



# INTERIM REPORT 022 2025

# Breaking the glass ceiling

Signing the first Digital Cash commercial agreement in Q2 was a great milestone. With IDFC FIRST Bank as a partner Crunchfish plans to enable offline payments for UPI applications as well as for Central Bank Digital Currency in India. Other positive signs for offline payment were the Bank of International Settlement's offline handbook, Crunchfish's award for outstanding advancement in digital currency and the Reserve Bank of India's offline payment innovation for CBDC as well as UPI. Within Gesture Interaction we introduced XR Skeleton for web and Apple broke the glass ceiling with the release of their Vision Pro glasses. This is accelerating the ARmarket where Crunchfish's Android partners are active.

### A bridgehead to India

It is key for Crunchfish to secure a banking partner in India as only the banks may post transactions on the UPI payment rail. Instant payments with UPI dominate the payment landscape in India and reached a volume of almost 10 billion transactions in July. Most UPI transactions are made from non-banking apps, and all such providers need a banking partner to commit payments on the UPI payment rail. With IDFC FIRST Bank as a partner Crunchfish plans to offer these app providers resilient UPI payments with offline payments.

Having IDFC FIRST Bank as a partner is also important to address the eRupee, as only bank apps are currently allowed to carry the digital rupee. Crunchfish and IDFC FIRST Bank have jointly approached RBI with the Digital Cash telecom solution. As a result, RBI has shortlisted the Digital Cash telecom solution as finalist in the CBDC-Retail offline payment category in their second hackathon.

### Offline payment for CBDC

Central Banks that plans to introduce CBDC are considering offline payment as an essential feature. The Bank of International Settlement came out with an offline handbook that confirmed Crunchfish's view that the payer's tamperresistant environment may be provided in software as well as in hardware. Crunchfish argues that a software-based tamper resistant environment, in contrast to a hardwarebased solution, is much more flexible. Our solution was awarded during Q2 by Currency Research at a conference as the outstanding advancement in digital currency of the year. This led directly to two additional partners that is in the process of integrating Crunchfish Digital Cash to their CBDC offering. Crunchfish recent release of consecutive offline payments is important for CBDC to enable the digital currency to be paid forward without going online.

### Enabling offline payments in an online world

Most of the central banks around the world are in the process of investigating and evaluating Central Bank Digital Currency (CBDC) and offline payment is often seen as a requirement. Crunchfish have during Q2 put a lot of effort into positioning Digital Cash towards the central banks and the surrounding eco-system of suppliers by presenting at CBDC conferences around the world. This have resulted in signed evaluation agreements with three different CBDC platform vendors which will be critical for our scale up ambitions.

Despite all the recent attention on the topic of offline payments, there remains an unclear understanding in the market around the practical design choices and trade-offs for offline real-time payments and CBDCs. During 2023, Crunchfish in partnership with Lipis Advisors have so far provided four white papers and webinars with the objective to describe the imperative for offline payments and provide practical guides to offline payments.



### New products within Gesture Interaction

Apple Vision Pro was announced in Q2 and sparked a race towards new use cases within XR. Companies worldwide are scaling up and positioning to ride this wave to success. Crunchfish gesture interaction products have been ready for this for some time and now we gear up to meet new demands from our Android partners.

Crunchfish announced the release of an upgraded version of XR Skeleton that executes in web-environment early in the quarter. This enables Crunchfish's hand tracking technology to execute in any browser and computing device which opens new business opportunities within e-shopping. Now end users can then get a stunning e-shopping experience with augmented reality without downloading an app. Fredrik Clementson is very welcome to drive this business area as the new CEO. Fredrik comes highly recommended and has extensive experience from many great tech companies in the region.

### Financing

Crunchfish raised a loan of 7,5m SEK in early August from one of its main shareholders. Crunchfish continues to plan for a directed emission of new shares to a third party. The financing from Socio that was announced as in November 2022 did not occur before the annual meeting in Q2 as Socio was not able to secure their own financing in time. Their interest to invest in Crunchfish remains but continues to be dependent on them getting access to their financing. In parallel, the company has decided to engage a broker to raise capital from other investors.



### **Crunchfish group**

### 2023-05-22

Crunchfish **publishes Q1 webinar** where Crunchfish CEO Joachim Samuelsson is interviewed by analyst Joen Sundmark from Västra Hamnen Corporate Finance.

#### 2023-05-22

Crunchfish publishes interim report Q1 2023.

### 2023-04-21

Crunchfish Annual Report webinar is made available, where Crunchfish CEO Joachim Samuelsson was interviewed by analyst Johan Widmark from Emergers. The interview is in Swedish and covers the main events of the year and its progress.

#### 2023-04-21

Crunchfish Annual Report is published. The report is in Swedish and is available on the company website.

### **Digital Cash**

#### 2023-07-07

Crunchfish released Digital Cash 2.2 enabling consecutive offline payments, in which the payer and payee exchange a transaction offline, and the payee can immediately spend the received funds in another offline transaction without going online. This feature may be the most desirable approach for CBDC given its resemblance to the properties of cash.

#### 2023-06-29

As a result of the successful RBI pilot project to enable offline payments with Digital Cash, Crunchfish today **entered a commercial license agreement** with IDFC FIRST Bank in India. Integration of Digital Cash is ongoing and release of an IDFC FIRST Bank payment app with support for Digital Cash is planned for Q3.

### 2023-06-15

Lipis Advisors in partnership with Crunchfish released the fourth white paper in the series "Enabling offline payments in an online world" with the title "Interoperability ".

### 2023-05-19

Crunchfish was awarded at the Digital Currency Conference

in Mexico City for Outstanding Advancement in Digital Currency. The award recognizes a company that has made a huge impression in the space and transformed the way digital currency is experienced. The jury was impressed by Crunchfish Digital Cash as a software-based, tamperresistant solution.

#### 2023-05-11

Lipis Advisors in partnership with Crunchfish released the third white paper in the series "Enabling offline payments in an online world" with the title "Privacy considerations".

#### 2023-05-05

The interest in offline solutions from central banks, commercial banks and payment system providers have skyrocketed in recent years. Crunchfish in partnership with Lipis Advisors were proud to announce the third white paper and webinar in the series "Enabling offline payments in an online world" with the title "Privacy considerations".

### 2023-04-28

Crunchfish have been nominated as finalist for the Digital Currency Awards in the category Outstanding Advancement in Digital Currency. This award recognizes the most exciting digital currency business of the year, one that has made a huge impression in the space with new and innovative services. Crunchfish has also been selected to pitch at the Fintech Innovation Showcase at the Digital Currency Conference (DCC) in Mexico City which Crunchfish CEO Joachim Samuelsson attends as a speaker and panelist.

#### 2023-04-24

A special Central Bank Digital Currency (CBDC) supplement "An Inflection Point for Global Payments: Industry Perspectives in 2023" was released to showcase case studies and perspectives from industry experts. Crunchfish provided the article "Central banks should modernize payments. Who else would?"

### **Gesture Interaction**

### 2023-04-25

Crunchfish released an upgraded version of XR Skeleton that executes in web-environment. This enables Crunchfish's hand tracking technology to execute in any browser and computing device which opens exciting business opportunities within e-shopping.

# Digital Cash





# First commercial Digital Cash agreement

As a result of the successful RBI pilot project to enable offline payments with Digital Cash, Crunchfish entered a commercial license agreement with IDFC FIRST Bank in India at the end of Q2. Integration of Digital Cash is ongoing and release of an IDFC FIRST Bank payment app with support for Digital Cash is planned for end of Q3.

The RBI pilot, to provide support for offline retail payments to the payment ecosystem of India based on the Digital Cash platform, concluded during May. The pilot was a great success, pre-defined targets on number of users and transactions were exceeded and user surveys came in very positive. RBI is expected to make an announcement in Q3, where they will present the results of the pilot together with their conclusions and recommendations.

IDFC FIRST Bank

Based on the successful pilot, Crunchfish and IDFC FIRST Bank entered into a commercial license agreement at the end of Q2. IDFC FIRST Bank have licensed both Digital Cash offline, for full offline transactions in proximity, as well as **Digital Cash telecom**, which enables payments using the telecom network if the payer lacks data connectivity. Crunchfish and IDFC FIRST Bank are working closely together on integration of Digital Cash into IDFC FIRST Bank's payment apps. First release to IDFC FIRST Bank customers is planned for end of Q3. In India it is only the banks that are permitted to post transactions on the UPI payment rail. Instant payments with UPI dominate the payment landscape in India and reached a volume of almost 10 billion transactions in July. Most UPI transactions are made from non-banking apps, and all such providers need a banking partner to commit payments on the UPI payment rail. With IDFC FIRST Bank as a partner and the joint solution based on Digital Cash, Crunchfish plans to offer these app providers resilient UPI payments even when their payers are offline.

