel realm.

Here comes the Minitel!

- Minitel = television + network + computing
  - 1974, BBC's Ceefax
  - 1979, CCETT's Antiope
- Getting it adopted by the French is not an easy task
  - Micro-computing is hard to grasp
  - Micro-computing is expensive
  - Nobody dreams of network

Le Minitel was a Videotex screen with a keyboard connected to the network with an internal modem.

The main task was to get it adopted by the French. Back then, very few households had a micro-computer : it was expensive and difficult to use.

And nobody dreamed of network.

Make it easy to use

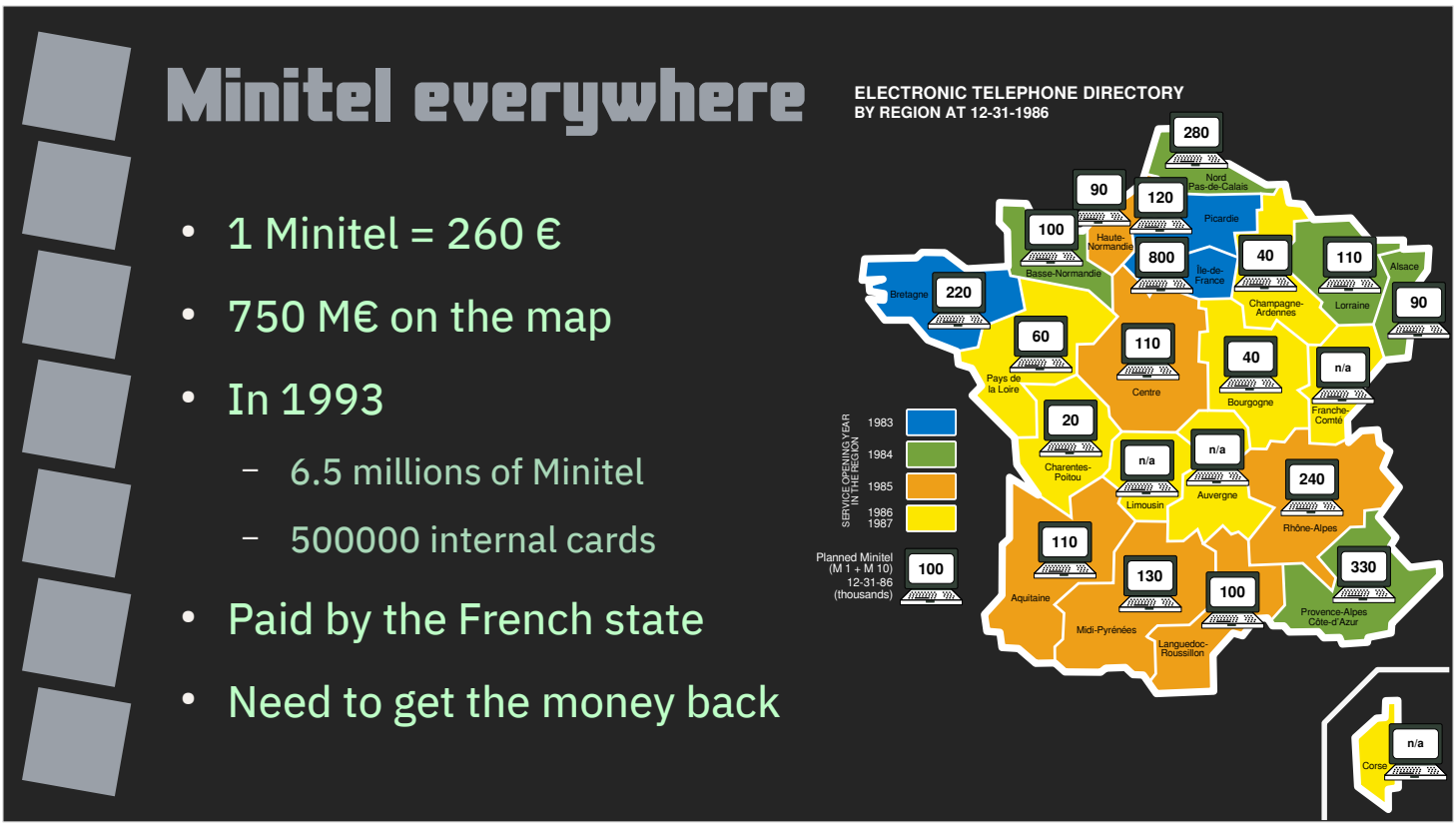
- A simple terminal
  - zero maintenance, zero config
  - easy to install and use
- One killer app
  electronic telephone directory
- Ad campaign
- A **FREE** terminal
  free as in free beer!

But don't forget the great French mind! We knew how to make Le Minitel a success.

