# BitVR

Ultimate VR/360° content decentralized copyright management and distribution eco-system driven by economic incentives.

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# Introduction

In recent years Virtual Reality hardware has advanced sufficiently to become more accessible to the consumer market. Devices, such as the HTC Vive[1] and Oculus Rift[2] bring high-end virtual reality hardware to home users. Even mobile phones can be used to access VR content with exceptional results, using adapter devices, such as Samsung Gear VR[3] or the very low-cost Google Cardboard[4].

The accessibility of VR hardware has led to an increased demand for VR content, ranging from 360° videos, which can be in flat formats or stereoscopic 3D[5], to more interactive content, such as immersive applications and games.

In parallel, blockchain technology has emerged from Bitcoin[6] and subsequent cryptocurrencies, to providing solutions for general-purpose decentralized applications. Ethereum[7] and similar platforms provide Turing-complete transaction processing systems that can be used to implement smart contract-based decentralized ecosystem with their own circular economic model.

BitVR is a peer-to-peer VR content platform. The platform brings together VR consumers and VR content creators in a decentralized ecosystem. Content will be served through a decentralized infrastructure. A token-based economy can be used to implement different monetization models. To this end, a fungible utility token can be employed in various ways such as paying for VR content, or for rewarding users who watched certain content.

In addition, a non-fungible token is used to represent content that can be tracked on the blockchain.

A key advantage of basing the proposed system on a blockchain is that it allows to track verify provenance and authenticity of the content, providing a solution to digital copyrights management. The usage of a non-fungible token enables copyright management and transfer of VR content ownership.

Behind the BitVR is the original team from the 360central. 360central Limited, a Google Street View Trusted Agency was founded in Hong Kong in 2011 with offices across Asia, creating 360x360 degree panoramic virtual tour, VR video, 360x360 degree video commercial, AR/MR, VR holographic showroom experience and total VR integration solutions served over 300 clients in Asia and produced over 5000 VR scenes/videos.

[1] HTC Vive VR headsets - https://www.vive.com   |   [2] Oculus Rift VR headsets - https://www.oculus.com/
[3] SAMSUNG Gear VR - http://www.samsung.com/global/galaxy/gear-vr/   |   [4] Google Cardboard - https://vr.google.com/cardboard/
[5] Stereoscopy Wikipedia Page - https://en.wikipedia.org/wiki/Stereoscopy   |   [6] Satoshi Nakamoto, A Peer-to-Peer Electronic Cash System. 2009. https://bitcoin.org/bitcoin.pdf
[7] A Next Generation Smart Contract and Decentralized Application Platform. Vitalik Buterin. 2013. https://github.com/ethereum/wiki/wiki/White-Paper

At a glance, why BitVR is the ultimate VR/360 video decentralized copyright management and distribution eco-system driven by economic incentives with the following details.
BitVR -

1. is the first utility token, a decentralized and secure digital currency for user-generated content in Virtual Reality.

2. is a decentralized VR content copyright network.

3. is a token to be utilized for VR content viewing, membership subscription and upgrades.

4. is for stock VR creators' pay-outs.

5. can be traded on cryptocurrency exchanges.

6. can be earned by creating or watching VR content.

7. can be earned by taking part in the community.

8. can be used to incentivize the usage of certain VR hardware.

9. provides smart contracts between the creators and subscribers.

10. is an ERC-20 token, the only form of payment in BitVR platforms.

11. guarantees users anonymous access to any VR content.

12. has triggered strong interest among market leaders and platforms with more than 100 million customers, who have already been waiting for.

13. is expected to bring revolutionary breakthrough on copyright management on the internet for VR content.

14. offers great opportunity to participate in the community of sharing, licensing and liquidating VR contents once kick-started the Initial Coin Offering (ICO) process, given the expected strong increase in widely adaptation of the content usage throughout the industries around the world.

# The Market

VIRTUAL REALITY

AUGMENTED REALITY

Augmented / Virtual Reality
Revenue Forecast ( $B )

120
100
80
60
40
20

2016
2017
2018
2019
2020

https://www.digi-capital.com/news/2016/01/augmentedvirtual-reality-revenue-forecast-revised-to-hit-120-billion-by-2020/#.WtlWqmaB3u0
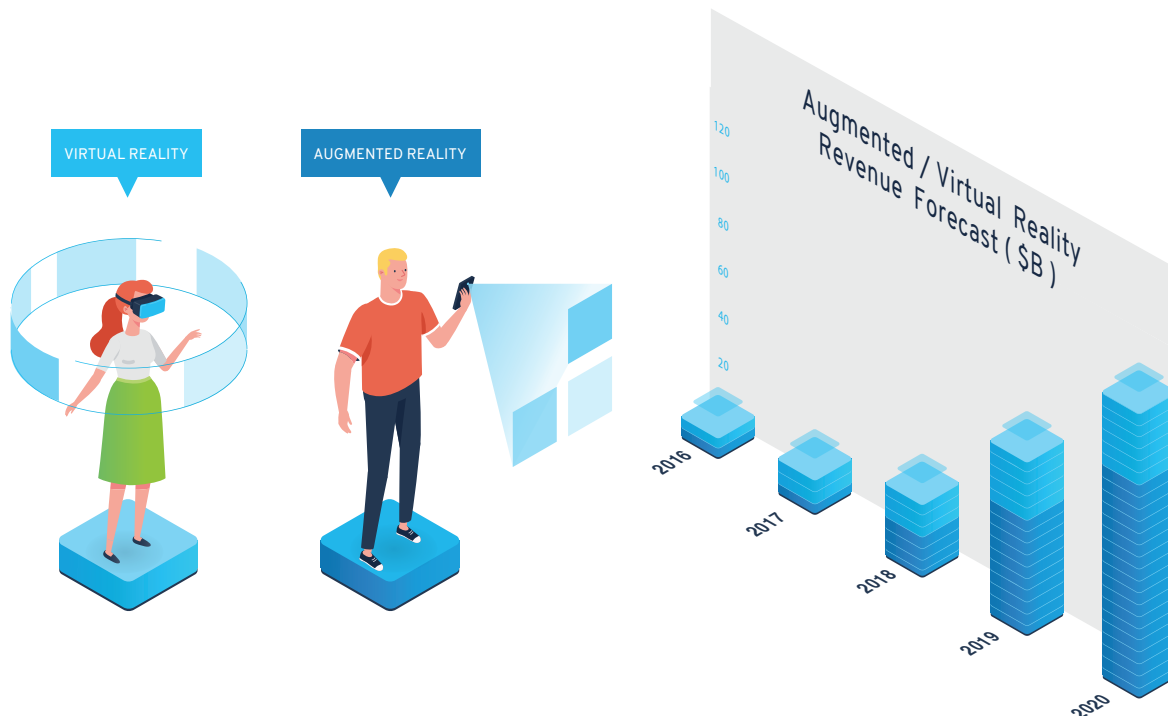
## The Diverse Potential of VR & AR Applications

- Healthcare $5.1B
- Engineering $4.7B
- Real estate $2.6B
- Retail $1.6B
- Military $1.4B
- Education $0.7B
- Video games $11.6B
- Live events $4.1B
- Video entertainment $3.2B