The license agreement with IDFC FIRST Bank includes an upfront fee covering usage of Digital Cash during two years to a limited, first batch of IDFC FIRST Bank customers. Support and maintenance on the Digital Cash SDK is also included in this upfront fee. The fee will be included in the financial results starting Q3 2023, until Q2 2025. Additional user fees will be charged to IDFC FIRST Bank when additional Digital Cash users are onboarded by the bank.

Commercial discussions with HDFC Bank, the other participating bank in the RBI pilot, have been further delayed. HDFC Bank management has been occupied with the merger of HDFC Ltd., India's premier housing finance company with and into HDFC Bank. Discussions around the agreement is expected to be restarted again when the merger has settled. The successful pilot with RBI has also created interest for Digital Cash from other banks and payment providers in India. The coming launch of IDFC FIRST Bank's app with Digital Cash is expected to further fuel these dialogues.

As a result of the license agreement with IDFC FIRST Bank, Crunchfish have also entered into a commercial agreement with V-Key. The agreement regulates Crunchfish's use of V-OS and V-Key's support to Crunchfish. With this agreement have Crunchfish and V-Key also created a framework for onboarding of new customers, which is important for the continued deployment of Digital Cash globally.



The project with one of the major e-wallets in India is still ongoing and part of the company's development plans. The e-wallet app today requires online connectivity at startup and thereby needs to be redesigned to host offline payment capabilities. The redesign was planned to be completed during Q2 2023 but has been delayed to Q4. First step to enable offline payments will be to cover use cases when no data network is available, but the telecom network is (e.g. SMS). Full offline support will be addressed after that. Crunchfish Digital Cash covers both these scenarios.



During the quarter Crunchfish exhibited Digital Cash at the Payment Innovation Summit in Mumbai. CEO Joachim Samuelsson was a keynote speaker talking about "Enabling offline payments in an online world", he was also part of the strategic panel that discussed the theme "Driving India Towards Becoming a Cashless Economy".

Crunchfish will attend the Global Fintech Fest (GFF) on September 5-7. GFF is the largest fintech conference in India, jointly organized by the National Payments Corporation of India (NPCI), the Payments Council of India (PCI), and the Fintech Convergence Council (FCC). Crunchfish will exhibit Digital Cash and as an official "Offline Payments Partner" host a panel discussion on "The impact of offline payments in a digital world: Robustness, Privacy and Inclusion". The panel includes Lalitha Natarajan, Head of Digital Partnerships, B2C business and Payments, IDFC FIRST Bank, Ravindra Govindani, Product Head – Off-Amazon Payments, Amazon Pay and Prasanna Lohar, President at India Blockchain Forum.



# Payment applications only work when everything works

Payment applications of today are not as robust as they ought to be. They are designed for the happy flow, which only works when everything works. If the payer lacks internet access or if a backend server is not operational the payment fails. Crunchfish fix this by augmenting payment applications with offline payments from an integrated Digital Cash Trusted Application.

We have all experienced the inconvenience and sometimes embarrassment of not being able to pay. It could be related that you do not have enough money in your bank account, but often it is due to other factors that the payer is not responsible for. For push payments, lack of internet connectivity is a common reason for not being able to pay, but it could also relate to a time-out as your bank is either congested or down. Pull payments, which is used at POS terminals by the card schemes, are also sensitive to bank server outages.

What if there was a solution that would make payment applications resilient? And what if this solution was available in software? Payers and merchants would no longer be dependent on the internet to make or receive payments, and payment providers would be relieved of the constant struggle to cope with the increasing volumes of instant payments. This would be great news for any private payment provider, but also for central banks who are aiming to compliment cash with Central Bank Digital Currency (CBDC) as a key differentiator would be that payers do not have to worry about internet connectivity any longer.





Trust in payment application enables Crunchfish Digital Cash to offer many offline payment use cases.

*Figure: Crunchfish Digital Cash Trusted Application integrates with payment applications and makes them robust by connecting offline or paying offline.* 

For push payments to become robust the key is to enable the payer to authorize a payment and communicate with the backend without an internet connection. This is possible by installing trust and security into the payment application client to enable it to authorize a payment locally and then connect to the backend using SMS if the internet is not available. **Crunchfish Digital Cash v2.1** released in March 2023 enables this functionality.

For push as well as pull payments it is important to isolate the remitting bank at the moment-of-payment from the payment flow. The core banking systems were designed a long time ago and was never designed to cope with the increasing volumes and instant payment systems of today. By reserving some money that could either be represented and available either online or alternatively offline in case the payment application client has been augmented with more trust and security, then it is possible to pay offline. With the recent release of Digital Cash v2.2 in July 2023 consecutive offline payments are now also supported.



# Offline payments needed for CBDC to be successful

Several central banks around the world are in the process of investigating and evaluating Central Bank Digital Currency (CBDC). Offline payment support is on the agenda for most of these projects. Crunchfish have during Q2 put a lot of effort into positioning Digital Cash towards the central banks and the surrounding eco-system of suppliers by attending CBDC conferences around the world and arranging the webinar series Enabling offline payments in an online world. The webinars host topics that are very relevant for decision makers within the CBDC community.

The efforts to position Crunchfish for CBDC deployments have gained a lot of attention and have resulted in signed evaluation agreements with three CBDC platform vendors during Q2. The platform vendors have direct relations with central banks around the world, several of them with offline payment support as a key requirement for CBDC deployment. A joint CBDC proposal has recently been submitted to one of the central banks by one of the platform partners.

**Digital Currency Conference, Mexico City May 15th-17th** CEO Joachim Samuelsson presented "Central Banks should modernize payments. Who else would?" and participated as a panelist in a session about offline payments.

Crunchfish was also **awarded** for Outstanding Advancement in Digital Currency. The award recognizes a company that has made a huge impression in the space and transformed the way digital currency is experienced. The jury was impressed by Crunchfish Digital Cash as a software-based, tamper-resistant solution.

### Executive Roundtable Event, Hong Kong June 9th

The Executive Roundtable Event was hosted by V-Key, Powerhouse and the Fintech Association Hong Kong on the theme "Strengthening the Future of Finance: Understanding Cybersecurity and Fraud in the Digital Age".



Joachim Samuelsson presented "A practical guide to offline payment security" and participated in a panel discussion, where industry leaders and experts were converging to tackle the critical topics of cybersecurity and fraud prevention.

# Central Bank Payments Conference 2023, Cape Town June 26-28th

Crunchfish exhibited Digital Cash and presented "Enabling offline payments in an online world". The Central Bank Payments Conference is the premier conference for leaders and experts from the central bank payments and market infrastructure community.



### The Global Payments Summit 2023, Cape Town June 28-30th

Crunchfish exhibited Digital Cash, presented "Enabling offline payments in an online world" and participated as a panelist in the discussion "How interoperable is mobile money going to be? – CBDCs and how can they change Cross-border payments".

IDFC FIRST Bank is an important partner for Crunchfish to address the eRupee, India's CBDC initiative. Currently only banking apps are allowed to carry the digital rupee. Crunchfish and IDFC FIRST Bank have presented the Digital Cash telecom solution for eRupee to RBI.

RBI's second edition of its global hackathon – HARBINGER 2023 - with the theme 'Inclusive Digital Financial Services' has reached the second phase – shortlisting of finalists. Crunchfish is among the few companies that have been shortlisted and invited by RBI to present innovative ideas on four problem statements. Crunchfish participate with the Digital Cash telecom solution in partnership with IDFC FIRST Bank in the category New use-cases for CBDC-Retail including offline transactions. The solution will be implemented and submitted before September 17th. Winners will be announced October 5th.



The Crunchfish Digital Cash Proof-of-Concept for offline payments with the Central Bank of Nigeria (CBN) has been further delayed due to the 2023 elections in Nigeria and the following change in administration. Currently there are no concrete plans on when the project will be restarted. Crunchfish remain in dialogue with the central bank and have met representatives at the CBDC conferences in Mexico City and Cape Town.

The partnership with Money Square in Jamaica continues and are addressing offline payment opportunities in Latin America and the Caribbean (LAC). First half of 2023 has mainly been about analyzing the market and establishing relations. This work will continue throughout 2023, with the ambition to initiate Proof-of-Concepts with e-wallets and central banks in the region.