First, Le Minitel was a plug and play terminal. Zero configuration, zero maintenance.

Second, it needed a killer app : the electronic telephone directory which gave access to the phone numbers of all France while the standard telephone directory gave you only the phone number in your region.

Third, Le Minitel was handed free! You read right, free as in free beer.



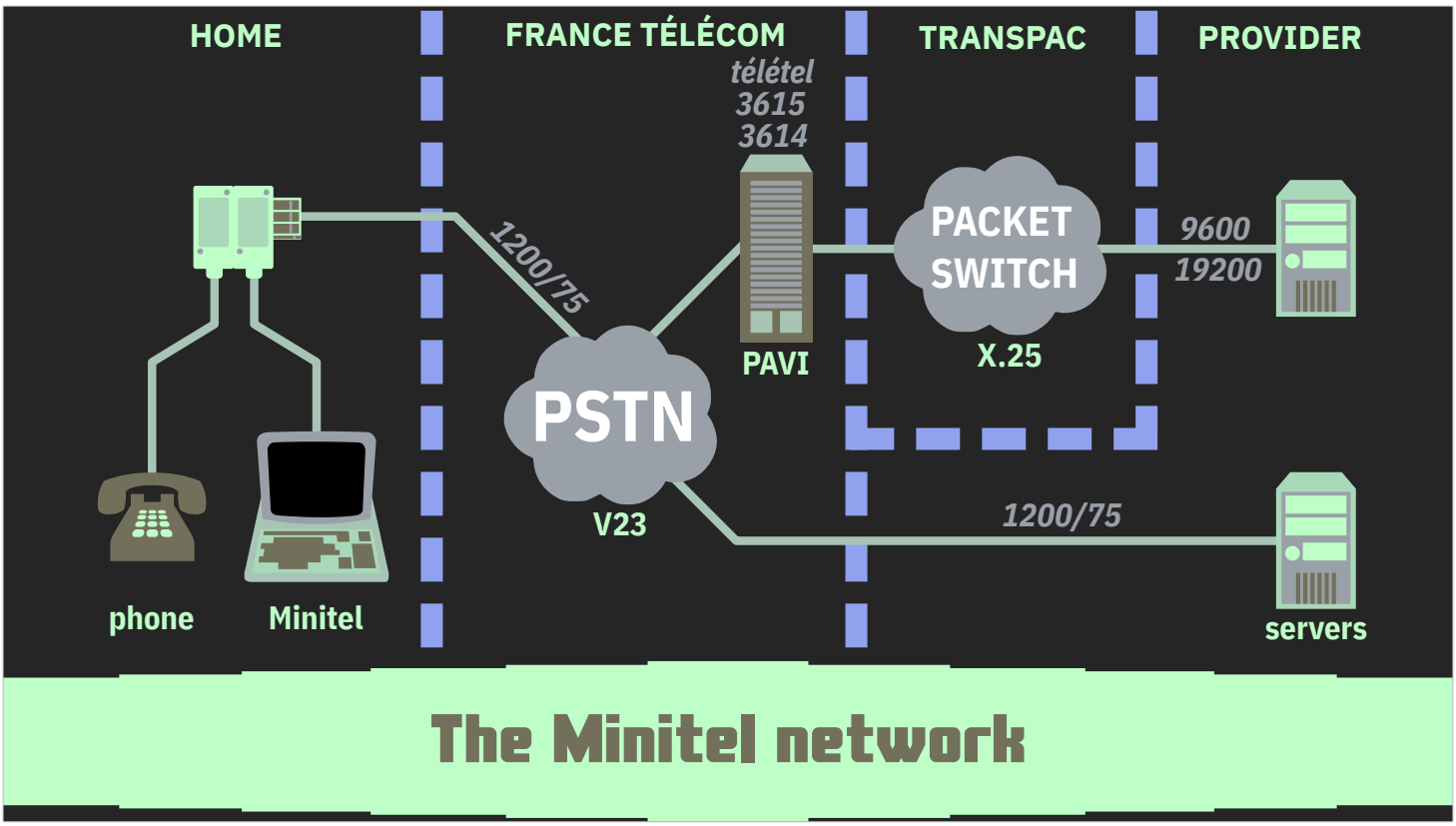
1 Minitel cost 260€, entirely paid by the French state.

In 1993, 6.5 millions of them were installed in households.

And the French needed to get the money back.

It did so by introducing the Kiosk, a catalog of services paid by time spent.

How it worked



This is a schema of the Minitel network.

On the left, at home, there was the Minitel and a telephone. The telephone was used to dial the number.

The phone line was then used to go through the Videotex access point or PAVI in French. The PAVI connects the PSTN to the packet switched network.

It housed the electronic telephone directory and, most importantly, it handled all the billing.