$18.9B
CONSUMER

$16.1B
ENTERPRISE AND
PUBLIC SECTOR

TOTAL
$35B

http://uk.businessinsider.com/goldman-sachs-vr-and-ar-market-size-and-segmentation-2016-4
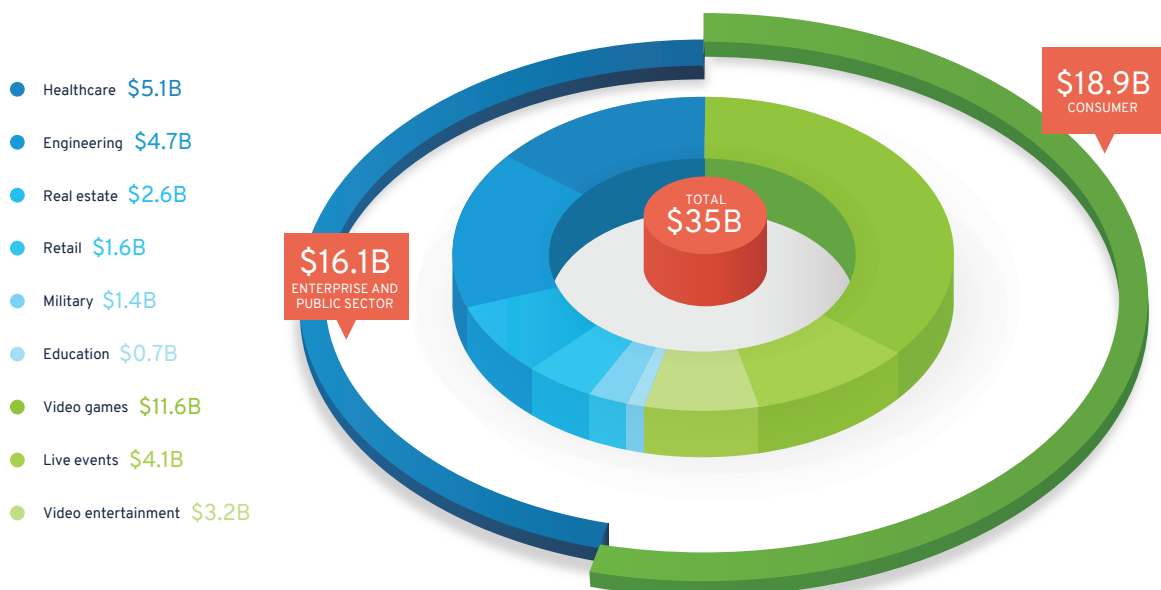
## VR / AR market could potentially grow to the size of the current smartphone market (in USD bin)



Legend: ● Hardware  ● Software & Services  ● M-commerce / E-commerce

Y-axis: 700, 600, 500, 400, 300, 200, 100, 0

X-axis: 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025
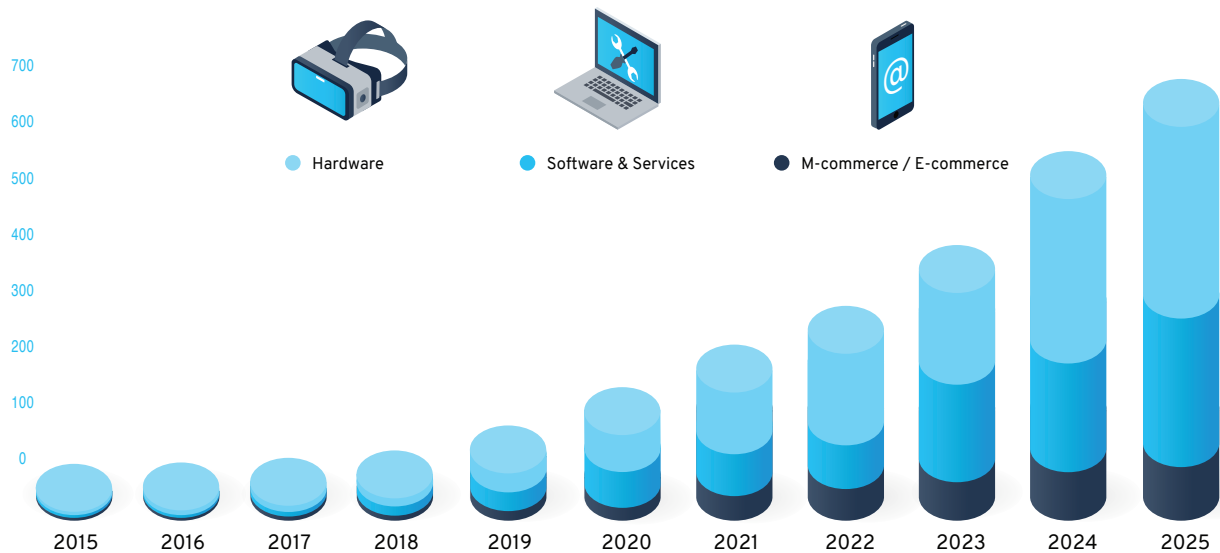
Source: Gartner, Credit Suisse
https://www.credit-suisse.com/ch/en/articles/private-banking/virtual-und-augmented-reality-201706.html

> " Virtual reality could be the next big social platform and connect more than a billion people. "

Mark Zuckerberg, Founder of Facebook

The renowned experts of the International Data Corporation (IDC) estimated that sales in VR and AR (Augmented Reality) are likely to explode from USD 5.2 billion in 2016 to USD 162.0 billion in 2020. The analysts at Research and Markets expected the global AR/VR market to grow at an average annual rate of 85.4 percent (AR) and 44.5 percent (VR) between 2016 and 2022 respectively.

http://www.idc.com/getdoc.jsp?containerId=prUS41676216

The visual quality and usability of VR headsets are being improved constantly. As a result, the focus is now on high-quality content that can fully utilize the hardware's potential. Facebook will shortly be launching Oculus Go, a pair of Oculus Go glasses at a price of $199, that does not require a PC or smartphone. Explosive user growth is expected by lowering the price barrier and making the technology affordable for recreational users.

Personal computing Juggernaut Microsoft has also recognized the signs of the times and acquired the Californian company Altspace VR with its 35,000 members in October 2017. Via the Altspace online portal, users can interact with each other as they would in a social network - now using Virtual Reality devices.

A continuous growing number of companies are currently working on new solutions, but the content range remains limited. While high-quality content costs a lot of money to create, many creators around the world are hesitating to invest into the expensive VR hardware and software without a marketplace that could provide secure copyright protection and economic incentives.

# The Problems

- Copyright infringement has always been a disruptive issue for any content creators from the early age of digital era.

- Creative content creators usually do not have the say of the pricing on their own work and where the content are ended up being used or viewed.

- VR/360° content is extremely expensive and time consuming to create and produce, due to the nature of the creation process and hardware/software cost. In need of fair and decentralized reward models for incentivize new content creators.

- Relatively high learning curve for any creative professionals or anyone who are interested to produce VR content.

- Lack of marketplace for VR content to be showcased and traded, connecting creators and consumers.

- In need of trusted, fast, secured and scalable payment form to be adopted among the industry.

- Lack of transparency in pricing structure and payout terms in traditional content market.

# The Solutions: BitVR Functionalities

## VR Content Platform

BitVR consists of a decentralized platform to connect creators with VR content consumers. Web-based access allows users to access different types of VR content. Content is classified, browsable and searchable.

**Supported content types include:**

- Flat high-resolution 360° videos
- Stereoscopic 3D 360° videos
- 360° photos
- Interactive content in a web-based format
- Interactive content in a downloadable format

Creators will be able to submit content of the above types, providing the corresponding data files, register their intellectual property rights and define access and licensing options for consumers.

