

DO'S AND DONT'S OF IMMEDIATE PAYMENT IMPLEMENTATION – THE HUNGARIAN STORY¹

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ABSTRACT

Launching the Faster Payments System in 2008 in the United Kingdom was the start of the modern era of immediate payments services. More than fifty countries have joined the UK since, instant payment services have become to be the norm in the payment industry. The number of countries is growing from month to month and the emphasis already is made not only on the implementation of new systems but more on reaching interconnectivity among systems and offering instant payments over the borders as well.

Hungary used always to be an innovative country, tourist could pay with bank cards for example as early as the year of 1961. It is not surprising therefore that the National Bank of Hungary made a brave decision on implementing immediate payment services in the country. In a bit more than three years' time a unique system was launched offering immediate payments services in Hungarian Forints. This article offers comments on the project by looking back at the implementation period with the eyes of one of the major technical participants, Capsys Informatics Ltd.

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INTRODUCTION

March 2nd, 2020 was an outstanding day in the history of financial services in Hungary: exactly at 0:00:00 the central infrastructure operated by Giro Ltd was opened for the payments service providers to process immediate payment transactions for and on behalf of their customers.

It was a really great day also because the Hungarian system is in many aspects different from most of the instant payment systems operated worldwide. The main difference is personalized in the scope of the project shown also by the characteristics defined by the National Bank of Hungary are the followings:

- the use of the instant payment service operated by Giro Ltd is mandated by a National Bank of Hungary decree for every payment service provider licensed in Hungary;
- each transfer is to be processed on the instant payment infrastructure in case if
 - the transfer instruction is given to the customer's HUF account;
 - the amount does not exceed HUF 10m (~EUR 30,000);
 - the transfer instruction is given electronically
 - the instruction does not contain any specified debit date;
 - the transfer instruction is not submitted in batches by a corporate customer;
- defined transfer time is five seconds;
- the scheme offers the request-to-pay option from the beginning;
- the scheme offers the use of the following secondary identifiers:
 - mobile phone numbers;
 - e-mail addresses;
 - tax identifiers;
- defined message standard is ISO 20022;
- the system is being operated on the basis of the HCT Inst Rulebook prepared by Giro Ltd.

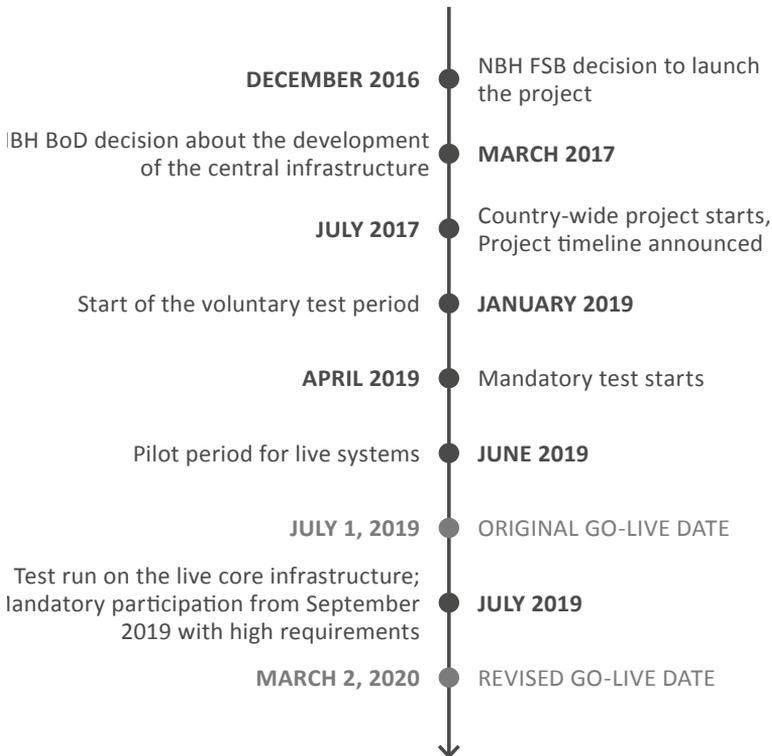
Due to the complexity of the project around 3,500 professionals participated directly in the implementation process not counting different vendors and the product professionals working in the banks. Capsys Informatics was an important participant as they were heavily involved in the two of the largest implementation projects incorporated into the national project. These two projects served five Banks. The volume of payments processed by these banks gives circa two

third of the Hungarian market showing the importance of the projects managed by Capsys.

In this article we would like to give a short picture of the project with the view of an insider and would like to share the experiences gained from participating in this extremely complex but finally successful project.

