

ENABLING OFFLINE PAYMENTS AT SCALE:



BANKABLE

IMPLEMENTABLE

GOVERNED

AS DIGITAL MONEY

ARCHITECTURAL REQUIREMENTS FOR RESILIENT PAYMENT SYSTEMS.

🗣️ SLIDE 1 — ENABLING OFFLINE PAYMENTS AT SCALE: AS DIGITAL MONEY

Today I want to challenge one of the most important assumptions in digital payments. We have treated offline payments as a feature — something you add at the edge of a system.

My message today is very different. Offline is not a feature. It is an architectural choice. And that choice determines three things:

- Where liquidity sits.
- How risk is managed.
- And who captures the economic value when payments move offline.

I will show you that the industry has been working with an incomplete model. That there are not two offline architectures — but three.

And that this third model — governed offline — allows offline payments at scale without breaking the structure of digital money. If that is true, then this is not just about resilience. This is about how we design digital money itself.

When Payments Fail ✖

SOCIETY PAUSES

OFFLINE IS AN ARCHITECTURAL RESPONSIBILITY.

SLIDE 2 — When Payments Fail

When payments fail, society pauses.
That is the reality we are now operating in.

Digital payments are no longer just convenience.
They are embedded in daily life, commerce, and public infrastructure.

So when they stop working, the impact is immediate and visible. This is why
offline is no longer optional. Offline is an architectural responsibility.

Offline is Where Systems are Exposed

CONNECTIVITY	✗
BACKEND SYSTEMS	✗
PAYMENT RAIL	✗

FAILURES CASCADE AND ARE BECOMING MORE FREQUENT.

SLIDE 3 — Offline is Where Systems are Exposed

Offline is where systems are exposed. Failures do not happen in isolation.

- Connectivity fails.
- Backend systems fail.
- Payment rails fail.

And these failures cascade. That is why offline matters. It is not an edge case. It is the moment where the true system design of the system is revealed.

Two Models Define Offline Payments

IMMEDIATE



Money on
User Devices

DEFERRED



Validation
Happens Later

THIS HAS FRAMED THE ENTIRE DISCUSSION.

SLIDE 4 — Two Models Define Offline Payments

The industry has approached offline payments through two models.

- Immediate offline — where money is placed on user devices.
- Deferred offline — where validation happens later.

These two models have defined the entire discussion. And because of that, the design space has been constrained from the start.

What Legacy Offline Models Actually Do



CONTINUITY HAS REQUIRED A TRADE-OFF.

SLIDE 5 — What Legacy Offline Models Actually Do

If we look at what these models actually do, the pattern becomes clear.

- Immediate offline moves money out.
- Deferred offline moves risk forward.

So continuity has required a trade-off.

Either you lose control of money or you accept delayed certainty and exposure.
That trade-off has been accepted as unavoidable.

A Hidden Assumption

OFFLINE = TRADE-OFF ●●



OFFLINE = ARCHITECTURAL CHOICE ●

A MISSING CATEGORY.

SLIDE 6 — A Hidden Assumption

And that leads to a hidden assumption. We have come to believe that offline equals trade-off. But that assumption only holds within the legacy models.

If instead we treat offline as an architectural choice, something new appears. A missing category.

Offline is not a trade-off. Offline is architecture.

Three Offline Architectures

IMMEDIATE



Money on Device

DEFERRED



Delayed Validation

GOVERNED



Controlled Execution

GOVERNED OFFLINE PRESERVES SYSTEM INTEGRITY - WITH BOUNDED RISK.

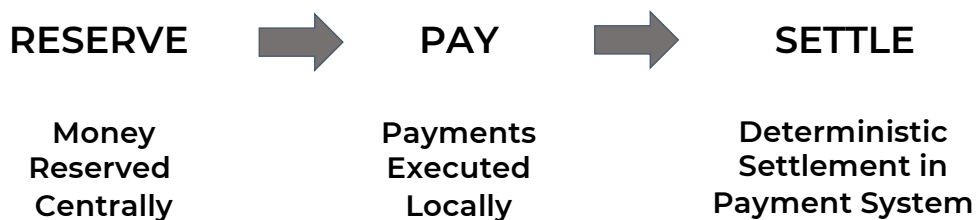
SLIDE 7 — Three Offline Architectures

Once you see that, you cannot unsee it. The picture becomes clear. There are three offline architectures.