Ownership rights of VR content can also be transferred between creators, meaning that content can also be traded.

## Blockchain Solution

BitVR will be implemented on top of the Ethereum blockchain.

The underlying distributed ledger technology provides a number of basic primitives, in order to implement the required functionality:

- The system functions under the assumption of a Byzantine fault-tolerance model. Any node may fail in any imaginable way, including by acting maliciously.
- Sequential consistency [8] is be guaranteed for transactions, meaning that all peers agree on a single view of the transaction order.
- The system provides support for implementing the BitVR fungible tokens.
- It is possible to immutably save sequences of timestamped data.

Most existing Blockchains provide these primitives. However, Ethereum is currently the most stable and widely used blockchain and has been chosen for this reason.

[8] Lamport, L. (1979). How to make a multiprocessor computer that correctly executes multiprocess programs. IEEE Trans. Computers, 28(9):690- 691.

## Decentralized Data Storage

Content and related metadata is in a decentralized storage system. The storage system will eventually be completely independent from a centralized storage service provider infrastructure.

This is achieved by leveraging storage provided to the system by BitVR peer nodes, mainly the creators' storage, in a distributed manner. Existing decentralized storage platform technology will be integrated.
The storage system provides automated facilities for load balancing and replication of high-demand content.

## Monetization

Different license options will be available, such as creative commons or more restrictive licenses. Licensing is closely linked to monetization, which is implemented through the token economy. Consumers will be able to access the content through the different licensing models.

Content can be monetized according to four different models:

- **Free-to-View** - Free content that can be viewed by anyone without a charge.
- **Pay-per-View** - This model allows creators to charge for content. Consumers pay a specified number of tokens to the creators to gain access to the content.
- **Paid-to-View** - In this model, users are rewarded for spending time to watch or interact with the VR content.
- **Paid-to-Improve** - In this model, users can be incentivized for improving the content, for example, by re-editing.

All transactions are subject to a 1% fee, which is paid into a vault contract. This vault is used to incentivize users for certain actions, including:

- Upload original free-to-view content
- Reach a certain predefined content viewing time
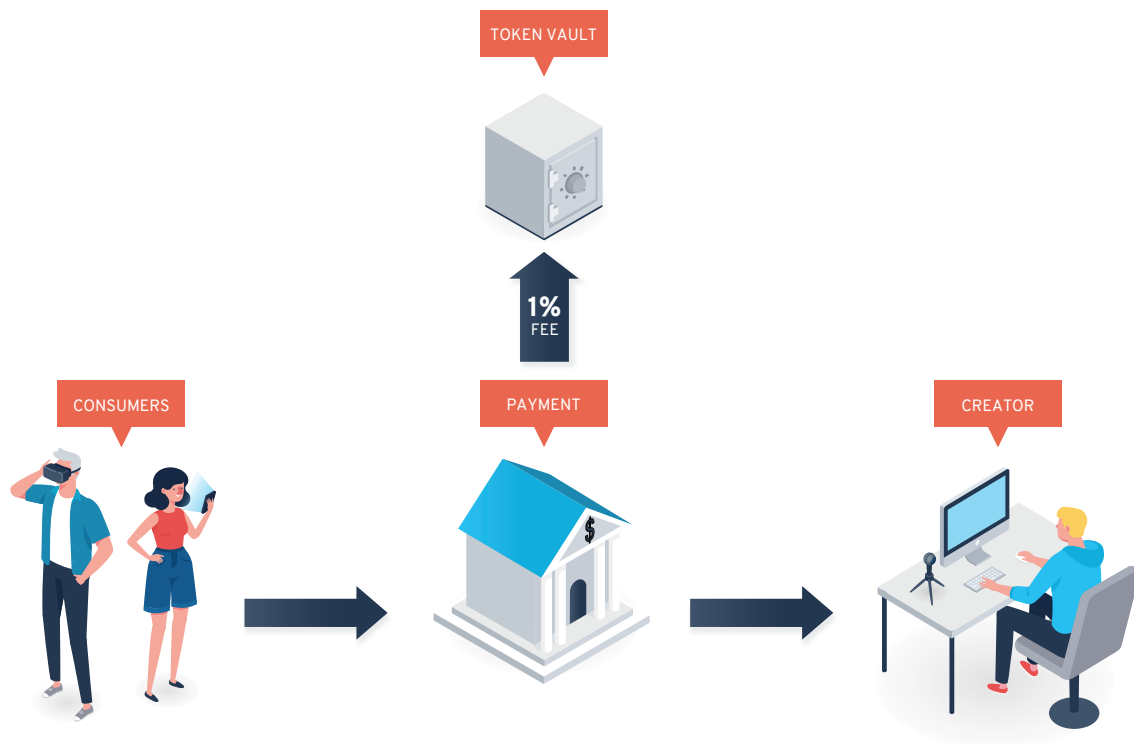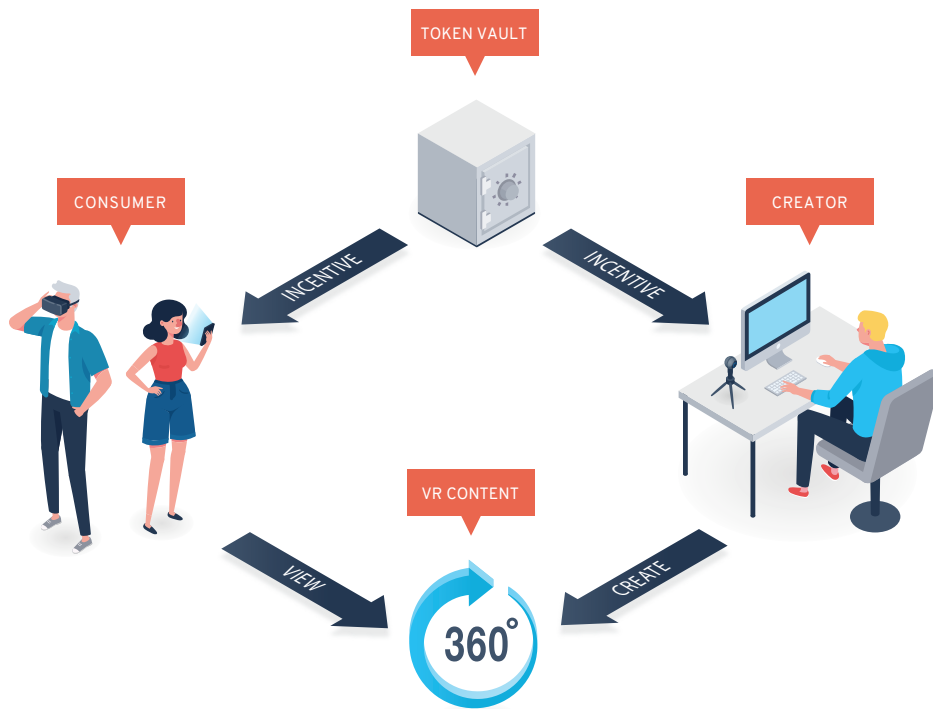
*Figure 1 - Token Payment*



*Figure 2 - Token Incentive*

Figure 1 and Figure 2 show examples of the circular token economy and the role of the token vault. Tokens are used by consumers to buy pay-per-view content. A 1% is retained and locked in the token vault smart contract. The token vault is used to incentivize creators to upload videos and consumers to view free-to-view content.