The timeline of the project

To implement a project of the shown complexity having more than thirty institutional participants needs time. It is very difficult to define, how much time exactly, but experience shows that to devote enough time is essential.



The official declaration of the National Bank was issued on December 14, 2016³ but discussions in the bank had started already in the year of 2013. The decision was made by one of the highest bodies of the bank, the Financial Stability Board which oversaw the whole implementation process planned to be finished by July 1, 2019. Seeing the real processes one of the boldest decisions of the National Bank ever was the postponement of the go-live giving more time to the PSPs to test and obliging them to take part in an additional eight months long testing allowing to have a successful launch.

The two largest participants on the PSP side OTP Bank and Takarekinfo issued information about their decisions on April 11, 2018⁴ and January 29, 2019⁵ respectively. Takarekinfo Data Management Ltd, a company of the Takarek Group serves the Takarek Group itself, Budapest Bank and MKB Bank.

The dates of the issue of information also show how much time for the planning and decision making was needed to reach the effective result. Capsys played a major part in the professional management of the biggest projects in Hungary. The scopes were slightly different but the work Capsys accomplished gives a good basis for the offered article.

The devil in the details

It seems to be a trivialness, but immediate payment service is a highly technology dependent solution. Payment service professionals knew already earlier of course how banks should clear payments, how these payments have to be settled but technology did not allow to do these processes faster. The real fastness appeared in payments in the card world first but neither hardware offerings nor the than prevailing ISO 8353 standard offered that richness of data offerings which would have been needed to process a piece of payment in its fullness. Interestingly it was the gaming industry which fought out for itself the technology solution taken later over by the payments industry to set up immediate payment solutions.

But to move hundreds, and in case of some systems thousands of payments from one account to the other in every second needs a very robust hardware on the one side and a very detailed, well monitored software solution on the other side. Risk in any solution is there but payments have to reach the beneficiary too and the

3 <https://www.mnb.hu/en/payments/instantpayments>.

4 <https://www.finextra.com/pressarticle/73421/hungarys-otp-bank-turns-to-aci-worldwide-for-instant-payments>.

5 <https://www.fintechfutures.com/2019/01/aci-worldwide-to-power-hungarian-real-time-payments/>.

system must ensure this. Immediate payments are very sensitive to technology – the smallest glitch, misconfiguration can cause transactions to fail. We have seen how misalignment of the sending and receiving systems timeout settings caused lost messages and thereby transactions to fail. Only a fraction of the participants among the Hungarian project participants had had living experiences from before but what we had to learn was

Lesson learnt: every little detail counts.

Hot topics in Hungary

Every project has a number of topics which for one reason or another receive more attention than others by the project stakeholders. This was true for the Hungarian implementation as well. In many cases there were several discussions revolving around the same topics. These discussions were important and fruitful to raise awareness and find consensus (or at least have the same understanding) regarding the solution for those problems.

- **The great TPS question – how many transactions per second?**

For the regulator it was a legal question: a transfer is to reach the beneficiary bank in five seconds, so the solutions of the PSPs have to meet this basic rule. To meet this rule everyone has to decide the capacity of their own systems, large banks have to have large capacity – hundreds of TPS (transaction per second), and for small banks a lower capacity might be enough. To process two transactions per minute one TPS, or in other word one transaction per second allowing 60 transactions per minute seems to be quite enough. But what happens if a large bank sends five transactions in one single second to one small bank, or for some business reason a large number of customers want to (or have to) make payments to the same bank at the same time? This might of course cause a system crash but there was no regulation on the TPS for the PSPs which might result in slower transactions in some cases. Volume statistics from the batch-based settlement system do not give a comprehensive picture about peak load to be expected for each participant. Interpolation from the hourly volumes to the second is not possible with high efficiency. What have been seen after go-live depicts this problem clearly: when looking at one minutes transaction volume, dividing it by 60 seconds (calculating the average TPS for that minute) shows roughly two thirds of the peak TPS measured in the same minute. Experience has proven that the fear was over estimated, until now at least...

- **Would transactions be lost?**

As usually in implementation processes testing started early and became to be more and more important. There was a very important observation: some of the messages meaning transactions were lost. Both Giro and the participating teams on behalf of the banks made changes, modifications tested again, modified again and the result reaching an acceptable very low level. The final target is zero of course as the technology should have assured zero transaction lost even in case of unexpected glitches. This is a topic on which we have to work further...

- **Transaction signature**

Due to the relatively short timeframe for the implementation the central infrastructure and participants implementation projects were run parallel. Therefore some requirements unfolded during the project. Such was the rule to sign every transaction separately and electronically (digital signature). This caused much turbulence among the banks as it would have been difficult to meet the regulation not in general but in that late state of the project. In such case it turned out to be a good practice to allow some time for the participants to implement the requirements, and allow an interval to test without them.