# **Practical Guides to Offline Payments**

Despite all the recent attention on the topic of offline payments, there remains an unclear understanding in the market around the practical design choices and trade-offs for offline real-time payments and CBDCs. During 2023 Crunchfish have been sponsoring a series of white papers written by Lipis Advisors with the objective to describe the imperative for offline payments and provide an overview of the various design considerations for payment system operators.



Design January 2023



Securitv March 2023

Here is a summary of the main points from the first four white papers on the topics of offline payment design, security, privacy, and interoperability. Two additional white papers are planned for 2023, with a focus on scalability in September and implementation issues in November.

### **Offline Payment Design**

There are many reasons why payment system operators should be thinking about how to allow offline payments for real-time payment systems and future retail CBDCs. These include greater financial inclusion, improved payment system resilience, and higher levels of user convenience, trust, and privacy. Various use cases for offline payments are being tested worldwide by central banks, payment system operators, financial institutions, and tech providers. However, there is still a lack of understanding among such players regarding what models for offline payments exist as well as potential use cases.



Privacv May 2023



Interoperability June 2023

Offline payments have previously been understood as a transaction that is recorded offline and processed at a later point in time. However, defining what makes a payment offline is not as straightforward as it might seem. Some industry experts would define it as a transaction that occurs between users without an internet connection. Payments made using non-internet servers, such as telecom servers, would fall under the definition of "offline." Others counter that a transaction can only be considered offline if it occurs "without a connection to any external power source, noninternet server, or general ledger."

Under this definition, offline transactions typically occur using hardware-based instruments that usually exist on either stored-value cards or smart phones. The devices communicate with each other, either manually or by using near-field communication (NFC), without the need for reconciliation with the online ledger for settlement. While experts might disagree about definitions, this is not highly relevant. Practically speaking, the characteristics of offline payment systems will vary depending on the operator's specific aims and requirements. Certain payment system operators may find that online connectivity after every transaction is adequate, while others may prefer functionality that allows for consecutive offline payments after a limited number of transactions or value threshold.

Similarly, in some models of offline payments, both the payer and payee can be in offline, and in other models, only one can be offline for the transaction to be successful. In models where an intermediary is required to settle the transaction, the offline element need not only be on the side of the payer/payee, but also on the side of the remitting bank, infrastructure, or other third parties.

In designing for offline payments, it is important to note that the main design choices are agnostic to the underlying online payment rail. The main design choices are instead related to the type of security protocol of the offline transaction (native layer-1 vs. non-native layer-2) as well as the trusted



White paper 1 on design: Payment system design options: An offline perspective

environment of the payer's bearer application (hardwarebased vs. software-based). This distinction is illustrated in Figure 1.

### Online payment rail: Token-based or account-based

Offline capabilities can be enabled for token-based payment rails (e.g., all cryptocurrencies and some CBDCs) as well as account-based rails (e.g., all real-time payment systems and some CBDCs). Central banks have a distinct choice when implementing digital cash. They may either base it on digital money by choosing an account-based payment rail implementation and enable digital money to work offline just as cash, or alternatively base it on physical cash by representing the physical banknote digitally and implement a token-based payment rail between the central bank and banks as intermediaries.

### Offline Security Protocol: Native Layer-1 vs. Non-native Layer-2 tokens

A security protocol for offline payments serves the purpose of addressing the various security risks by ensuring the

### Payment system design options

integrity and authenticity of the offline transaction. There are generally two design options for such a protocol. First is a native layer-1 solution, where the offline payment solution uses the same native security protocols as the underlying payment service. Alternatively, offline payments can be implemented using a non-native layer-2 security protocol, where tokens are signed out by debiting a locally held offline balance. A non-native layer-2 solution can be integrated with any type of payment rail and general ledger as the offline security protocol can be interoperable with any underlying payment system.

Layer-1 and layer-2 solutions are commonly used by cryptocurrencies to augment the crypto payment system with higher throughput. Similarly, offline payment systems implemented as either layer-1 and layer-2 solutions augment the underlying payment service with resilience and other desired features by enabling it to function offline as well.

Payment systems, especially CBDCs, must provide the same level of personal integrity as paying with cash. It is still possible to balance integrity with AML and tax evasion by imposing transaction limits on offline wallets not subject to full KYC. A layer-2 security protocol separate from the underlying online payment rail is therefore much preferred. This provides privacy-by-design, in contrast to an unacceptable surveillance-by-design.

### Offline Trusted Environment: Hardware- vs. softwarebased

The second major design choice for offline payments relates to the nature of the Trusted Environment where the offline application can execute in a separate, secure environment in which the security protocol is being carried out. Such environments can be either hardware- or software-based.

Hardware-based protocols involve the use of physical devices to facilitate transactions without an internet connection, allowing them to perform payment processing tasks and store data locally or using non-internet servers. Software-based protocols, on the other hand, involve the use of software applications on a smartphone. In terms of scalability, hardware-based offline payment systems can typically handle a large volume of transactions without requiring an internet connection or external infrastructure. However, the production and distribution of physical devices, also known as Secure Elements (SE), can make this approach relatively more expensive to implement and maintain.

Software-based trusted environments, on the other hand, do not require the distribution of physical components and may be updated more easily over the air.

Smartphones are the dominant bearer for payments today. In the future it is likely that smart glasses will play the same role. As it is not possible that all should be forced to use devices with the same hardware when it comes to smartphones or smart glasses, its trusted environment must be software-based. For financial and digital inclusion there is a need to deploy Digital Cash applications on cards, wearables, and feature phones as well. These hardwarebased trusted environments are peripheral bearers that need to be able to exchange digital cash with the smartphone as the main bearer, even in full offline-mode.

### **Offline Payment Security**

Having gained a better understanding of the design elements of a secure offline payment system, we next discuss the specific security risks and mitigation at each level of the system architecture. One of the key risks in an offline payment scheme is double spending. There are many types of attacks that might lead to double-spending, e.g., man-inthe-middle attacks, transaction replay, cloning, jailbreaking, and tampering with the bearer application.

Some of the major security threats that can occur at the level of bearer application (e.g., smartphone, feature phone, wearable device, card, etc.) include tampering with the trusted application or its data. There is also the risk of cloning if the device is jailbroken or rooted, which enables a reset of the offline balance to prior levels. Although it is always possible to discover fraudulent cloning when the payer goes online, it is important to mitigate against rollbacks if the payer stays offline by imposing additional risk limits on transactional amounts. Cloning between devices is commonly mitigated via device fingerprinting, which ties the offline trusted application to the device on which it is running. Unauthorized access may be mitigated using Additional Factor Authorization (AFA) based on passphrases or biometrics to access the offline trusted application, for example. The trusted environment also protects against overdrafts and ensures that imposed risk limits by the issuer and the regulator are followed.

At the level of the offline payment messaging scheme, the risk of transaction replay and man-in-the-middle attacks - both manifestations of double-spending - must be mitigated. A transaction replay attack uses malicious apps to delay or intercept data transmission that occurs over a network. This information can then be processed and resent numerous times to effectively duplicate transactions. Even though it is relatively simple for hackers to carry out replay attacks, offline payment messaging schemes offer preventive measures for these attacks using timestamps and challenge requests and by positioning bookmarks in the new local ledger. Targeting the connection between the two parties is an alternative to directly attacking the integrity of the offline payment, with a man-in-the-middle assault the most typical method of doing this. In such attacks, the payer application and the payee application believe that they are communicating directly with the intended end point, but the attacker is intercepting and/or modifying the communication in the middle.



White paper 2 on security: Offline payment systems using signatures from a Digital Cash Trusted Application

All cryptographic systems that are secure against manin-the-middle attacks use two means: authentication and tamper detection. While an SE approach can provide tamper detection, authentication of the transactions can be ensured using public key infrastructure (PKI). While PKI is widely used on the internet today, it relies upon cryptography that is believed to be secure given the computational power available today and in the medium term. However, today's cryptographic schemes will eventually be broken by a quantum computer. This will rapidly accelerate the irrelevance of today's security systems and will have a

dramatic impact on all sectors of the economy. To address this, there are plans to update the security algorithms with longer keys and signatures so that quantum computers cannot break them. However, for offline payments this is not viable due to limited bandwidth and storage capacity offline. To ensure integrity of offline payments when quantum computers are available therefore requires using a quantum-secure cryptographic key as a shared secret.