## Intellectual Property Right Management

The blockchain-based intellectual property right management system allows to openly verify content authorship and provenance. To do so, the existence of a certain version of the content at a certain time is provable and authors are identifiable through a public key infrastructure.

## Supported Hardware

BitVR hardware support is content dependent. However, the video and interactive web content are supported by hardware compatible with WebVR content, which includes most current devices.

As such compatibility can be guaranteed for at least the following devices:

- Google Cardboard
- Google Daydream
- Samsung Gear VR
- HTC Vive
- Oculus Rift
- PlayStation VR
- Windows Mixed Reality
- Most mobile VR adapters

## Third-Party Usage Model

BitVR allows third-party platforms to integrate with the system. To this end, third-party service providers may embed BitVR hosted content into their site. Let's consider a practical real-world use case for this:

An educational web site would like to offer courses as 360° videos on their site. Users can obtain training by watching this content using by paying in BitVR tokens through a pay per view model.

Whilst content is hosted and streamed through the BitVR platform, the education provider can use their own platform as a user interface.

To make this third-party usage model possible, BitVR provides a third party JavaScript API that can be used by web-developers to embed BitVR platform access. User still use their local browser plugin wallet software to access and pay for services.

## Ecosystem Functions Map

| Footage Management Platform | VR Production Platform | Content Hub | Distribution and display Management platform | End Terminal Applications |
|---|---|---|---|---|
| For footage creators to upload and manage the footages in their accounts | For end content creators to leverage the footages and compose / upload end contents | End customers browse and order contents | The contents are distributed to the relevant parties / devices, get ready for usage | Display content accordingly, with control and relevant effects |

**Earning Activities**

| | | | | |
|---|---|---|---|---|
| • Upload the Footages, visual elements (transition, templates, etc)<br><br>• Content initiation / topic, idea provider | • Compose, edit the footages, visual elements into end contents<br><br>• Create 3rd party tools for users to produce end contents under the BitVR frameworks | • Create accounts<br><br>• Provide useful information (comments, topics…)<br><br>• 3rd party distribute VR contents via their own website/app<br><br>• Referral<br><br>• User feedbacks creation (comments, reviews, voting for the contents / topics) | • Create / sharing client side Play management (Playlist, display control, etc)<br><br>• Create 3rd party tools for distribution<br><br>• Function as part of the distribution storage | • Create end display applications specific to the end user industry (e.g. education, marketing, gaming)<br><br>• Provide useful information (topics, comments, voting, etc) |

**Spending Activities**

| | | | | |
|---|---|---|---|---|
| • Crowd funding for completing a video | • Leveraging footage resources (special features, footages, etc)<br><br>• Use 3rd party tools | • Order / rent contents, (individual content item or packages)<br><br>• Membership<br><br>• Register as content hub in the BitVR infrastructure | • Leverage resources (Playlist, display control, etc) | • Pay per view<br><br>• Leverage special features<br><br>• Share / duplicate the contents |

## BitVR

**Reward the contribution with BitVR (BitVR mining)**     **BitVR payment**     **Currency exchange, integrate with other currency system**

# Application Areas

Sports

Training

Education

Property Market

Travel Agents

Entertainment

Special Therapy

Restaurants

Retails

Services

## Business Use Cases

### A differentiated creator model

This is a structure to capture the contributions of various creators in a single content item (a VR video)

- Each of the content item could register with multiple creator roles, in the context of VR content, e.g.
  - Primary content/video creator
  - Editor of the content, leverage the content footage to create a new content item (secondary creation, adding information into the video, editing several video contents into a single video.)
  - Combine additional interaction logics into the video and the content item, using various types of technology.
  - Package the content items to be end-user viewable content (e.g. an App in viewing device)

Each of the "role" would be registered in the content item (a content item could also contain multiple contributors with the same role, e.g. a content item that is combined with 3 different content footages).

The content item could include the contract which specifies the percentage of income that each contributor can obtain if this item is purchased.

When a content item is "purchased/subscribed/viewed" (depends on the contract agreement), the income could be distributed to each BVR account according to the specified percentage.

The definition of each role could be specific for different industries. BitVR and the copyright management mechanism could be applied in various industries.

## Platform A - Education

In order to provide more engaging education, VR is proven to be a new area that help learnings. Currently, schools would invest to create VR labs. However, in pursuance of encourage more quality content to be created, BitVR model could be applied.

In education industry, there could be several types of contributors when it comes to education content creation. They earn BVR tokens when the education organizations order the VR contents:

- The topic ideas: they probably are the teacher users who knows what they want. Through certain platform, they can provide the topics or submit content orders.
- The original content creators: They create the most original visual contents and register to the BitVR copyright system.
- The secondary creators: They combine the content items to make them meaningful content for specific usage. (In the form of adding additional information/special effects, combine, or create playlists, etc).
- The end content item could contain the information of all these contributors and they are rewarded with BVR tokens in certain proportion when the end content has been purchased or viewed.
- Platform creator can create app to leverage these content items and manage the business transactions. The same content items could be distributed not limited to a single platform.
- End customers are the education organizations (schools, tutor centres, etc) or the direct end users. They order the contents via the platform, paying BVR to view the VR contents.

## Platform B - Property

Currently, in second-hand property market, it is always time-saving to have images of the properties screened through for potential buyers before visiting the actual property.

The image contents of the property owned by property agent could be stolen on internet and illegally used by another property agent. Therefore, discourage the business to produce higher quality VR contents for potential buyer to screen through the options before they visit.

With the BVR content asset management, the property agents can share property information to earn BVR, while purchasing image content from another agent using BVR. This ecosystem encourages the sharing of cost in producing high quality VR contents of property market.

These VR content can also be leveraged by interior designers and architects to perform secondary editing for their own projects.

### Platform C - Travel

Creators from different countries could produce various footages of tourist attractions. The content could be managed in the asset management system. Travel agencies can offer virtual tours to attract more business, the creators receive BVR tokens once the content has been used or viewed.

Platform creators can create tools for combining different footages into a single content item. The platform can earn portion of the BVR tokens when the content has been viewed.

Virtual tours could be a service by itself for customers to "travel" around the world without moving. Customers pay BVR to watch the high quality videos in the comfort of their own home. The BVR income can directly split between different roles of contributors.

Third party online shopping platforms can create an interactive feature to enable online purchase features from different countries. Customer can be triggerred to buy when watching the VR videos and paying by BVR when buying via the VR content.

### Platform D - Retail, Restaurant, Services, Museum

VR is a good way to promote a location or services, attracting potential customers to have immersive experiences and generate high tendency to visit.

In order to reduce the cost of VR production, creators can help retailers / restaurants to create the content items, and then receive BVR tokens when end customers view the content. Through the asset management system, creators would know that they could receive the BVR payment when the contents are viewed.

Other app providers can extend the services or use the content to book a specific table or purchase item in the store. The VR contents could enable location related value-added services, e.g. +2% service charge when customers would like to book a specific table (for better view or memory related purposes). Part of the service charge will be split to the app provider and the content creator in the form of BVR tokens. In this model, everyone would benefit from the usage of the VR contents while engaging with customers.

In additional, the retail stores can also offer discounts or product information in the VR content by using feature from certain app provider by paying with BVR. When end customer view these content and information, part of the profit will be split between various contributors of the content items.