- **Batch or no batch?**

For the time being corporate batches are not allowed to be processed on the immediate payment system at all but this rule was not planned to exist. However, the TPS question discussed above is even more critical when considering batch payments. A bank will send batches with its highest capacity, which again may overload a smaller bank. Batches do not move of course permanently on the system but for example of tax days they could cause systematic problems. The solution was to postpone corporate batch processing on this system until at least September 1, 2020 allowing PSPs to develop their systems further.

- **Creditor time-out (“AB05”)**

The great bogey man of the project! AB05 is the ISO20022 status reason code for “creditor timeout”, meaning that the receiving bank did not respond in time to the central infrastructure (or to be more precise the response did not reach the central infrastructure in time), and GIRO considered the transaction to have failed and rejected back to the sending bank. It is considered to be the creditor bank’s fault and causes the creditor bank to fail certification when seen in large numbers. “Large” in our case means one in a thousand transactions. It is easy to imagine how project teams were observing tests closely and what reactions seeing AB05 in the statistics triggered.

This might be the worst situation for anyone transferring money. Its possibility depends also how the participants share the time they have among themselves mainly to meet the 5 sec rule and also the response time regulation. A timeout can be the result of a lost transaction as well as the result of the bad rules. Eventually the system proved to be good for processing more than one million transactions in the volume of HUF 150 billion for the first two and a half days.⁶

- **Reconciliation report**

It must be a basic characteristic for an instant payment system that it works naturally well. Reconciliation, nevertheless is a good tool in the hands of the participants to keep everything under control. In the beginning reconciliation seemed to be just one of the usual reports but the PSP's worked hard to use this very report well. Even a lost transaction can be found by using the reconciliation report as it is produced in every hour. It may sound strange that an immediate payment may not be searched for immediately – but due to the mandatory nature of immediate payments in Hungary, most customers do not even recognize that their payment is supposed to be settled within 5 seconds instead of a few hours as before. Furthermore, it is up to a bank's own decision whether to have staff operate the immediate payment system 7 × 24 – which may be an extreme cost factor compared to the volumes in off-peak hours.

- **The pilot question**

The original intention of the National Bank was a “big bang” on July 1, 2019. All international experiences showed that the time would have been too short and project participants themselves felt it. There was a big lobbying on the PSPs part and finally the National Bank took a very good decision by introducing an additional but mandatory pilot period. Participants processed awfully high number of transactions but using only a few technical accounts, not real ones. Many problems were identified of course but the fact that not real accounts were used caused some other problems later. The launch, nevertheless, proved to be successful!

Lesson learnt: country level consultancy to align.

6 <https://www.giro.hu/kozlemenyek--/sikeresen-vizsgazik-az-azonnali-fizetes-infrastrukturaja>

Happy(ish) path

Everyone plans to have a faultless normal way of development and implementation, the “happy path”. Exception (error) paths are hard even to imagine, as this kind of path is much more complicated. It is hard to think about this in the design phase and it might not even be necessary. Testing is a good period to get answers to the questions arisen. What was the difference between the interpretations of Giro and the PSPs? Which standard was understood well and which not? It is a typical problem that in case of a faulty message it is rejected by the central system even in case if the message was correct from the business point of view but had some technical failures. The answer nevertheless is rejection, but of a technical kind. If the bank’s system did not prepare for processing technical rejects because “happy path” was scheduled first, these first rejects will be very hard to detect and correct. The interpretations, therefore, should be similar on both sides, on that of the banks and the central system provider as well. This needs good cooperation and the testing period offers opportunity to correct these interpretational failures as well. So no one can say on day one: I have sent the message but did not get answer.

*Lesson learnt: prepare for exceptions on day one,
it will save you time analysing issues.*

“In the long run we are all dead”⁷

This phrase was repeated many times in the course of the project. When designing a system one of the major targets is to design a time-proof or future-proof one. By this reason the system-designer team might wish to put into the solution every up-to-date detail but this approach might cause the following problems:

- the design phase may take too long, and focus may be taken from the details critical for compliance;
- the resulting system may not be efficient – we may end up designing functionality which will not even be used for many years;
- costs may skyrocket;

7 “In the long run we are all dead.” In KEYNES, J. M. (1923): *The Tract on Monetary Reform*. London: Macmillan and Co., limited.

- some of the new products which exist in the designer’s mind do not exist among the bank’s services, among their processes the support of which is, anyhow, the system’s task.