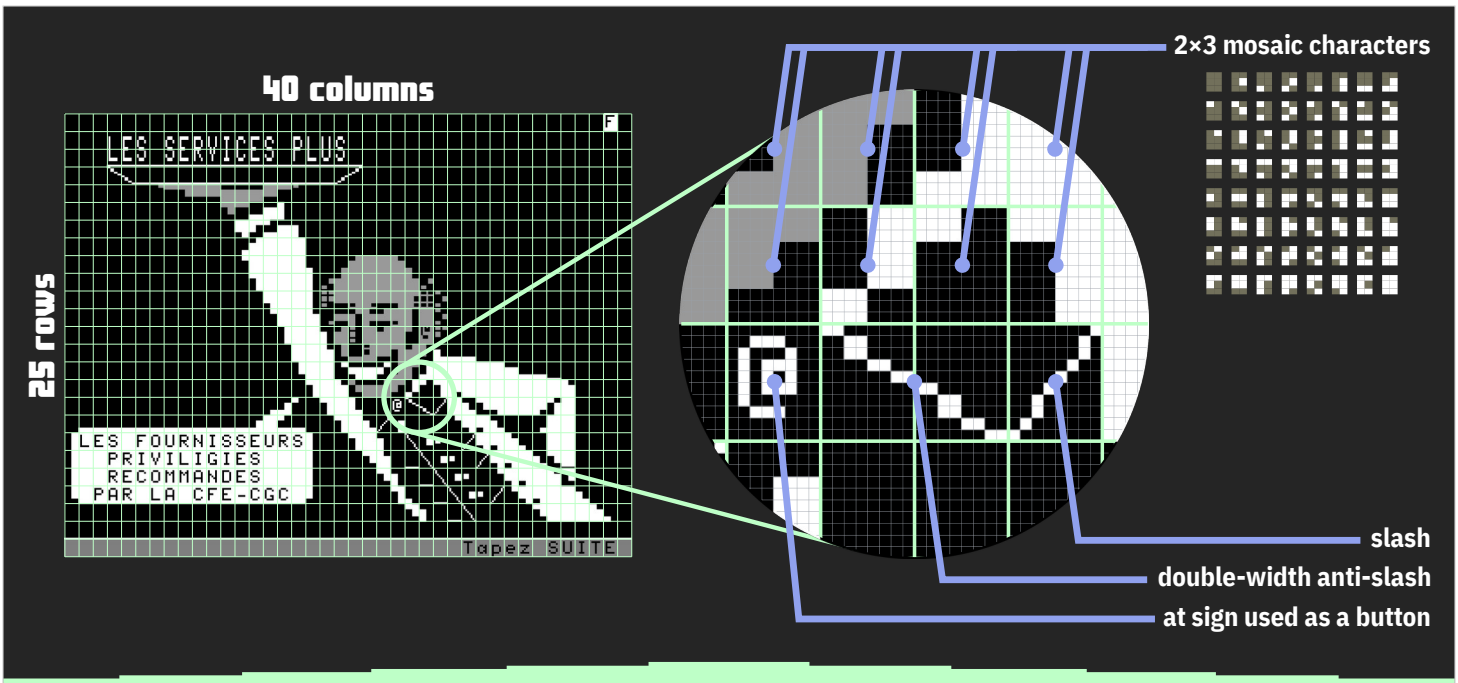
Servers directly connected to the PSTN avoided the Transpac network but were very limited in the number of lines they could handle.

Le Minitel itself is a black and white passive terminal which communicates in 7 bits Videotex.

Screens are composed of 40 columns for 25 rows. This gives an actual resolution of 320×250 pixels.

It can display 8 colors : black, red, green, blue, yellow, cyan, purple and white.