Even if protection against double-spending must be provided at the transactional level in an offline payment scheme, there should nevertheless be a seamless integration with the online general ledger where double-spending can also be discovered at the time of reconciliation between the offline and online ledgers. Offline payment solutions should therefore have adequate backend protections, such as

certificate revocation, to ensure that the risks arising at the time of reconciliation are effectively addressed. It is also possible to deploy measures like those used in securing online payment systems, like behavioral biometrics and certificate expiration, etc. Last, the risk of loss and fraudulent use of offline payments can be reduced by imposing risk limits on offline wallets. These limits can be linked to KYC levels, higher limits for full KYC compliance, and lower limits for partial KYC compliant customers. Such limits could be imposed by the issuer or driven by regulatory mandate.

#### **Privacy Considerations**

Offline payment implementations can offer different levels of privacy depending on the anonymity of the wallet and the nature of reconciliation with the online ledger. However, fully anonymous offline payments would pose numerous challenges from a compliance perspective, as CBDCs would still need to comply with existing KYC/AML regulations.



*White paper 3 on privacy: Wallet identity vs. Reconciliation considerations* 

In the previous white papers , we discussed whether the offline security protocol was native layer-1 or non-native layer-2. The choice of offline security protocol is also a highly relevant design choice that will impact the privacy features of the offline payment system. In building an offline payment system designed to complement an account-based online rail, for example, a layer-1 offline protocol may limit privacy from the system operator as offline transactions would be subjected to the same degree of transparency as the online transactions. In contrast, offline payments based on a nonnative layer-2 protocol would potentially allow for greater privacy for users given that the security protocol is separate from the online payment scheme. In this instance, the level of privacy would be comparable to withdrawing money from an ATM; the sender signs out funds through the debiting of a locally held offline balance. Only adjustments to balances are reflected on the online ledger.

#### Interoperability

To avoid having payment services in incompatible silos it is important to ensure interoperability. To accomplish this the e-wallets must guarantee the payer's intent to pay and that the debit is cleared before sending the payment to the recipient on the backbone rail. Front-end offline payments applications have a Security Association (SA) with a private key and a certificate with the associated public key.



*White paper 4 on interoperability: Interoperable offline proximity payments* 

Many offline systems rely on hardware-based, layer-1 solutions and where the payer uses the receiver's public key for application-level encryption. However, hardware-based trusted environment, layer-1 solutions and their encryption schemes are typically proprietary and hinder interoperability. Crunchfish propose instead using an interoperable software-based trusted environment with a layer-2 solution using PKI-based signatures that implements an application and communication network-agnostic Trusted Application Protocol (TAP).

All payment applications could augment their service with the TAP. Although today's payment services are reliant on the robust internet protocol, a payer has no use of the payment service without internet access. TAP facilitates instant settlement as well if the payment rail is open, which makes TAP ideal as the underlying protocol for interoperable payment services. The TAP header contains at least the signature of the application data using the private key of the payer. The extended application data payload may then be sent and verified at any node in the system having access to the same CA-root certificate, regardless of it is sent remotely using TCP/IP, VPN, or telecom to a host server or locally to a payment application over WiFi, LAN or in proximity. Whereas online payment schemes lack survivability in the face of failures, the TAP is designed to cope despite of temporary failures on any link or node at the moment-of-payment.



Researched and written by



Sponsored by



# Gesture Interaction



Cam! Giraffa.\_\_Camelopard



# A Quantum Leap

In this quarter the most significant and disruptive happening within XR has taken place. Apple Vision Pro has been announced sparking a race towards new use cases, experiences and fortunes. Companies worldwide are scaling up and positioning to ride this wave to success. Crunchfish gesture interaction products have been ready for this for some time and now we gear up to meet new demands.

Crunchfish has been part of the spatial computing domain for a long time delivering computer vision based gesture interaction products like XR Skeleton, XR Pose and XR Tracking. The XR often found in the naming of Crunchfish's gesture products is an industry umbrella term meaning that the product is suitable to be used in AR, MR and VR implementations. Still, this naming is easily misunderstood which is something Apple has recognized and is making an effort to change. Thanks to Apple, the meaning of spatial computing will become well known. Something today referenced to as AR, MR, VR or collectively as XR can be superseded by something simple and convenient and referenced as spatial computing.

Tech giants like Meta and HTC are forerunners in the VR domain, bringing spatial computing headsets like Meta Quest Pro and HTC Vive XR Elite with great capabilities to the market. So far with modest market success as the products are fairly niche in the market. With the world's largest tech company measured in market value entering the domain there is a good chance that the tables will turn.

Apple has a tradition in making technology convenient and accessible, to remove technical hurdles and create



Apple Vision Pro Source: https://www.wired.com/story/apple-vision-pro-specs-price-release-date/

intuitive user interfaces. They are also experts in expanding the addressable market with their products which is likely to have a significant impact on the spatial computing ecosystem. With Apple entering spatial computing it is expected to become a new standard in how to interact with this technology and how to simplify it and make it accessible to a wider market. This change will also function as a guidance to the Android community and the market outside of the Apple ecosystem will get a huge boost too. This is the market in which Crunchfish has been active for a long time and



within short the addressable market will be multiplied.

In 2015 Apple acquired an AR company and hired Mike Rockwell to lead the Vision Pro product development who presented Vision Pro at the WWDC23 keynote. With the announcement, eight years later, the work of a stealth team of the tech giant of the world sees the light of day. It is a disruptive event with the potential to elevate the XR market to massive heights. The classic V gesture comes to mind. Most players in the spatial computing domain will gain from Apple's entry.

Crunchfish XR Skeleton supports the V gesture, but Crunchfish's "signature gesture" is another gesture often referred to as a "pinch", which basically is a touch event within the immersed context but called a pinch in spatial computing. By using the Crunchfish XR Skeleton product family partners and customers have access to "the pinch" and a wide range of other gestures.

Our products are proven in the market with many commercial agreements and implementations together with partners like Ximmerse, Lenovo and Oppo. Now is the opportunity for Crunchfish gesture interaction's growth to accelerate by starting to scale up and capture the new market opportunities.

Our lean and efficient organization combined with our versatile product

platform puts us in pole position to leverage opportunities. We notice the excitement in the market and Crunchfish is ready to deliver "the pinch" and many more gestures to customers and partners to create intuitive immersive experiences.

# Crunchfish XR Skeleton web

Crunchfish announced the release of an upgraded version of XR Skeleton that executes in web-environment early in the quarter. This enables Crunchfish's hand tracking technology to execute in any browser and computing device which opens new business opportunities within e-shopping.

Crunchfish has released an upgraded version of the XR Skeleton product that can execute in web environments such as browsers in mobile phones and laptops. Earlier releases of Crunchfish's hand tracking technology supports Android operating system and integration in Android apps, while this latest release – XR Skeleton for Web – works in web pages and runs on any website and operating system. The end users can then get a stunning e-shopping experience with augmented reality without downloading any apps.

Crunchfish and SpectreXR have since earlier a partnership that targets to offer customers a powerful object interaction solution in AR/VR. Crunchfish has also an ongoing collaboration with Change2 in Italy to develop a Proofof-Concept that enables virtual try-ons. One of the most exciting things about using hands for interaction in AR is that it enables the users to interact with the virtual world like in real life. With XR Skeleton for Web, Crunchfish opens new exciting business opportunities in the areas of e-shopping, live video shopping, virtual try-ons etc. This new product release already supports virtual try-ons of watches and bracelets based on Crunchfish's long experience in hand gesture interaction. Thanks to the versatility in the product platform it has been straightforward to develop support for this new use case. Better and more modern ways of interacting with the end customer is of high importance with the rapid increase in e-shopping. Crunchfish XR Skeleton for Web can easily be expanded to support more virtual try-on products.



"With this new product capability we have something great to showcase customers within e-shopping. During the fall we will continue to work with partners to validate our business model and offering in the market. Our focus will be to further tune the functionality to create a real Wowexperience to the end customer", **says Fredrik Clementson, CEO at Crunchfish Gesture Interaction** 



# Welcome Fredrik Clementson

Fredrik Clementson is the new CEO of Crunchfish Gesture Interaction. He is Joining from Neo4j where he's been part of a massive scale up and rapid efficient growt

# Tell us a little bit about your background and who you are?

First I'd like to thank Joachim for having me and that you and the board has given me the opportunity to work with the Crunchfish Gesture Interaction business.