## Platform E - Training

Currently, training providers are hesitating to provide online video trainings because the contents could be downloaded, copied and distributed illegally.

With the content asset management platform, training providers can limit the amount of content copies and track who has the right of viewing the training content. Renting can easily be achieved under this mechanism.  Trainer and the producer can earn BVR tokens when customers view the contents.

Customer can pay BVR tokens for viewing the training. Third party app provider could build applications for managing various contents, packaging the training and selling to customers. The earned BVR tokens could be split between various contributors of the content item.

Besides, the content items are not limited to be resale by one specific platform provider.
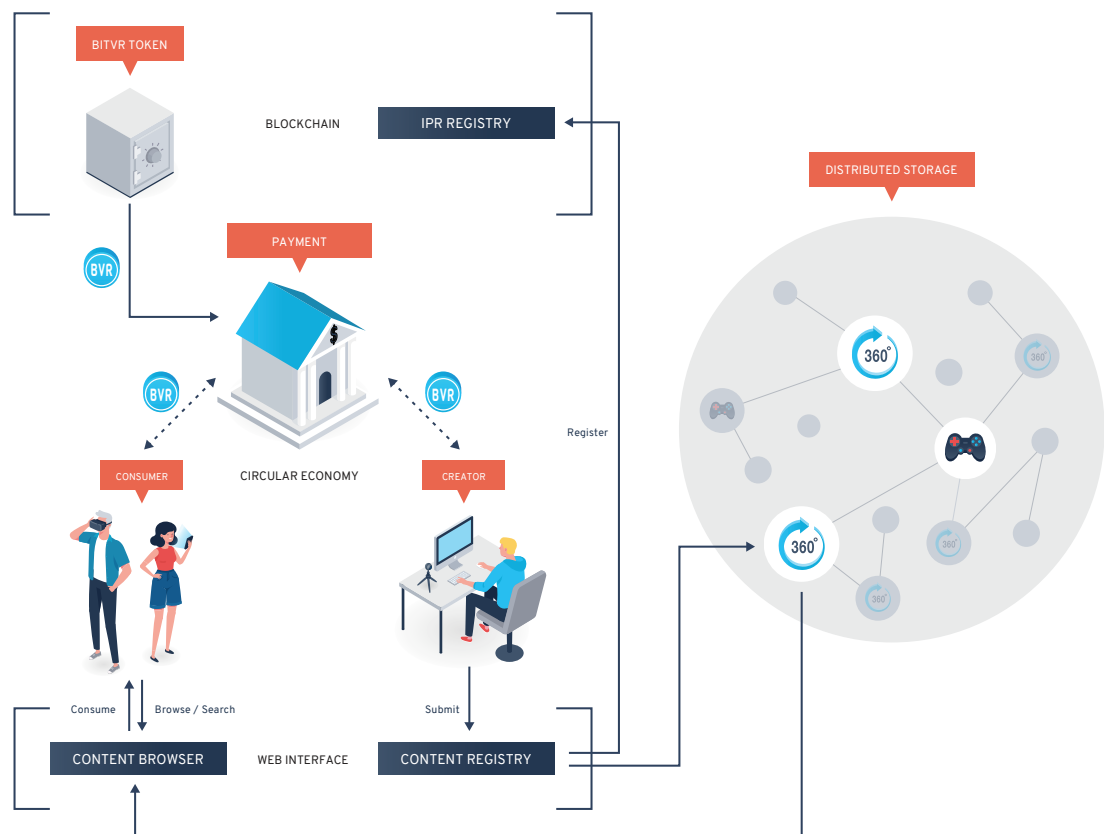
# BitVR Implementation Details



*Figure 3 - System Overview*

Figure 3 illustrates the BitVR high-level system architecture with its components. Creators and consumers interact with a web interface, split into two components: the content browser that allows VR consumers to browse and serve for content, and the content registry, which allows creators to provide new content.

The web interface interacts with the distributed storage system to store and retrieve content.

It also interacts with the blockchain to use the intellectual property rights (IPR) registry, in which creators register the ownership and licensing options for their content. The blockchain also provides the necessary functionalities for the BitVR token. Consumers and creators engage in a circular token-based economy whilst interacting with the content.

In the remaining of this section, we will look at the system components in detail.

## Web Application
## Architecture



| | | UI LAYER |
|---|---|---|
| CONTENT BROWSER | CONTENT REGISTRY | |

| | | | MANAGER LAYER |
|---|---|---|---|
| TOKEN MANAGER | IPR MANAGER | CONTENT MANAGER | |

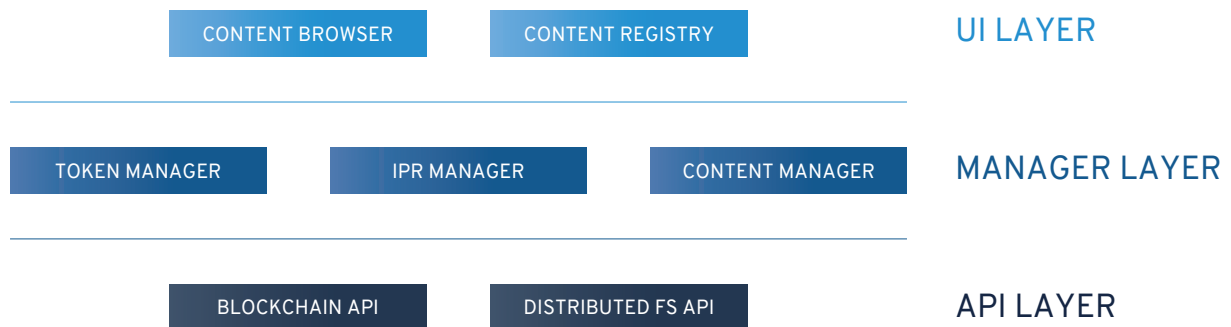| | | API LAYER |
|---|---|---|
| BLOCKCHAIN API | DISTRIBUTED FS API | |

*Figure 4 - Web Application Architecture*

The web application provides access to BitVR for both VR content consumers and creators. Out of necessity, the web application is the most centralized component of the BitVR system, due to the centralized nature of the world wide web.

However, the BitVR web site can be implemented entirely in the client-side frontend and does not require a centralized backend. Backend functionality is provided by the distributed storage component and the blockchain. Therefore, whilst the web application is a centralized component, the actual implementation of it can be stored on a distributed filesystem and accessed through a gateway.

The web application can be divided into three layers (Figure 4). At the highest level, a user interface layer provides the content browser and content registry interfaces for VR content consumers and creators respectively.
The two user interfaces interact with a series of managers implemented at the next layer:

- The Token Manager implements the logic required for the in-application payment system, provided by the token economy model. This manager provides all the necessary primitives to provide the four content monetization models introduced in BitVR Functionalities.
- The IPR Manager provides the logic for IPR management and content owner verification.
- The Content Manager provides access to stored content and allows storing of new content.

Managers make use of two backend APIs that interact with the underlying blockchain and the distributed storage network. The blockchain API is primarily used by the token manager and the IPR manager to execute token transfers and register and retrieve IPR information.

## Front-end

The BitVR web front-end will be implemented in HTML5 and JavaScript. This is currently the only viable option for natively supporting VR content in the web browser. To enable VR content, the WebVR library[9] will be used. This HTML5 JavaScript standard allows integration with most hardware on a variety of web browser without additional plugins and is the most universally supported approach to enable VR content on the Web.