The project, therefore, is to be divided into two parts: the first is a compliance project which must correspond to the existing real needs, rules and deadlines while the second is an innovation project which can contain the dreams as well and does not have that rigid deadlines. This does not mean that the compliance project should not produce a clear, future-proof design. But compliance specific requirements should prevail over the “long run”.

Lesson learnt: have two project layers – compliance and innovation.

Same, same, but different

There was a major observation made during the implementation period: it seemed that standards used were well-defined clear-cut ones, but it turned out that the situation was much more complicated. There is a chain in the implementation process which starts with the product team of the vendor, then comes the vendor’s project team making testing and controls compliance with the central system’s documentation. In their turn they implement the product into the client’s system who would then test it in a landing environment using their own hardware. The final phase is the environment integrated with the central system where the differences finally would be unravelled. This is the most expensive way unfortunately – any differences have to be communicated back to vendor’s developer and any fixes go through this long chain to be tested. If the vendor’s developer has at hands already samples or simulators for every message made to the deepest details the development and implementation process is much more effective and shorter in time also. Technical documentations are very important but don’t have all details, and as we know – the devil is in the details. A lot of these “devils” were seen during these implementations – differences in understanding of ISO 20022, SOAP, XML, TCP standards were causing processing issues.

Lesson learnt: Central Infrastructure should provide samples or simulators for every message to the deepest detail.

Developer versus remittance-Info

A project implementation always produces funny moments as well. To lift the mood some of the colleagues wrote jokey remarks – of course only to the “remarks” column. No scandal happened but the necessary carpeting followed of course...but no one was dismissed!

Lesson learnt: don't let your developer populate the remittance-Info field...

Batch and high TPS processing

This topic was already mentioned in the “Hot topic” section. It is, nevertheless, important to return to as project experiences show it is a very important question. The major feature of the Hungarian project, the fact that everyone participated in it makes this topic to be even more important.

Giro determined to have a central infrastructure having a capacity of 500 TPS but there was no guidance for or expectation towards participating PSPs as for the capacity of their systems. Taking a card processing system it is easy to determine the necessary capacity if one relates it to the number of cards issued and the number of acquirers. In case of the planning a completely new immediate payment system which is very different from the already existing ones it is hard to decide what capacity one has to develop meaning of course how much money the PSP has to invest. A bank can manage only a low number of accounts but having corporate clients they can receive a high number of transfers producing a high need of TPS capacity (i.e. public utility companies). It is hard also to say how big the transaction concentration will be making planning to be even more insecure. It can be said however that big mistakes have not been made and some adjustments can be made also later.

Lesson learnt: quota has to be agreed as well as some kind of separation mechanism for batch payments has to be implemented.

Giraffing

From a certain point of view the Hungarian immediate payment implementation project was a mass project as more than thirty PSPs were to implement the system in the same rather short period of time. There are some very good IT service providers for banks in the country but there were only a few companies having the

luck of being involved in previous immediate payments system implementation, and hardly any single professionals even to have this type of knowledge. By this reason knowledge transfer was an indispensable part of the project. According to the experiences gained a good “technology” for knowledge transfer was giraffing – meaning that the experienced professional is sitting at the computer and doing the work while his other colleagues are standing behind watching over his shoulder and following him on the screen – stretching their necks forming a giraffe. The next step will be giraffing made by the experienced colleague to control the new one.

Lesson learnt: widespread knowledge transfer within the project is key from day one.

How much testing is enough?

When designing the national project Giro’s timing included two months for connectivity test and five months for certification test, altogether seven months for testing. In case of a development of a major bank infrastructure the following test are to be carried through:

- Unit Test – to be made by the vendor’s developer on their own environment;
- Integration Test – to be made by the vendor on their own environment;
- Smoke Test – to be made on the bank’s environment to control delivery of the separate boxes;
- Connectivity Test – to be made on the bank’s environment to control whether separate boxes can cooperate with each other;
- System Integration Test – end-to-end test to control whether processes go through the entire solution;
- User Acceptance Test – detail testing made by the bank to control right operation of every function and data combination;
- Load Test – testing simulating high endurance;
- Stress test – testing simulating extremely high endurance;
- Disaster Recovery Test, High Availability Test – testing to simulate emergency situation.

The above test phases are to be made some times in recurring cycles as in case of a faulty Load Test i.e. all prior test are to be repeated after correction to test the correctness of the solution. This kind of repeat tests cause many problems if only one test environment of the central system is available so in some periods there may be a big “crowd” in this environment. It is a basic rule of the profession not to test

on live environment so the best solution is if the Central Infrastructure supports either a simulator or not one but several test environments.