- Immediate — money on device.
- Deferred — delayed validation.
- Governed — controlled execution.

And that third model is fundamentally different. Because governed offline preserves system integrity while keeping risk bounded.

How Governed Offline Works



MONEY STAYS CENTRAL - EXECUTION MOVES LOCAL.




SLIDE 8 — How Governed Offline Works

The principle is simple.

- Money stays central.
- Execution moves local.
- Funds are reserved centrally.
- Payments are executed locally within defined limits.
- Settlement is deterministic when the system reconnects.

So we are not moving money out to devices. We are moving controlled execution to the edge, while keeping money within the system.

Governed Offline System-Level Validations

2023	2025 –	2025 –	2026 –	2026
				
RBI	NPCI	ECB	BoE	CBSO
Regulatory Approval	Digital Rupee Implementation	Digital Euro Innovation	Digital Pound Lab	Global Endorsement

REGULATORY APPROVAL 2023 BY THE RBI IN INDIA –
VALIDATION ACROSS MAJOR SYSTEM ENVIRONMENTS.

SLIDE 9 — Governed Offline System-Level Validations

This is not theoretical. Governed offline has already been validated.

- Regulatory approval by the RBI in India.
- Implementation in the NPCI digital rupee context.
- Exploration as a pioneer within the ECB digital euro innovation project.
- Testing in the Bank of England Digital Pound Lab.
- And endorsement by the Central Bank Standards Organisation.

This architecture is already entering real systems.

Institutional Design Criteria



BANKABLE

IMPLEMENTABLE

GOVERNED

A LENS TO EVALUATE OFFLINE ARCHITECTURES.

SLIDE 10 — Institutional Design Criteria

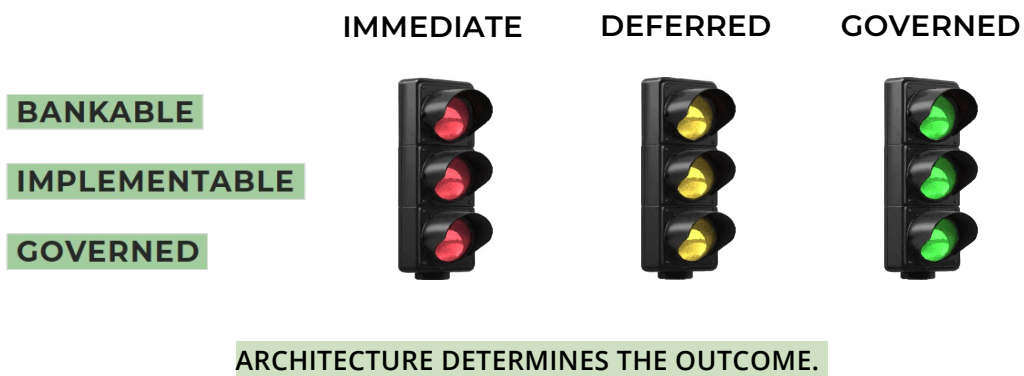
To evaluate offline properly, we need the right lens. Not a technical lens but an institutional one.

Any offline solution needs to be

- Bankable.
- Implementable.
- Governed.

These are the institutional criteria that determine whether something can operate at scale as digital money.

The BIG Analytical Framework



SLIDE 11 — The BIG Analytical Framework

When we apply this framework, one thing becomes clear.
Architecture determines the outcome.

The three models may look similar at a distance.
But under stress, they behave very differently.

And the difference is structural — not incremental.



Architectural design choice

Make
physical cash
work digitally

Make
digital money
work offline

● IMMEDIATE

● GOVERNED



VASTLY DIFFERENT OUTCOMES.