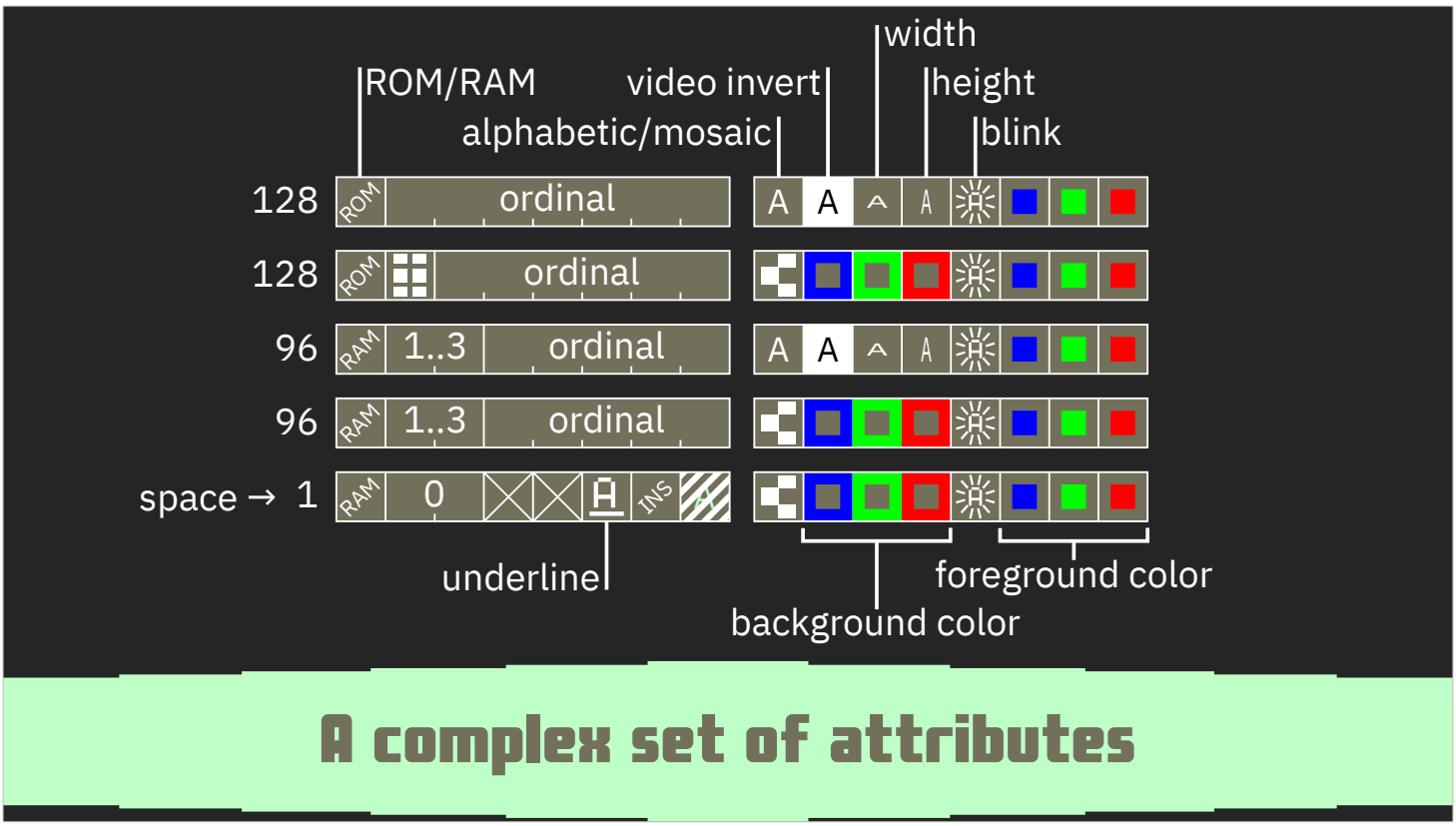
It can download at 1200 bits/s and upload at 75 bits/s. 75 bits is approximately 7 characters per second which was considered enough for the keyboard.



To overcome the limitation of text screens, Videotex has 64 special characters. They are the 64 combinations of a character divided into 2×3 blocks.

In order to get the best out of Videotex, you had to combine mosaic characters with ASCII characters.

In this example, the button is an at sign.



A complex set of attributes

Videotex uses a complex set of attributes. They are coded internally on 16 bits.