The very good solution arrived in the late period of the project: the National Bank recognized the need and allowed an additional eight months for testing in addition to the prior seven months. The project benefited much of this test period as it helped to strengthen stability of all participants' system as well as the central infrastructure.

Lesson learnt: a lot of testing is needed (9+ months) but you can't test real life, a ramp-up pilot should be considered therefore.

Their favourite sport is jumping to conclusion

An instant payment solution may be a highly complex system, especially if combined with "Open Banking" (PSD2) or if multiple participants are using a shared solution. Such implementations will have many components which are linked and exposed to each other. A symptom in one system component may be caused by a problem in another component. It is often seen that root cause analysis is hindered by hasty conclusion based on insufficient information. A typical example is when two systems interact with each other, system *A* is sending a request to system *B* and waiting for a response, but it doesn't arrive. Stating that "system *B* did not respond" is an incorrect conclusion – in fact there could be multiple reasons: the request was lost on the way from *A* to *B*, the request was incorrect and *B* couldn't process it, *B* sent a response but it was lost on the way, the response arrived but *A* couldn't process it, etc. Based on such conclusions the search for the root cause may be completely mislead, even stalled.

Lesson learnt: efficient analysis of a problem requires sharp logic, based on evidence.

Reconciliation

In the beginning of the project the assumption was that reconciliation was a formality which was necessary to have only to tick off items and see whether everything was in order. The reality, however, was that the stress was put on large volume handling. The pilot correctly focused on load tests, so that the participants and central system are proven to handle the load expected. But load tests success criteria cannot be 100% – allowing a low percentage of erroneous transactions does not impose a major risk for the future real-life operation. But that little

number of missed transactions could show a consequent error in the processing, which goes unnoticed as the test met the success criteria. Reconciliation, however, turned out to be very important as very large data volumes were to be controlled and analysed in the course of the tests. Participants want to see the result of their tests immediately afterwards, so that action can be taken before the next test. Certification tests focus on compliance with the central system, but “end to end” (from electronic channel to account management system) results are as well important. The same tool can be used later, after go-live, to locate problems in the live environment.

***Lesson learnt: to support testing and operation
a reconciliation tool should be built.***

Zero downtime – takes time

7 × 24 availability is one of the basic characteristics of modern immediate payments systems. On top of “high availability” techniques (redundancies across multiple geolocation) this necessitates in permanent operation allowing to operators to upgrade their systems without any kind of stoppage i.e. with “zero-downtime”. This type of upgrade requires not only a very complicated architecture but expensive as well therefore it has to be organized very carefully. By this reason achieving zero downtime solution needs weeks and, in some cases, months dedicated to this topic. It is important to aim at zero downtime, and in most cases, it can be achieved, but it comes with a cost.

One has to consider that there are periods when the load factor is lower thus elements of the system could even be stopped for some seconds without resulting in any major client complaint. Doing upgrades during a low traffic period is advisable on a security basis as well. Even systems with the highest loads have periods when the traffic is so low, that an alert may be raised for lack of transactions for many minutes – which actually did happen!

***Lesson learnt: to meet requirements it takes a lot of designing and testing
including cost-benefit factor as well.***

CONCLUSIONS

The above examples show that implementation of an immediate payment systems – let alone two – is a tedious work. Every detail must be in place, even the smallest errors can cause annoying problems in the form of lost transactions. The system must bear high transaction volumes steadily with very small error rate. The complexity of a country project requires more quality assurance (testing) than usual IT projects. The solution should be future proof but must meet all current requirements at the same time. In today's digital age customers want and got used to accessing services 7×24 which sounds like a natural requirement but in practice implies additional burden in terms of implementation and operation efforts.

One of the most important lessons to learn from the Hungarian project is that a full client reachability is not a dream but the result of a regulatory decision. Hungarian banks are far not the most developed ones in Europe neither from technological nor from business point of view but they were successful in managing the project. We think that this is really a lesson which large European banks proposing European Payments Initiative and organizations supporting them like the European Commission and the European Central Bank have to take into consideration.

There are tasks left for the Hungarian regulator and banks as well. The country is a small one but is linked with thousand ties both to the European Union and other countries of the world. This interconnectivity of the whole economic life is to be reflected in the interoperability of payment services meaning that the country's HUF denominated payment system is to be connected to any of the two Pan-European payment systems. As most probably the EBA Clearing operated RT₁ and ECB's TIPS will reach interoperability by the end of this summer it is practically indifferent which will be chosen by the Hungarian banking community along with SWIFT gpi just to have the connectivity to other parts of the world as well.

Development of payment systems is a thousand years long process so it will not end with new services we presented. We, however think that the system we presented together with those hinted in the conclusion will serve successfully for many years.