I like to think of myself as an experienced optimist with almost 20 years within the software industry at companies like Teleca, Obigo, Precise Biometrics and most recently Neo4j the leader in graph database category. I've seen hyper growth and the ups and downs of the mobile industry which all fascinates, inspires and humbles me. It's what I love about the technology industry.

### What is your view on the gesture interaction Market?

Right now I think there is a built up need and pull in the market driven by the Apple Vision Pro announcement. Still many players in this domain want to see more of the new device and app ecosystem before moving forward but in general this type of disruptive event is something that the market has been waiting for or even been longing for. Personally I'm convinced that the spatial computing use case will become much more adopted and mainstream compared to today's niche usage. This change can be really fast and it's a great opportunity for companies like us. I see the announcement as a start signal in a race we've been training for a very long time. We are ready to go.

### What are your thoughts on Crunchfish Gesture Interaction's potential?

I think I've joined Crunchfish at a perfect time. We may be at the verge of wide adoption of immersive technologies over the coming years and we have a mature product to offer to several market verticals like device manufacturers (OEMs), car industry (driver monitoring systems or infotainment) and a brand new market segment for us in e-shopping with our virtual try-on's support in Skeleton XR for web. When reflecting on our product portfolio and the versatility in our product platform my conclusion is that we have plenty of opportunities. The team has done a great job in product development!

### What is your near term priority?

Right now my focus is to get to know our team, our customers and prepare for efficient scale up. As an organization we must continue to be aligned, efficient and happy. On a foundation like that we have a good structure to successfully serve our customers. Our team is very capable and I feel lucky to have joined them. I'm confident that we will be able to accomplish great things together.

Regarding our existing customers I'm eager to understand their product launches, new projects and expected volumes going forward and how we can help them to maximize their market share and capture as much of the market as possible as it expands going forward. I'm a strong believer that it's important to build a compelling end user solution together with our partners and that it is easier to grow business with an existing customer than chasing after new ones. But just to be clear, to maximize our growth we will do both!



# Financials



### **Financial Q2 report**

### Sales and earnings for the quarter

Net sales amounted to SEK 295 (134) thousand for the second quarter and operating expenses amounted to SEK 13,867 (10,906) thousand. Costs have increased as a result of an increased number of employees and an increased number of contracted consultants. EBITDA for the period amounted to SEK -7,620 (-5,149) thousand. Loss before tax for the second quarter amounted to SEK -8,639 (-6,749) thousand and has been charged with amortization of intangible assets of SEK 1,221 (1,558) thousand and tangible fixed assets of SEK 53 (76) thousand.

### Sales and earnings for the half year

Net sales amounted to SEK 465 (351) thousand for the period and operating expenses amounted to SEK 25,378 (21,920) thousand. EBITDA for the period amounted to SEK -13,352 (-10,471) thousand. Loss before tax for the period amounted to SEK -15,468 (-13,481) thousand and has been charged with amortization of intangible assets of SEK 2,198 (3,002) thousand and tangible fixed assets of SEK 116 (111) thousand.

#### Investments

During the second quarter, the Group invested SEK 4,162 (3,429) thousand in intangible fixed assets and SEK 591 (0) thousand in tangible fixed assets. During the first half year, the Group invested SEK 8,267 (6,863) thousand in intangible fixed assets and SEK 591 (60) thousand in tangible fixed assets.

#### Liquidity and financing

At the end of the second quarter the Group's cash and cash equivalents amounted to SEK 9,130 (19,055) thousand. Cash flow from operating activities during the second quarter amounted to SEK -5,922 (-5,348) thousand.

### Staff

As of June 30, 2023, the number of employees was 22 (20).

### **Risks and uncertainties**

A number of different risk factors could impact Crunchfish's operations and industry negatively. It is therefore very important to consider relevant risks in addition to the Company's growth opportunities. Relevant risks are presented in the prospectus issued by Crunchfish AB in October 2021 and the annual report for FY 2022, which can be found at crunchfish.com.

### Related party transactions

Company management and administrative staff are employed in the parent company Crunchfish AB. Reported sales in the parent company consists of income from services rendered for management and administration of the company's two subsidiaries.

### Sales and earnings for the quarter, parent company

The parent company's net sales amounted to SEK 4,803 (4,632) thousand for the second quarter and operating expenses to amounted to SEK -5,140 (-4,995) thousand. EBITDA for the period amounted to SEK 182 (168) thousand. During the second quarter, the parent company invested SEK 0 (0) thousand in intangible fixed assets and SEK 0 (0) thousand in tangible fixed assets.

### Sales and earnings for the half year parent company

The parent company's net sales amounted to SEK 9,111 (9,308) thousand for the period and operating expenses to amounted to SEK -9,897 (-10,192) thousand. EBITDA for the period amounted to SEK 164 (221) thousand. During the period, the parent company invested SEK 0 (0) thousand in intangible fixed assets and SEK 0 (60) thousand in tangible fixed assets.

### Major shareholders for Crunchfish AB (publ) as of June 30, 2023

| Shareholder  | number of shares | % of shares |
|--|------------------|-------------|
| Femari Invest AB (CEO Joachim Samuelsson & Petra Samuelsson) | 7,500,000        | 22.70       |
| Corespring Invest AB (Chairmain Göran Linder)                | 5,985,441        | 18.12       |
| Paul Cronholm (Founder & CTO)                                | 1,100,601        | 3.33        |
| Carlquist Holding AB   | 1,000,000        | 3.03        |
| Mikael Kretz incl. company holdings                          | 720,000          | 2.18        |
| Håkan Paulsson incl. family and company holdings             | 625,000          | 1.89        |
| Lars Andreasson incl. family                                 | 455,000          | 1.38        |
| Claes Capital Consulting AB                                  | 363,480          | 1.10        |
| Mats Kullenberg incl. company holdings                       | 314,829          | 0.95        |
| Granitor Invest AB   | 314,818          | 0.95        |
| Total, ten largest shareholders                              | 18,380,169       | 55.63       |
| Other shareholders (approx. 7,000)                           | 14,658,998       | 44.37       |
| Total  | 33,039,167       | 100.00%     |

### Share price development during 6 months



### Financial calendar

Crunchfish AB publishes financial reports after each quarter. Upcoming reports are planned to be published according to the schedule below:

Half-year report 2023 August 24, 2023, 8:30 am CET

Interim report Q3 2023 November 15, 2023, 8:30 am CET

Year-end report 2023

February 15, 2024, 8:30 am CET

### Accounting principles

This report has been drafted according to the Annual accounts act (Årsredovisningslagen) and BFNAR 2012:1 (K3).

### **Auditor's review**

This report has not been subject to review by the company's auditor.

### **Company information**

Crunchfish AB (publ), corporate registration number 556804–6493, is a limited company seated in Malmö, Sweden.

### **Certified Adviser**

Västra Hamnen Corporate Finance AB is the company's Certified Adviser. E-mail: ca@vhcorp.se Phone: +46 40 200 250

### **Further information**

For further information, please contact: Joachim Samuelsson, CEO ir@crunchfish.com Crunchfish AB (publ) Stora Varvsgatan 6A 211 19 Malmö

# Statement by the Board of Directors and the CEO

The Board of Directors and the CEO hereby assures that this interim report gives a fair overview of the company's operations, financial status, and result. Malmö, August 24, 2023

The Board of Directors Göran Linder (chairman) Robert Ekström Susanne Hannestad Joakim Nydemark Joachim Samuelsson Malte Zaunders

This information is information that Crunchfish AB is obliged to publish in accordance to the EU Market Abuse Regulation. The information was provided by the contact persons above for publication on August 24, 2023.