## Supported Content

As explained, a variety of content formats will be supported by BitVR. In practice, BitVR envisages to support mainly 360° videos and WebVR compatible interactive content natively in the browser.

Additionally, content providers may choose to provide downloadable content on their merits, as long as it can be played back by a number of VR devices.

## Distributed Storage
## Overview



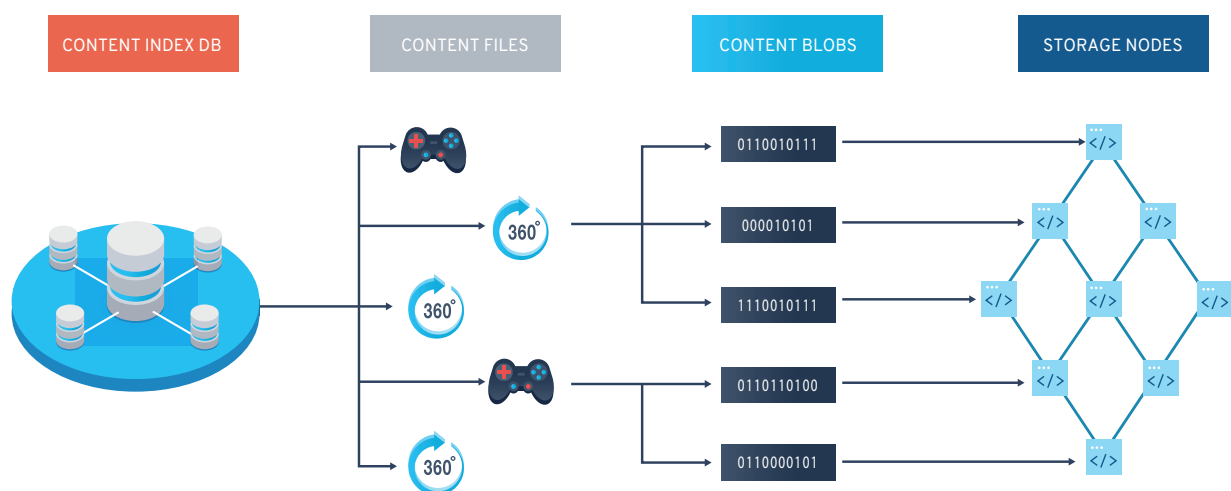| CONTENT INDEX DB | CONTENT FILES | CONTENT BLOBS | STORAGE NODES |

*Figure 5 - Distributed Storage Architecture*

Figure 5 illustrates the distributed storage components. Distributed storage is divided into a distributed database and a distributed file system.

[9] WebVR library - https://webvr.info/

The BitVR storage system is split into two components. Content metadata, such as categorizations and other content descriptions, are stored in the databases. Each entry in the database references a content file which is stored in the distributed filesystem. The distributed filesystem splits files into data blobs, which are distributed amongst the nodes that make up the storage network.

A searchable content database is required to store metadata and provide quick lookup. It is currently not feasible to store large content data in a database system. Instead, as in centralized systems, the most sensible architecture is to reference content files on a file storage system from the database.

## Content Database

There are currently three options to store the content database:

1. **Storing content indexes on the blockchain.** Storing the content index on the blockchain is technically feasible. Implementing the content database on-chain con Ethereum can be done in the form of a non-fungible token, for example, based on ERC-721[10].
2. **Centralized database server.** The simplest solution is to treat the content database as part of the off-chain web application and use a centralized database server.
3. **Using a decentralized database.** BigchainDB[11] is the preferred option for running a distributed database. The system is designed as a database module for blockchain projects and provides efficient decentralized data storage.

BitVR will represent content as an ERC-721 non-fungible token to leverage the provenance and ownership tracking properties of the blockchain. Using ERC-721 allows content ownership to be transferred and allows the content index to be closely integrated with the IPR management module.

Each content token links to a content files stored on the off-chain distributed file storage system.

[10] ERC-721 Non-Fungible Token Standard - https://github.com/ethereum/eips/issues/721
[11] BigchainDB - https://www.bigchaindb.com/

## File Storage

Storing files in a distributed way is the objective of various blockchain based projects, such as Storj[12] and Sia[13].

However, these systems are currently work in progress and are not ready for use in a project such as BitVR at the time of writing. We may study integration with such a system at a later stage.

Currently, the only viable distributed files system in existence is the Interplanetary Filesystem (IPFS)[14].

IPFS is based on distributed hash tables. Distributed hash tables distribute the so-called buckets holding data across a peer-to-peer network. The hash value acts as a key for allowing nodes to address data on the network. Figure 6 illustrates how data can be distributed amongst nodes in a distributed system using a distributed hash table.
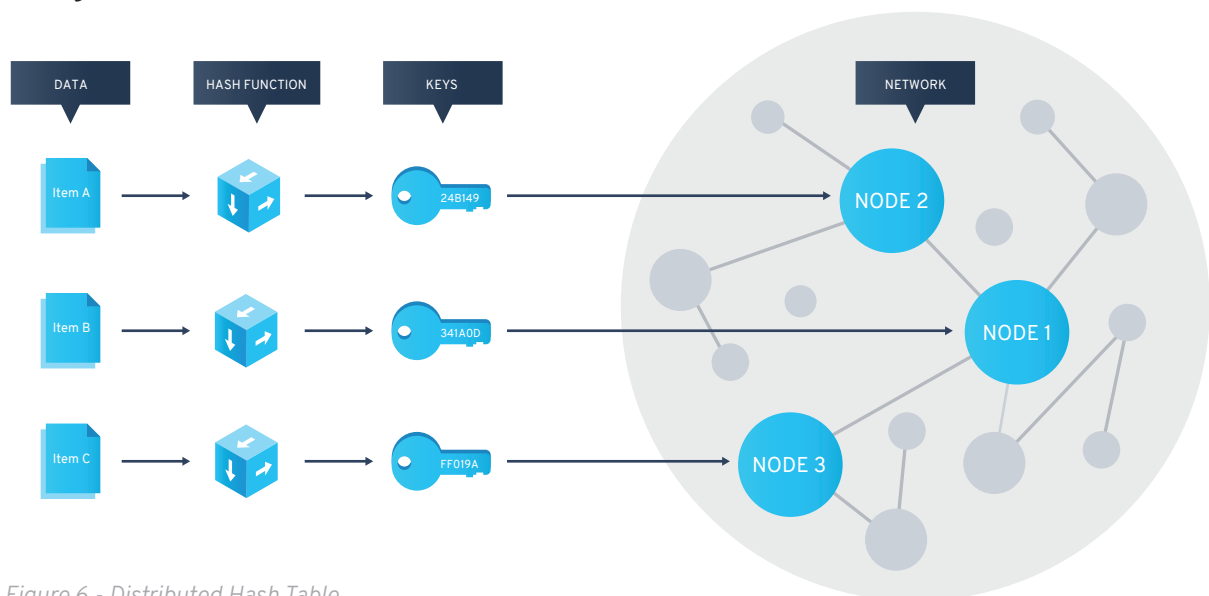


*Figure 6 - Distributed Hash Table*

IPFS uses this data-structure to divide files into blocks and stored across the network. Files are identified and addressed by their hash values. Version history of each file is maintained in a similar manner as in the Git version control system[15].