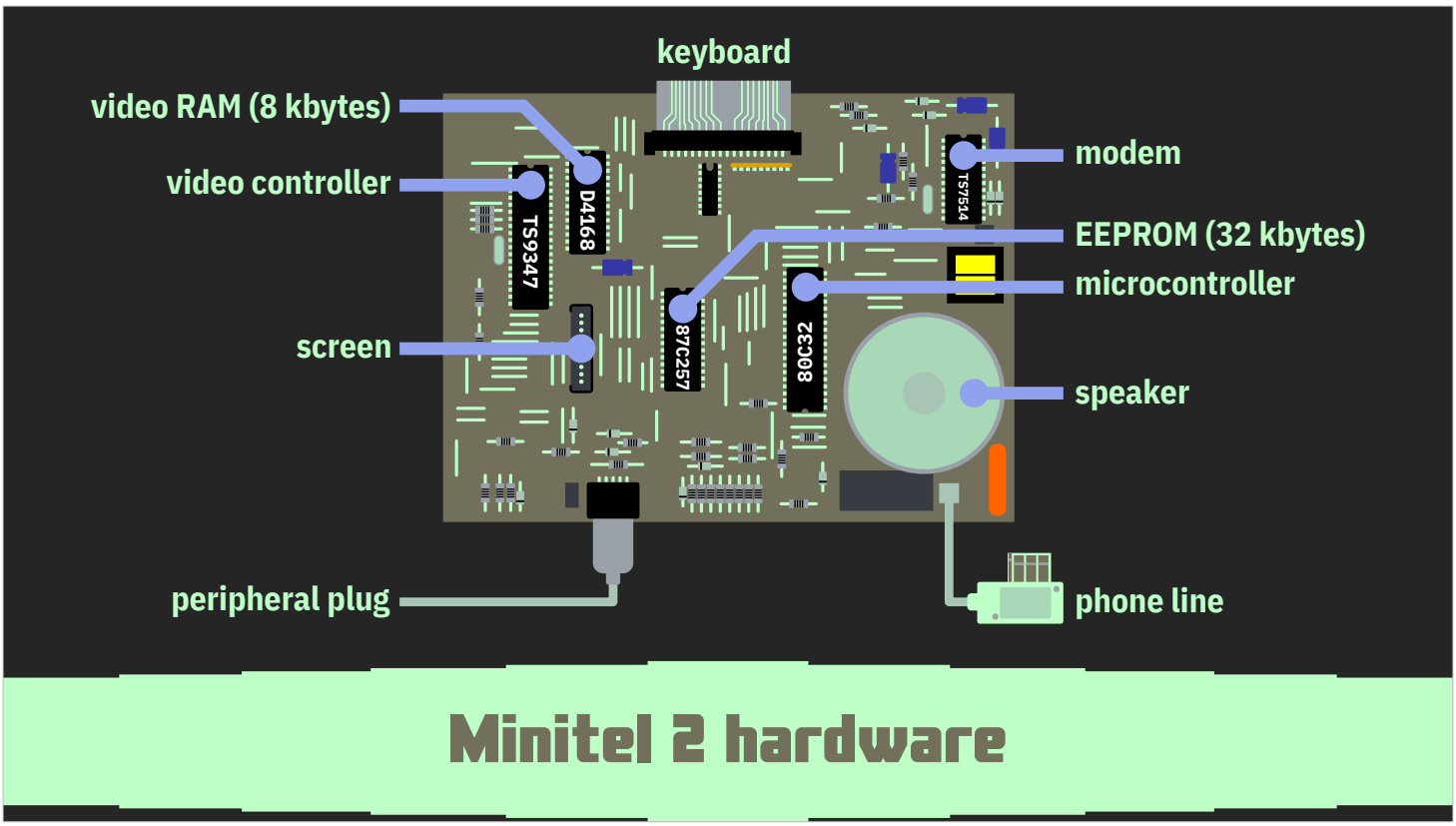
The engineers played with constraints to be able to display up to 449 characters on a screen while having 8 colors, mosaic characters, blinking, underlining, double width, double height, video inversion.


```
0C                          clear screen
1F 4C 4C                    go to row 12, column 12
1B 4F                       set double width + double height
1B 43                       set foreground color to yellow
46 4F 53 44 45 4D 27        FOSDEM'
1B 4E                       set double width + normal height
1B 46                       set foreground color to cyan
0B                          move cursor to preceding row
32 30                       20
```

What Videotex stream looks like

This slide shows what Videotex stream looks like. For those familiar with ANSI console, this is the same principle but with different capabilities.

Characters before the space are control characters which are not visible but change the terminal behaviour.



At the hardware level, Le Minitel is close to a computer, a computer your cannot reprogram.

The processor is a micro-controller to which the modem, the speaker, the keyboard and the video chipset are connected.

The enemy brothers

Web (<HTML5)	Minitel
client initiates request	full duplex
no state	continuous
separation of content and presentation	graphics and text are the same
hyperlink	no hyperlink
hardware agnostic	tied to hardware
HTML, CSS, JS	Videotex

Web and Videotex are very different.

On the web, the browser initiates the request. On Minitel, communications are full duplex : the server may send data whenever it wants.

The web has no state while the Minitel uses a continuous stream.

The web separates content and presentation. Not the Minitel.

The greatest advantage of the web is its hyperlink system which the Minitel sadly lacks of.

It is also hardware agnostics contrary to the Minitel.