### Group income statement (SEK)

|  | Q2 2023     | Q2 2022     | Q1-Q2 2023  | Q1-Q2 2022  | 2022        |
|--|-------------|-------------|-------------|-------------|-------------|
| Operating income   |             |             |             |             |             |
| Net sales  | 294 731     | 134 437     | 465 303     | 350 786     | 6 186 821   |
| Own work capitalized                                     | 4 162 896   | 3 428 777   | 8 266 892   | 6 863 345   | 13 555 352  |
| Other operating income                                   | 515 329     | 530 400     | 980 067     | 1 120 950   | 1 975 692   |
| Total operating income                                   | 4 972 956   | 4 093 614   | 9 712 262   | 8 335 081   | 21 717 865  |
|  |             |             |             |             |             |
| Operating expenses                                       |             |             |             |             |             |
| Other external expenses                                  | -5 999 339  | -3 917 211  | -10 313 967 | -8 127 119  | -16 174 705 |
| Personnel expenses                                       | -6 593 884  | -5 310 537  | -12 748 089 | -10 632 686 | -21 734 875 |
| Depreciation of tangible and intangible fixed asset      | -1 274 161  | -1 663 930  | -2 313 652  | -3 113 229  | -6 138 787  |
| Other operating expenses                                 | 0           | 0           | -2 286      | 0           | -1 856 868  |
| Loss from participations in associated companies         | 0           | -14 510     | -340        | -46 599     | -67 871     |
| Total operating expenses                                 | -13 867 384 | -10 906 188 | -25 378 334 | -21 919 633 | -45 973 106 |
|  |             |             |             |             |             |
| Operating profit   | -8 894 428  | -6 812 574  | -15 666 072 | -13 584 552 | -24 255 241 |
|  |             |             |             |             |             |
| Financial items  |             |             |             |             |             |
| Profit/loss from participations in group companies       | 0           | 0           | 0           | 0           | -9 330      |
| Other interest income and similar profit items           | 263 684     | 76 303      | 265 833     | 119 917     | 254 527     |
| Interest expense and similar loss items                  | -8 501      | -12 268     | -67 365     | -16 741     | -20 488     |
| Profit or loss from financial items                      | 255 183     | 64 035      | 198 468     | 103 176     | 224 709     |
|  |             |             |             |             |             |
| Profit or loss after financial items                     | -8 639 245  | -6 748 539  | -15 467 604 | -13 481 376 | -24 030 532 |
|  |             |             |             |             |             |
| Profit or loss before tax                                | -8 639 245  | -6 748 539  | -15 467 604 | -13 481 376 | -24 030 532 |
|  |             |             |             |             |             |
| Taxes  |             |             |             |             |             |
| Tax on income for the period                             | 0           | 0           | 0           | 0           | 0           |
|  |             |             |             |             |             |
| Profit or loss for the period/year                       | -8 639 245  | -6 748 539  | -15 467 604 | -13 481 376 | -24 030 532 |
|  |             |             |             |             |             |
| Key figures  |             |             |             |             |             |
| EBITDA   | -7 620 267  | -5 148 644  | -13 352 420 | -10 471 323 | -18 116 454 |
| Earnings per share                                       | -0,26       | -0,22       | -0,47       | -0,44       | -0,77       |
| Number of shares, average                                | 33 039 167  | 30 925 298  | 33 039 167  | 30 925 298  | 31 313 537  |
| Number of shares at balance sheet date                   | 33 039 167  | 30 925 298  | 33 039 167  | 30 925 298  | 33 039 167  |
| Earnings per share after full dilution                   | -0,26       | -0,22       | -0,47       | -0,44       | -0,77       |
| Number of shares after full dilution, average            | 34 672 967  | 32 338 098  | 34 672 967  | 32 338 098  | 32 527 045  |
| Number of shares after full dilution, balance sheet date | 34 672 967  | 32 338 098  | 34 672 967  | 32 338 098  | 34 615 467  |



Assets

### Group balance sheet (SEK)

Intangible assets Capitalized expenses for development work Total intangible fixed assets Tangible fixed assets Equipment Total tangible fixed assets **Financial assets** Participation in associated companies Total financial assets Total fixed assets **Current assets Current receivables** Account receivables Receivables from associated companies Other receivables Prepayments and accrued income Total current receivables

Cash and bank balances Cash and bank balances Total cash and bank balances

Total current assets

Total assets

| Jun 30, 2023 | Jun 30, 2022 | Dec 31, 2022 |
|--------------|--------------|--------------|
|              |              |              |
|              |              |              |
| 39 578 267   | 31 183 184   | 33 508 932   |
| 39 578 267   | 31 183 184   | 33 508 932   |
|              |              |              |
|              |              |              |
| 1 010 522    | 645 720      | 535 164      |
| 1 010 522    | 645 720      | 535 164      |
|              |              |              |
| 68 313       | 89 925       | 68 653       |
| 68 313       | 89 925       | 68 653       |
|              |              |              |
| 40 657 102   | 31 918 829   | 34 112 749   |
|              |              |              |
|              |              |              |
|              |              |              |
|              |              |              |
| 565 814      | 542 636      | 1 547 884    |
| 0            | 7 500        | 0            |
| //80/9       | 1 841 705    | 449 987      |
| 1 528 593    | 1 203 376    | 1 089 417    |
| 28/2480      | 3 595 217    | 3 087 288    |
|              |              |              |
| 9 129 869    | 19 054 706   | 29 292 563   |
| 9 129 869    | 19 054 706   | 29 292 563   |
|              |              |              |
| 12 002 355   | 22 649 923   | 32 379 851   |
|              |              |              |
| 52 659 457   | 54 568 752   | 66 492 600   |

### Group balance sheet cont. (SEK)

|   | Jun 30, 2023 | Jun 30, 2022 | Dec 31, 2022 |
|---|--------------|--------------|--------------|
| Equity and liabilities                                |              |              |              |
| Equity  |              |              |              |
|   |              |              |              |
| Equity attributable to parent company shareholders    |              |              |              |
| Share capital   | 1 519 802    | 1 422 564    | 1 519 802    |
| Unregistered share capital                            | 0            | 23 506       |              |
| Other contributed capital                             | 276 128 560  | 253 715 581  | 276 001 326  |
| Other capital including profit or loss for the period | -234 217 288 | -208 200 528 | -218 749 684 |
| Total equity  | 43 431 074   | 46 961 123   | 58 771 444   |
|   |              |              |              |
| Long-term liabilities                                 |              |              |              |
| Lease liabilities                                     | 486 630      | 0            | 0            |
| Total long-term liabilities                           | 486 630      | 0            | 0            |
|   |              |              |              |
| Current liabilities                                   |              |              |              |
| Lease liabilities                                     | 423 964      | 443 793      | 383 485      |
| Accounts payable                                      | 1 071 446    | 1 892 640    | 1 914 397    |
| Other liabilities                                     | 1 091 560    | 488 758      | 777 788      |
| Accrued expenses and accrued income                   | 6 154 783    | 4 782 438    | 4 645 486    |
| Total current liabilities                             | 8 741 753    | 7 607 629    | 7 721 156    |
|   |              |              |              |
| Total equity and liabilities                          | 52 659 457   | 54 568 752   | 66 492 600   |
|   |              |              |              |
| Key Figures   |              |              |              |
| Equity-assets-ratio                                   | 82,5%        | 86,1%        | 88,4%        |
| Debt-to-equity ratio                                  | 1,0%         | 0,9%         | 0,7%         |
| Interest-bearing net debt                             | n/a          | n/a          | n/a          |

# Changes in the group equity (SEK)

|                                    | Q2 2023    | Q2 2022    | Q1-Q2 2023  | Q1-Q2 2022  | 2022        |
|------------------------------------|------------|------------|-------------|-------------|-------------|
| Equity at beginning of period/year | 52 073 099 | 49 110 662 | 58 771 444  | 55 843 499  | 55 843 499  |
|                                    |            |            |             |             |             |
| Translation difference             | -2 780     | 0          | -2 780      | 0           | 0           |
| Share issues                       | 0          | 4 599 000  | 0           | 4 599 000   | 26 077 445  |
| lssue costs                        | 0          | 0          | 0           | 0           | -589 378    |
| Warrant premiums                   | 0          | 0          | 130 014     | 0           | 1 470 410   |
| Profit or loss for the period/year | -8 639 245 | -6 748 539 | -15 467 604 | -13 481 376 | -24 030 532 |
|                                    |            |            |             |             |             |
| Equity at end of period /year      | 43 431 074 | 46 961 123 | 43 431 074  | 46 961 123  | 58 771 444  |