SLIDE 12 — Architectural Design Choice

Do you want to know – what it is? An innocent design decision early may determine everything. You can feel it when you go to work, when you go to church and when you pay your taxes.

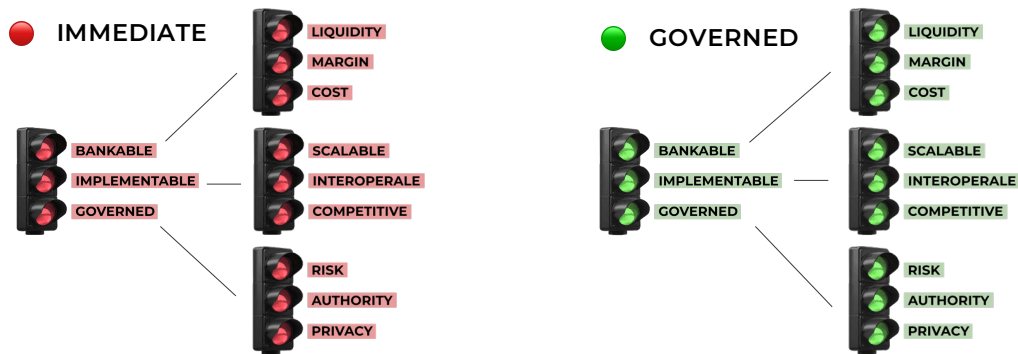
If you let form come before function you may think it is about making physical cash work digitally, when you really should make digital money work offline.

Fortunately you can be told what the consequences are. You can see it for yourself and after this there is no driving back.

- You go on green. The story ends. Money still sit within regulated institutions. Offline payment can be implemented at scale and governed as digital money
- If you drive against red. You stay in wonderland and I will show you how deep the rabbit hole goes.

Remember, All I can offer you is the truth. Nothing more.
Follow me.

Governed Superior for All Criteria



GOVERNED POTENTIAL DEFACTO STANDARD FOR OFFLINE PAYMENTS.

SLIDE 13 — Governed Superior for All Criteria

When evaluated across all criteria, governed offline is not just better. It is structurally superior.

Across all institutional sub design criteria as well within bankable, implementable, and governed.

That is why it has the potential to become the de facto standard for offline payments.

Cross-System Interoperability in Offline Mode

		IMMEDIATE	DEFERRED	GOVERNED
AUTHORISATION:	Intent to pay	●	●	●
SOLVENCY:	Money to pay	●	●	●

GOVERNED OFFLINE ESTABLISHES AUTHORISATION AND SOLVENCY LOCALLY.

🔑 SLIDE 14 — Cross-System Interoperability

Interoperability requires two things.

- Authorisation — the intent to pay.
- Solvency — the ability to pay.

Only governed offline establishes both locally. And that changes everything.

Because once those two conditions are secured in the wallet, the same solution works across systems. Across banks, wallets, national systems, regional systems, and even globally. And it works offline.

Patented Architecture. Open Ecosystem.

- System-level FRAND licensing (value sharing)
- Service-level offline wallet licensing (vendor neutral)
- No additional transaction fees

CRUNCHFISH ENABLES GOVERNED OFFLINE -
CONTROL REMAINS WITH REGULATED INSTITUTIONS.

SLIDE 15 — Patented Architecture. Open Ecosystem

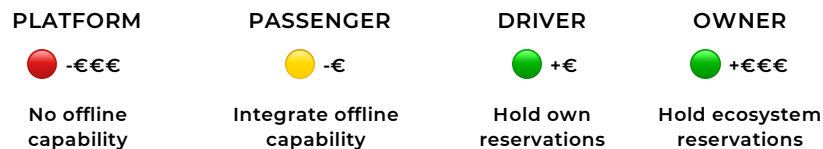
This architecture is patented. In the US, in Europe, in Taiwan, we just received the India grant today, and we have it pending in China.