What's needed to emulate a Minitel

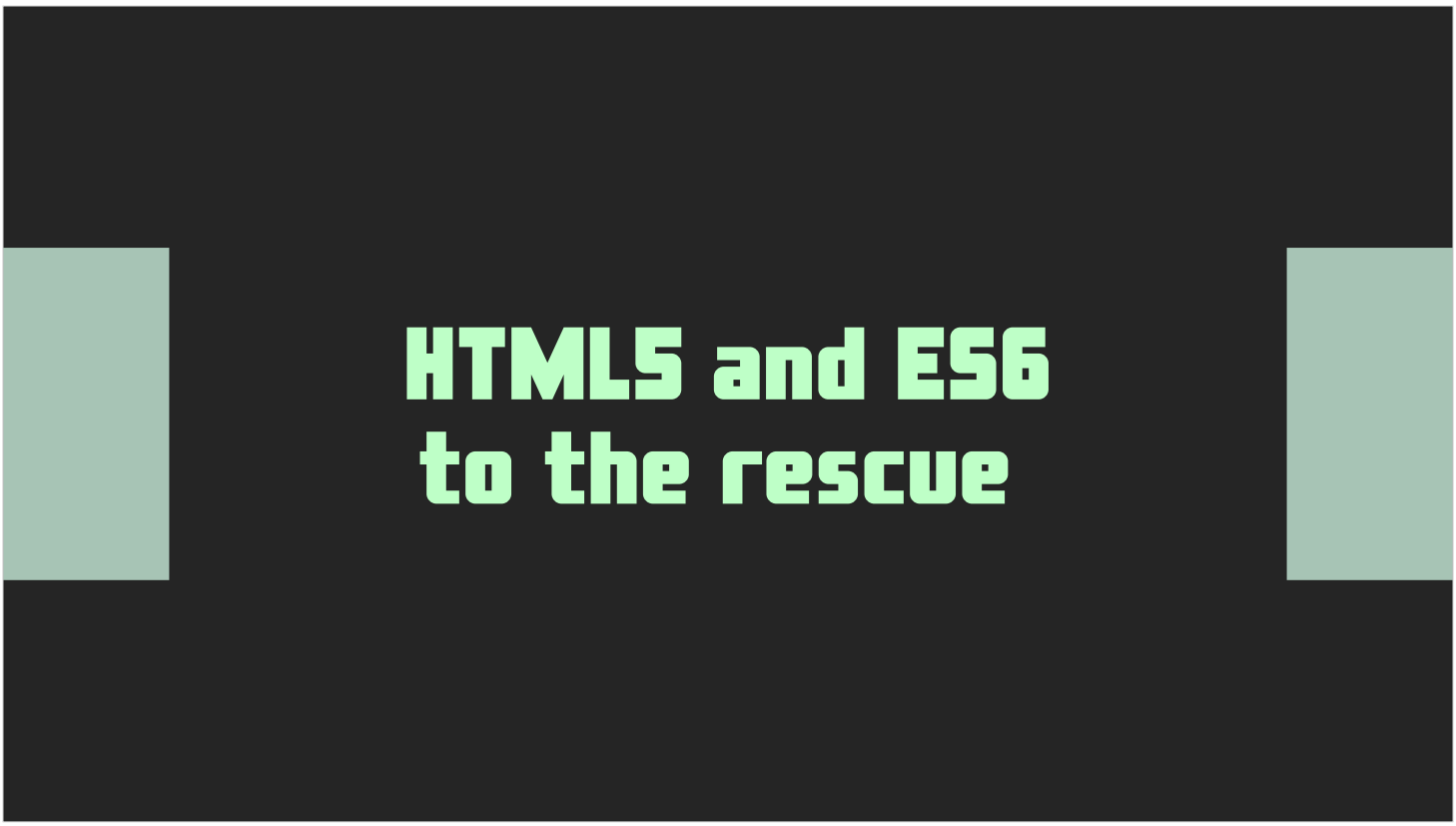
- A widely available platform
- Specific capabilities
  - asynchronous communication
  - graphic primitives
- Identifying essential parts
  - Videotex interpreter
  - video controller
  - a Minitel service to connect to

To emulate the Minitel, we need to satisfy some points.