# Group cash flow statement (SEK)

|   | Q2 2023    | Q2 2022    | Q1-Q2 2023  | Q1-Q2 2022  | 2022          |
|---|------------|------------|-------------|-------------|---------------|
| Operating activities                                  |            |            |             |             |               |
| Operating profit or loss                              | -8 894 428 | -6 812 574 | -15 666 072 | -13 584 552 | -24 255 241   |
| Adjustments for non-cash intems                       | 1 274 165  | 1 674 168  | 2 313 992   | 3 155 556   | 7 618 349     |
| Interest received etc.                                | 36 386     | 5 932      | 38 535      | 19 471      | 30 585        |
| Interest paid   | -8 564     | -12 268    | -32 253     | -16 741     | 9 748         |
| Income tax paid                                       | 0          | 0          | 0           | 0           | 0             |
|   |            |            |             |             |               |
| cash flow from operating activities before            |            |            |             |             |               |
| changes in working capital                            | -/ 592 441 | -5 144 /42 | -13 345 /98 | -10 426 266 | -16 596 559   |
| Cash flow from changes in working capital             |            |            |             |             |               |
| Decrease(+)/increase(-) in receivables                | 424 736    | -263 750   | 214 802     | 48 583      | 194 235       |
| Decrease(-)/increase(+) in current liabilities        | 1 246 011  | 60 908     | 980 118     | -619 943    | -450 381      |
|   |            |            |             |             |               |
| Cash flow from operating activities                   | -5 921 694 | -5 347 584 | -12 150 878 | -10 997 626 | -16 852 705   |
| Investing activities                                  |            |            |             |             |               |
| Investments in technology development                 | -4 162 896 | -3 428 777 | -8 266 892  | -6 863 345  | -13 555 352   |
| Investments in equipment                              | -591 453   | 0          | -591 453    | -60 202     | -60 202       |
|   |            |            |             |             |               |
| Cash flow from investing activities                   | -4 754 349 | -3 428 777 | -8 858 345  | -6 923 547  | -13 615 554   |
| Einancing activities                                  |            |            |             |             |               |
| Share issue   | 0          | 4 236 723  | 0           | 4 236 723   | 25 488 067    |
| New financial leasing agreements                      | 591 453    | 0          | 591 453     | 0           | 0             |
| Amortization of financial leasing agreements          | -39 527    | -58 612    | -64 344     | -116 791    | -177 099      |
| Warrant premiums paid                                 | 0          | 0          | 130 014     | 0           | 1 470 410     |
|   |            |            |             |             |               |
| Cash flow from financing activities                   | 551 926    | 4 178 111  | 657 123     | 4 119 932   | 26 781 378    |
| Change in each and each opwivelepts                   | 10 104 117 | 4 508 350  | 20.252.100  | 12 001 241  | 2 ( 0 ( 0 0 1 |
| Crash and cash and cash equivalents                   | 10 024 117 | 23 582 586 | 20 332 100  | 22 755 502  | 32 755 502    |
| Exchange rate difference in cash and cash equivalents | 224 591    | 70 370     | 180 /06     | 100 / 45    | 222 012       |
| Exchange rate difference in cash and cash equivalents | 224 301    | 10 5 10    | 109 400     | 100 443     | 223 942       |
| Cash and cash equivalents at end of period/year       | 9 129 869  | 19 054 706 | 9 129 869   | 19 054 706  | 29 292 563    |

# Parent company income statement (SEK)

|  | Q2 2023    | Q2 2022    | Q1-Q2 2023 | Q1-Q2 2022  | 2022        |
|--|------------|------------|------------|-------------|-------------|
| Operating income   |            |            |            |             |             |
| Net sales  | 4 803 416  | 4 632 432  | 9 110 834  | 9 308 303   | 17 915 726  |
| Other operating income                                   | 515 329    | 526 596    | 944 682    | 1 093 991   | 1 948 733   |
| Total operating income                                   | 5 318 745  | 5 159 028  | 10 055 516 | 10 402 294  | 19 864 459  |
|  |            |            |            |             |             |
| Operating expenses                                       |            |            |            |             |             |
| Other external expenses                                  | -2 724 076 | -2 498 322 | -4 861 293 | -5 130 291  | -10 147 595 |
| Personnel expenses                                       | -2 412 994 | -2 492 437 | -5 027 693 | -5 051 372  | -9 199 908  |
| Depreciation of tangible and intangible fixed asset      | -3 010     | -4 229     | -6 020     | -10 701     | -20 646     |
| Other operating expenses                                 | 0          | 0          | -2 286     | 0           | -405 611    |
| Total operating expenses                                 | -5 140 080 | -4 994 988 | -9 897 292 | -10 192 364 | -19 773 760 |
|  |            |            |            |             |             |
| Operating profit   | 178 665    | 164 040    | 158 224    | 209 930     | 90 699      |
|  |            |            |            |             |             |
| Financial items  |            |            |            |             |             |
| Profit/loss from participation in group companies        | 0          | 0          | 0          | 0           | -28 700     |
| Other interest income and similar profit items           | 334 329    | 120 353    | 357 211    | 176 564     | 541 405     |
| Interest expense and similar loss items                  | -994       | -706       | -36 220    | -2 514      | -2 486      |
| Profit or loss from financial items                      | 333 335    | 119 647    | 320 991    | 174 050     | 510 219     |
|  |            |            |            |             |             |
| Profit or loss after financial items                     | 512 000    | 283 687    | 479 215    | 383 980     | 600 918     |
|  |            |            |            |             |             |
| Profit or loss before tax                                | 512 000    | 283 687    | 479 215    | 383 980     | 600 918     |
| _  |            |            |            |             |             |
| Taxes  |            |            |            |             |             |
| Tax on income for the period                             | 0          | 0          | 0          | 0           | 0           |
| Due fit au loss fau tha navied (user                     | 540.000    |            | 170 045    |             | 600.040     |
| Profit or loss for the period/year                       | 512 000    | 283 687    | 4/9 215    | 383 980     | 600 918     |
| Keyfigures   |            |            |            |             |             |
| FRITDA   | 181 675    | 168 269    | 164 244    | 220.631     | 111 345     |
| Farnings ner share                                       | 0.02       | 0.01       | 0.01       | 0.01        | 0.02        |
| Number of shares, average                                | 33 039 167 | 30 925 298 | 33 039 167 | 30 925 298  | 31 313 537  |
| Number of shares at balance sheet date                   | 33 039 167 | 30 925 298 | 33 039 167 | 30 925 298  | 33 039 167  |
| Earnings per share after full dilution                   | 0.01       | 0.01       | 0.01       | 0.01        | 0.02        |
| Number of shares after full dilution. average            | 34 672 967 | 32 338 098 | 34 672 967 | 32 338 098  | 32 527 045  |
| Number of shares after full dilution, balance sheet date | 34 672 967 | 32 338 098 | 34 672 967 | 32 338 098  | 34 615 467  |



# Parent company balance sheet (SEK)

| Assets                            |  |
|-----------------------------------|--|
| Fixed assets                      |  |
|                                   |  |
| Tangible fixed assets             |  |
| Equipment                         |  |
| Total tangible fixed assets       |  |
|                                   |  |
| Financial assets                  |  |
| Participations in group companies |  |
| Receivables from group companies  |  |
| Total financial assets            |  |
|                                   |  |
| Total fixed assets                |  |
|                                   |  |
| Current assets                    |  |
| Current receivables               |  |
|                                   |  |
| Other receivables                 |  |
| Propayments and accrued income    |  |
| Total current receivables         |  |
|                                   |  |
| Cash and bank balances            |  |
| Cash and bank balances            |  |
| Total cash and bank balances      |  |
|                                   |  |
| Total current assets              |  |
|                                   |  |
| Total assets                      |  |