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[12] Storj Cloud storage blockchain - https://storj.io/
[13] Sia Cloud storage blockchain -  https://sia.tech/
[14] The Interplanetary Filesystem Whitepaper. Juan Benet. IPFS - Content Addressed, Versioned, P2P File System (DRAFT 3).
    https://github.com/ipfs/papers/raw/master/ipfs-cap2pfs/ipfs-p2p-file-system.pdf
[15] Git version control system. https://git-scm.com/

There is a simple incentive scheme for ensuring nodes keep seeding the content they store, by keeping debit and credit balances of the number of bytes verified. Blocks are sent to nodes depending on their accumulated debt. Nodes that do not collaborate are penalized by being ignored for a certain period of time.

Note, that the IPFS incentive scheme only encourages nodes to seed the content they host. However, nodes only store files they choose to host. In the current version, nodes can "pin" files to host them. There is no guarantee that content will remain persistent in the system. Therefore, BitVR content providers must pin the content to be sure it is kept available. This is handled at the API layer and is transparent to users.

In the early phases of deployment, BitVR will provide IPFS storage infrastructure to ensure content remains available.

The BitVR token reserve will then be used to incentivize large content providers to run storage infrastructure themselves.
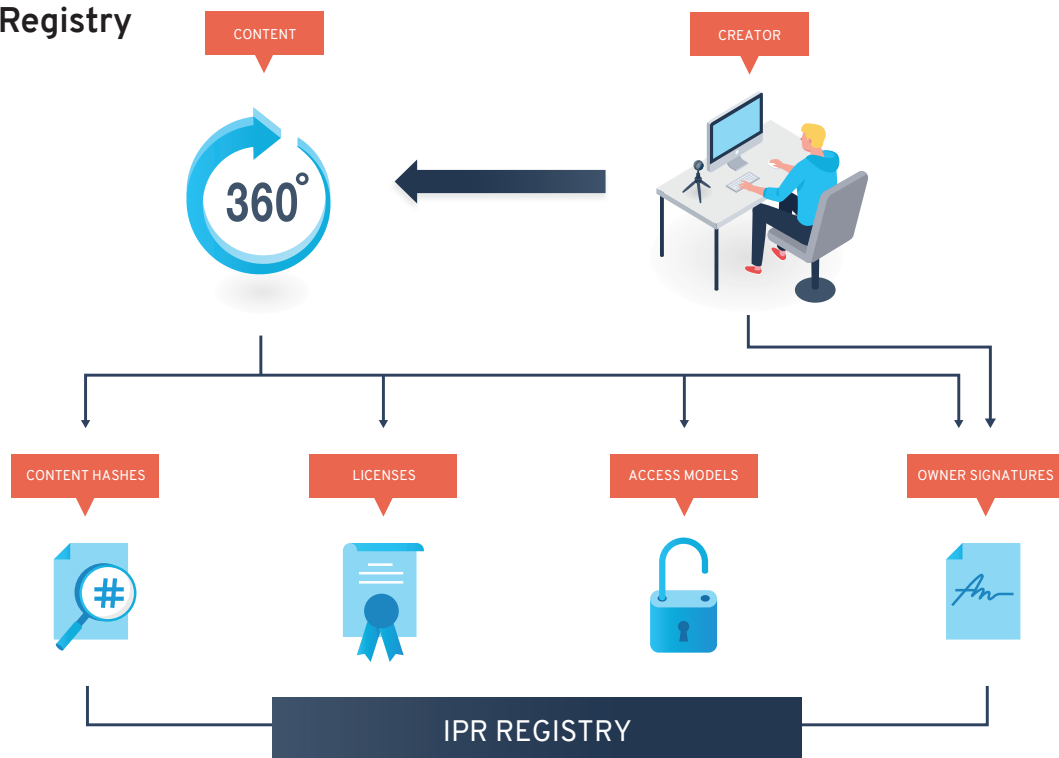
**IPR Registry**



*Figure 7 - IPR Registry Overview*

The IPR registry is implemented on the blockchain. Each content item is represented as a non-fungible content token. Non-fungible tokens represent transferrable assets which may differ individually, hold an individual value and reference item-specific metadata.

The BitVR non-fungible content token follows the ERC-721[16] standard for non-fungible Ethereum tokens. Content ownership may, therefore, transferred by transferring ownership of the corresponding ERC-721 token.

For each ERC-721 token, timestamped hashes of the content file are stored, in order to be able to provably verify that a file existed in a certain version at a certain time. This information is linked to a cryptographic owner signature, allowing the owner of the file to prove ownership by holding the private key corresponding to the signature. Furthermore, the token holds information on each content file's license and chosen monetization model.

It is also possible to allow content providers to store some additional information, related to content, which can serve to identify the creator. This may include a product registration number for the creation software or similar identifiers. To this effect, an API will be provided for implementing plugins for software such as VR video editors.

[16] ERC-721 Non-fungible token standard -  https://github.com/ethereum/eips/issues/721

# BitVR Token

| | |
|---|---|
| Name | **BitVR Token** |
| Symbol | **BVR** |
| Decimals | **18** |
| Total Supply | **1,000,000,000** |

The BitVR is a fungible token implemented as an ERC-20 token on top of the public Ethereum blockchain.

The token has the following characteristics:

- Total supply of the token is large enough to scale in a growing market.
- Individual are small enough to allow for micro-payments.
- The token is divisible (18 decimals) to deal with a potential value increase.
- Total supply is based on a controlled release elastic model, in order to avoid inflation.

As an ERC-20 standard compliant token the BitVR token will implement the following interface:

```
1.   contract  ERC20Interface {
2.        function  name()  view  returns(string  name);
3.        function  symbol()  view  returns(string  symbol);
4.        function  decimals()  view  returns(uint8  decimals)
5.
6.        function  totalSupply()  public  constant  returns(uint);
7.        function  balanceOf(address  tokenOwner)  public  constant returns(uint balance);
8.        function  allowance(address  tokenOwner,  address  spender) public constant
9.                      returns(uint  remaining);
10.       function  transfer(address  to,  uint  tokens) public returns(bool  success);
11.       function  approve(address  spender,  uint  tokens) public returns(bool  success);
12.       function  transferFrom(address  from,  address  to,  uint  tokens)  public
     returns(bool  success);
13.
14.       event  Transfer(address  indexed  from,  address  indexed  to,  uint  tokens);
15.       event  Approval(address  indexed  tokenOwner,  address  indexed  spender,
16.           uint  tokens);
17. }
```
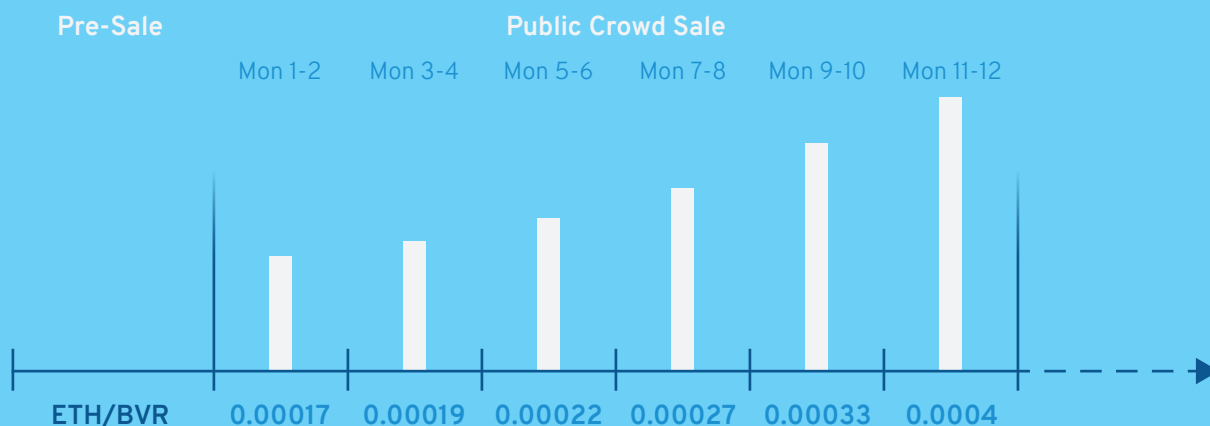
In addition, a burn() function will allow tokens to be destroyed. This is required by the crowd sale model (see below).