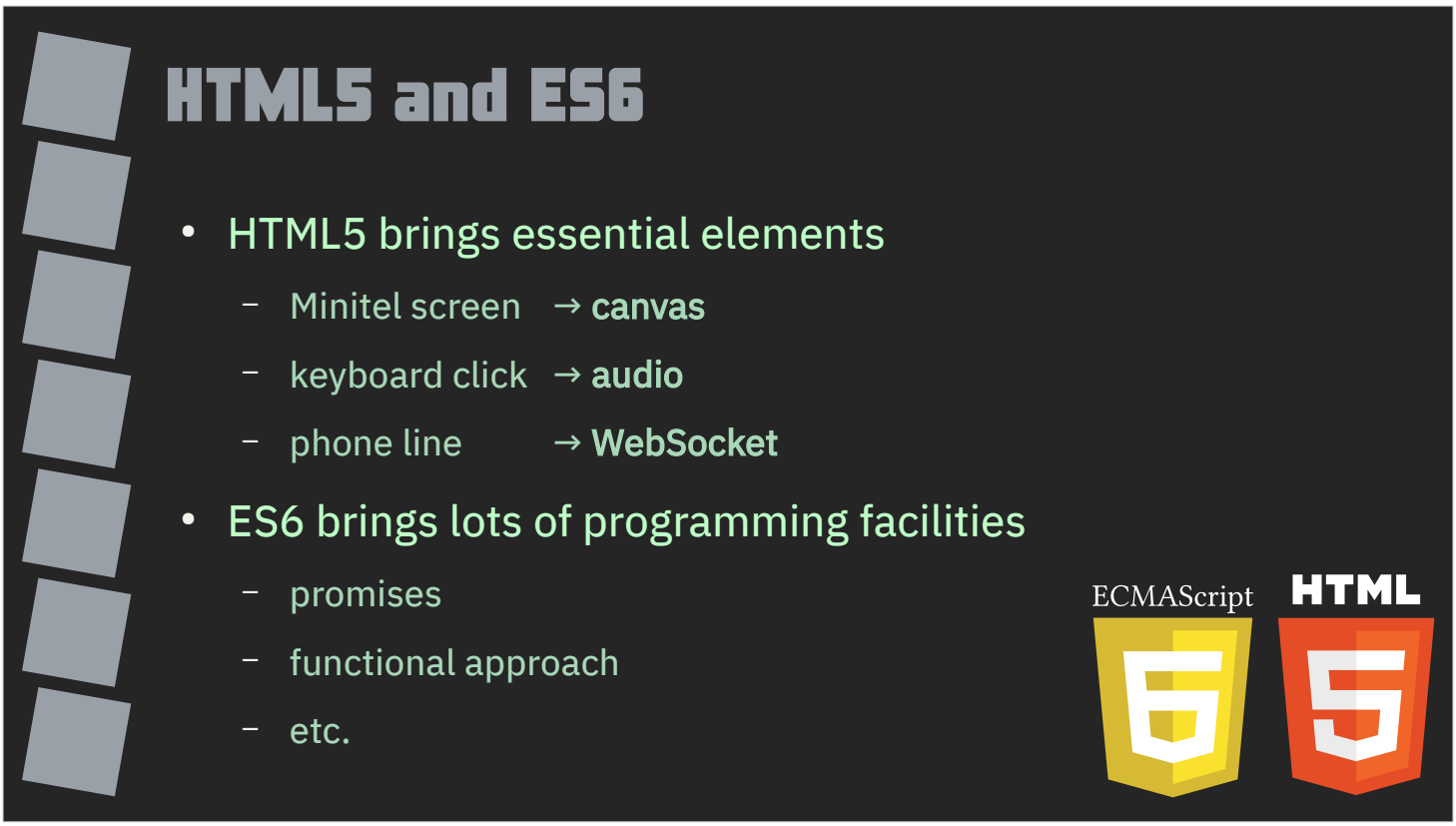
The platform should be widely available, otherwise the World won't be able to enjoy the greatness of Le Minitel.

It should be capable of asynchronous communication, of graphic primitives to look as closely as possible like Le Minitel.

The best is to work on three parts : the Videotex interpreter, the video controller and a Minitel service to connect to.