But the ecosystem is open. Crunchfish enables governed offline — control remains with regulated institutions.

- The model is built on FRAND licensing at system level.
- Software licensing at wallet level.
- And no additional transaction fees.

We enable the system — we do not control it.

The Offline Train is Leaving the Station



VALUE FLOWS TO THE RESERVATION HOLDERS.

SLIDE 16 — The Offline Train

This is where the economics become clear. Offline has historically been seen as a cost.

- Hardware cost.
- Risk cost.
- Reconciliation cost.

Governed offline changes that. Now there are strategic positions.

- Platform.
- Passenger.
- Driver.
- Owner.

And the key insight is this: Value flows to the reservation holders. Whoever holds the reservations captures the economic value.

Beyond Payments: Trusted Client Execution

- **Resilient Open Banking**
 - Governed offline payment
 - Native authorisation without dependency on national eID infrastructure
- **Digital Identity**
 - Secure handling of identity and credentials, even in offline environments
 - EUDI Wallet
- **Verifiable Credentials & Client Trust**
 - Secure local business logic execution for both static and dynamic assets

TRUSTED CLIENT EXECUTION - NOT JUST OFFLINE PAYMENTS.

SLIDE 17 — Beyond Payments

What we have described so far is offline payments. But the architecture has broader implications.

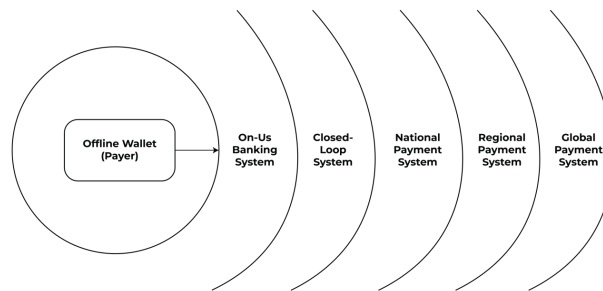
We provide trusted client-side execution.

- This enables resilient open banking without dependency on national eID systems.
- It enables digital identity and EUDI wallet use cases.
- And it enables verifiable credentials and client trust, handling both static and dynamic assets locally.

So this is not only about payments. It is about trust in clients at the edge.

From Insight to Action

- On-Us Banking Systems
- Closed-Loop Systems
- Open Payment Systems
 - National
 - Regional
 - Global



PARTNER WITH CRUNCHFISH TO SHOWCASE OFFLINE PAYMENTS.

SLIDE 18 — From Insight to Action

This is now moving from insight to action.

There is a clear opportunity to demonstrate this in real systems.

- Across on-us banking systems.
- Closed-loop systems.
- Open national, regional, and global systems.

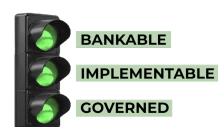
We invite partners to work with us to showcase governed offline in practice.

Offline Payments as Critical Infrastructure

1) Three offline architectures, not two:



2) Architecture determines the outcome:



3) The holders of offline reservations capture the value.

GOVERNED EXTENDS BEYOND PAYMENTS TO TRUSTED CLIENT EXECUTION.

SLIDE 19 — Offline Payments as Critical Infrastructure

Let me leave you with this. Offline payments are no longer optional. They are becoming a requirement for digital money to function under stress.

When you evaluate the alternatives against what actually matters — control, scalability, and governance – the conclusion is not ambiguous.

There is only one architecture that holds. Governed offline is not just a better way to do offline. It is the only model that preserves the integrity of digital money while enabling payments to continue when the system does not. That is why this is not about improving offline. This is about establishing a **de facto standard**.

First for offline payments. But if you take one step further —

- If authorisation can be established natively,
- If solvency remains within the system,
- If payments can execute independently of connectivity

Then this is no longer only about offline. This is about defining how digital payments work. And that leads to the real conclusion. This is not a feature decision. This is an architectural decision.

Who adopts it — and who follows. Who holds the reservations owns the

economics of payments.



 **SLIDE 20 — Crunchfish – Rethinking Payments**

Thank you.