| Jun 30, 2023   | Jun 30, 2022   | Dec 31, 2022   |
|--|--|--|
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| 45 119   | 61 084   | 51 139   |
| 45 119   | 61 084   | 51 139   |
|  |  |  |
|  |  |  |
| 123 057 790  | 91 973 208   | 123 057 790  |
| 21 935 612   | 18 916 613   | 0  |
| 144 993 402  | 110 889 821  | 123 057 790  |
| 145 038 521  | 110 950 905  | 123 108 929  |
| 145 056 521  | 110 950 905  | 123 108 929  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| 565 814  | 542 636  | 1 547 884  |
| 565 814<br>443 955   | 542 636<br>101 664   | 1 547 884<br>0   |
| 565 814<br>443 955<br>0  | 542 636<br>101 664<br>712 789  | 1 547 884<br>0<br>211 928  |
| 565 814<br>443 955<br>0<br>1 254 979   | 542 636<br>101 664<br>712 789<br>1 103 378   | 1 547 884<br>0<br>211 928<br>1 089 417   |
| 565 814<br>443 955<br>0<br>1 254 979<br><b>2 264 748</b>   | 542 636<br>101 664<br>712 789<br>1 103 378<br><b>2 460 467</b>   | 1 547 884<br>0<br>211 928<br>1 089 417<br><b>2 849 229</b>   |
| 565 814<br>443 955<br>0<br>1 254 979<br><b>2 264 748</b>   | 542 636<br>101 664<br>712 789<br>1 103 378<br><b>2 460 467</b>   | 1 547 884<br>0<br>211 928<br>1 089 417<br><b>2 849 229</b>   |
| 565 814<br>443 955<br>0<br>1 254 979<br><b>2 264 748</b><br>7 789 595  | 542 636<br>101 664<br>712 789<br>1 103 378<br><b>2 460 467</b><br>18 286 913   | 1 547 884<br>0<br>211 928<br>1 089 417<br><b>2 849 229</b><br>28 509 210   |
| 565 814<br>443 955<br>0<br>1 254 979<br><b>2 264 748</b><br>7 789 595<br><b>7 789 595</b>                      | 542 636<br>101 664<br>712 789<br>1 103 378<br><b>2 460 467</b><br>18 286 913<br><b>18 286 913</b>                      | 1 547 884<br>0<br>211 928<br>1 089 417<br><b>2 849 229</b><br>28 509 210<br><b>28 509 210</b>                      |
| 565 814<br>443 955<br>0<br>1 254 979<br><b>2 264 748</b><br>7 789 595<br><b>7 789 595</b>                      | 542 636<br>101 664<br>712 789<br>1 103 378<br><b>2 460 467</b><br>18 286 913<br><b>18 286 913</b>                      | 1 547 884<br>0<br>211 928<br>1 089 417<br><b>2 849 229</b><br>28 509 210<br><b>28 509 210</b>                      |
| 565 814<br>443 955<br>0<br>1 254 979<br><b>2 264 748</b><br>7 789 595<br><b>7 789 595</b><br><b>10 054 343</b> | 542 636<br>101 664<br>712 789<br>1 103 378<br><b>2 460 467</b><br>18 286 913<br><b>18 286 913</b><br><b>18 286 913</b> | 1 547 884<br>0<br>211 928<br>1 089 417<br>2 849 229<br>28 509 210<br>28 509 210<br>31 358 439                      |
| 565 814<br>443 955<br>0<br>1 254 979<br><b>2 264 748</b><br>7 789 595<br><b>7 789 595</b><br><b>10 054 343</b> | 542 636<br>101 664<br>712 789<br>1 103 378<br><b>2 460 467</b><br>18 286 913<br><b>18 286 913</b><br><b>20 747 380</b> | 1 547 884<br>0<br>211 928<br>1 089 417<br><b>2 849 229</b><br>28 509 210<br><b>28 509 210</b><br><b>31 358 439</b> |

### Parent company balance sheet cont. (SEK)

|                                     | Jun 30, 2023 | Jun 30, 2022 | Dec 31, 2022 |
|-------------------------------------|--------------|--------------|--------------|
| Equity and liabilities              |              |              |              |
| Equity                              |              |              |              |
|                                     |              |              |              |
| Restricted equity                   |              |              |              |
| Share capital                       | 1 519 802    | 1 422 564    | 1 519 802    |
| Unregistered share capital          | 0            | 23 506       | 0            |
| Total restricted equity             | 1 519 802    | 1 446 070    | 1 519 802    |
|                                     |              |              |              |
| Unrestricted equity                 |              |              |              |
| Profit brought forward              | 149 171 615  | 126 154 938  | 148 440 683  |
| Profit or loss for the period/year  | 479 215      | 383 980      | 600 918      |
| Total unrestriced equity            | 149 650 830  | 126 538 918  | 149 041 601  |
|                                     |              |              |              |
| Total equity                        | 151 170 632  | 127 984 988  | 150 561 403  |
|                                     |              |              |              |
| Current liabilities                 |              |              |              |
| Accounts payable                    | 463 188      | 1 122 612    | 978 120      |
| Other liabilities                   | 953 748      | 129 204      | 766 808      |
| Accrued expenses and accrued income | 2 505 296    | 2 461 481    | 2 161 037    |
| Total current liabilities           | 3 922 232    | 3 713 297    | 3 905 965    |
|                                     |              |              |              |
| Total equity and liabilities        | 155 092 864  | 131 698 285  | 154 467 368  |
|                                     |              |              |              |
| Key Figures                         |              |              |              |
| Equity-assets-ratio                 | 97,5%        | 97,2%        | 97,5%        |
| Debt-to-equity ratio                | 0,0%         | 0,0%         | 0,0          |
| Interest-bearing net debt           | n/a          | n/a          | n/a          |

# Changes in parent company equity (SEK)

|                                    | Q2 2023     | Q2 2022     | Q1-Q2 2023  | Q1-Q2 2022  | 2022        |
|------------------------------------|-------------|-------------|-------------|-------------|-------------|
| Equity at beginning of period/year | 150 658 632 | 123 102 301 | 150 561 403 | 123 002 008 | 123 002 008 |
|                                    |             |             |             |             |             |
| Share issues                       | 0           | 4 599 000   | 0           | 4 599 000   | 26 077 445  |
| lssue costs                        | 0           | 0           | 0           | 0           | -589 378    |
| Warrant premiums                   | 0           | 0           | 130 014     | 0           | 1 470 410   |
| Profit or loss for the period/year | 512 000     | 283 687     | 479 215     | 383 980     | 600 918     |
|                                    |             |             |             |             |             |
| Equity at end of period /year      | 151 170 632 | 127 984 988 | 151 170 632 | 127 984 988 | 150 561 403 |



### Parent company cash flow statement (SEK)

|   | Q2 2023     | Q2 2022    | Q1-Q2 2023  | Q1-Q2 2022  | 2022        |
|---|-------------|------------|-------------|-------------|-------------|
| Operating activities                                  |             |            |             |             |             |
| Operating profit or loss                              | 178 665     | 164 040    | 158 224     | 209 930     | 90 699      |
| Adjustments for non-cash items                        | 3 010       | 4 229      | 6 020       | 10 701      | 20 646      |
| Interest received etc.                                | 109 724     | 96 133     | 132 606     | 126 780     | 461 235     |
| Interest paid   | -983        | -706       | -1 108      | -2 514      | -2 516      |
| Income tax paid                                       | 0           | 0          | 0           | 0           | 0           |
|   |             |            |             |             |             |
| Cash flow from operating activities before            |             |            |             |             |             |
| changes in working capital                            | 290 416     | 263 696    | 295 742     | 344 897     | 570 064     |
|   |             |            |             |             |             |
| Cash flow from changes in working capital             |             |            |             |             |             |
| Decrease(+)/increase(-) in receivables                | -43 602     | 120 144    | 584 481     | 340 700     | -512 003    |
| Decrease(-)/increase(+) in current liabilities        | 219 721     | 394 539    | 16 267      | -253 617    | -60 949     |
|   |             |            |             |             |             |
| Cash flow from operating activities                   | 466 535     | 778 379    | 896 490     | 431 980     | -2 888      |
|   |             |            |             |             |             |
| Investing activities                                  |             |            |             |             |             |
| Investments in equipment                              | 0           | 0          | 0           | -60 202     | -60 202     |
| Disposal of shares in subsidiaries                    | 0           | 0          | 0           | 0           | 16 300      |
| Repayment of shareholder contribution                 | 0           | 0          | 0           | 370 000     | 370 000     |
| Loans provided to group companies                     | -11 143 433 | -9 660 846 | -21 935 612 | -19 301 613 | -31 412 918 |
|   |             |            |             |             |             |
| Cash flow from investing activities                   | -11 143 433 | -9 660 846 | -21 935 612 | -18 991 815 | -31 086 820 |
|   |             |            |             |             |             |
| Financing activities                                  |             |            |             |             |             |
| Share issue   | 0           | 4 236 723  | 0           | 4 236 723   | 25 488 067  |
| Warrant premiums paid                                 | 0           | 0          | 130 014     | 0           | 1 470 410   |
|   |             |            |             |             |             |
| Cash flow from financing activities                   | 0           | 4 236 723  | 130 014     | 4 236 723   | 26 958 477  |
|   |             |            |             |             |             |
| Change in cash and cash equivalents                   | -10 676 898 | -4 645 744 | -20 909 108 | -14 323 112 | -4 131 231  |
| Cash and cash equivalents at beginning of period/year | 18 241 899  | 22 908 437 | 28 509 210  | 32 560 241  | 32 560 241  |
| Exchange rate difference in cash and cash equivalents | 224 594     | 24 220     | 189 493     | 49 784      | 80 200      |
|   |             |            |             |             |             |
| Cash and cash equivalents at end of period/year       | 7 789 595   | 18 286 913 | 7 789 595   | 18 286 913  | 28 509 210  |