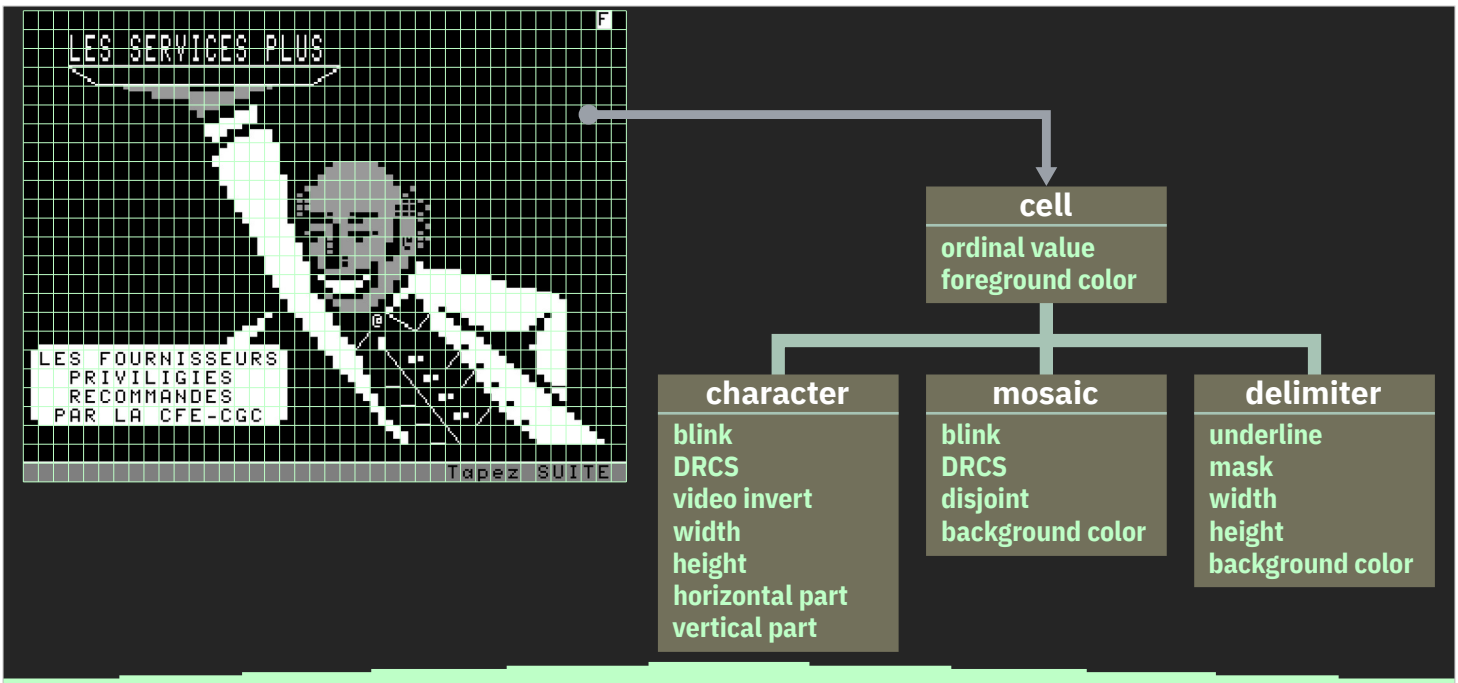


Happily, we now have HTML5 and ES6!



With HTML5 we now have canvas to draw the Minitel screen, audio to have the keyboard click of the Minitel and WebSocket to emulate the phone line.

ES6 bringes lots of programming facilities like arrow functions, promises, a more functional approach etc.



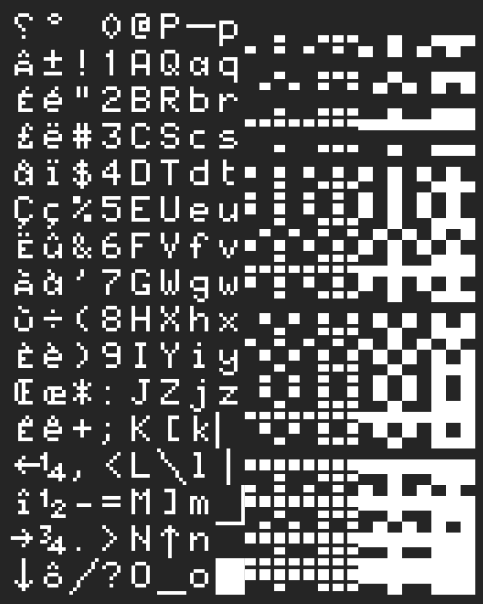
The video memory

The video memory uses the object model of ES6. Each cell may be a standard character, a mosaic character or a delimiter character (the space character).

Each of theses children has specific attributes.

Video Display Unit (VDU)

- Refreshes 50 times/second
  - draws modified rows
  - draws blinking characters
- Draws characters given their...
  - fore/back color + video inversion
  - underline
  - size
  - mask



The video display unit looks into the video memory 50 times per second. It draws modified rows and rows containing blinking characters.

Creating a Minitel page (demo)

Let's see it in action by creating a Minitel page.

The MiEdit Minitel editor URL is https://zigazou.github.io/miedit

Surfing on Minitel (demo)

Let’s go surfing on the good old Minitel

Resources

- MiEdit and emulator
  - sources → https://github.com/Zigazou/miedit
  - online → https://zigazou.github.io/miedit/
- Minitel font
  - sources → https://github.com/Zigazou/Minitel-Canvas
- PyMinitel
  - sources → https://github.com/Zigazou/PyMinitel

THANKS FOR WATCHING!

- Many thanks to Christian Quest for his invaluable help
- Thanks also go to Julien Mailland
- Contact me
  - Twitter → @zigazou
  - Mail → zigazou@free.fr

Minitel services... alive!

Name	Web	Phone
Electronic telephone directory	http://3611.re/	+339 7227 3671
3615 code	http://3615co.de/	
3614 Hacker	http://www.3614hacker.fr/	+339 7252 7252
3614 Teaser	http://www.3614teaser.fr:8080/	
3615 SM	http://sm.3615.live/	
Eureka	http://eureka.rxl1.com/emul/	
Jelora		+339 7262 9267
Computel (runs on a vintage Apple //e)		+331 8421 8116
JCA		+331 8421 8115
Cosmos 6502		+331 8421 8124