# BitVR Token Crowd Sale

## Crowd Sale Organisation

The BitVR token can be purchased from BitVR.io during the pre-sale and crowd sale phases. Below you will find the most important information about the BitVR token sale:

| | |
|---|---|
| Private Pre-Sale Starts | **18th Feb 2019 at 00:00 UTC (Extended)** |
| Public Crowd Sale | **To be annunced** |
| Public Sale Price | **16.667% of Public Crowd Sale tokens will released for sale every 2 months.** |

**1 ETH =**

- **Month 1-2:** 3,000 BVR + 3,000 BVR Bonus
- **Month 3-4:** 3,000 BVR + 2,250 BVR Bonus
- **Month 5-6:** 3,000 BVR + 1,500 BVR Bonus
- **Month 7-8:** 3,000 BVR + 750 BVR Bonus
- **Month 9-10:** 3,000 BVR
- **Month 11-12:** 2,500 BVR

Pre-Sale — Public Crowd Sale

| | Mon 1-2 | Mon 3-4 | Mon 5-6 | Mon 7-8 | Mon 9-10 | Mon 11-12 |
|---|---|---|---|---|---|---|
| ETH/BVR | 0.00017 | 0.00019 | 0.00022 | 0.00027 | 0.00033 | 0.0004 |

| | |
|---|---|
| Accepted Currencies | **BTC, BCH, ETH, LTC** |
| Soft Cap | **200,000,000** |
| Hard Cap | **500,000,000** |
| Minimum Subscription | **1,200 BVR** |

## Token Distribution

Only 1 billion (1,000,000,000) BitVR tokens will ever be created. The BitVR tokens are intended to be allocated as follows:
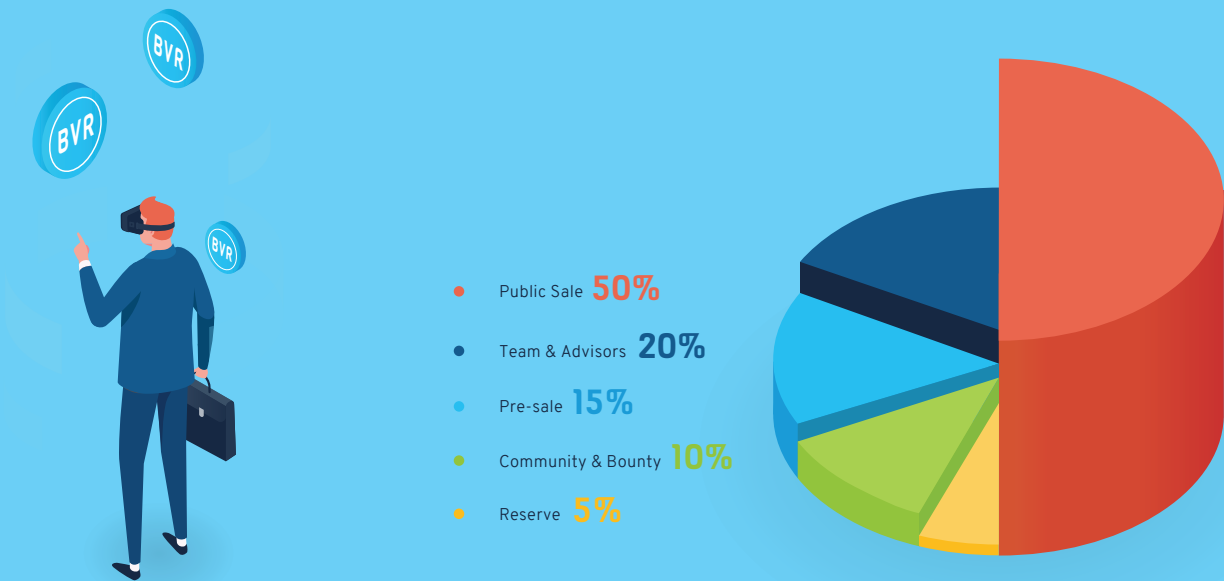


- Public Sale **50%**
- Team & Advisors **20%**
- Pre-sale **15%**
- Community & Bounty **10%**
- Reserve **5%**

*Figure 8 - Token Distribution*

Unsold tokens from the public sale allocation during the public sale will be burned.

## Bounty Program

2% of the community token will be reserved for the bounty program from the beginning of the project.

## Airdrop

After the crowd sale we will launch an airdrop. The airdrop will offer additional tokens to everyone who has kept their tokens stored in a wallet. The airdrop will depend on the number of tokens spent on the referral program during pre-sale and main sale. If a larger than expected number of tokens remains, we could potentially launch a second airdrop.

## Expenses Allocation

It is expected that the crypto-tokens raised during ICO will be allocated approximately as following, subject to the team's adjustment from time to time based upon market reaction, etc. The team will disclose periodically, as appropriate, and keep transparent of such allocation:

Technical and Main-net Development

**35%**
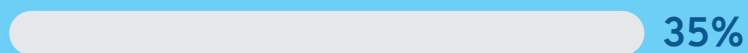
Incubators - 3rd Party Portal/Product Integrations with the BitVR Platform

**30%**

Global Marketing and Business Development

**15%**

Academy – Creator Training Program and Hardware Rental Program

**8%**

Operations

**7%**

Contingency Allocation

**5%**

# Roadmap



The BitVR system will be implemented in several phases:

## Q3 2018 Pre-sale

In phase BitVR tokens will be sold to private investors before the actual crowd sale begins. Tokens sold at this stage will be allocated and distributed after the token creation event.

## Q1 2019 ICO Crowd Sale

The public crowd sale will distribute tokens created at the token creation event through a crowd sale smart contract. Unsold tokens in the crowd sale will be added to the token vault. However, a small percentage will be retained for the BitVR airdrop.

## Q1 2019 Partnerships

Also, in this timeframe the first partnerships with content providers and VR hardware suppliers will have been created. In addition, third-party partnerships, aimed a leveraging the third-party API will be formed.

## Q2 2019 BitVR Air Drop

An airdrop will distribute additional tokens to BitVR token holders. This will incentivize investors to hold onto their tokens instead of selling after the ICO end. The source for the tokens distributed via airdrop will be the reserve tokens.

## Q2 2019 BitVR Version 1

The BitVR system will see its first fully functional release with version 1.0. This release will include:

- The full BitVR web interface, including the BitVR token wallet. Users will have the ability to upload and consume VR content. The token economy will be enabled, allowing creators to monetize their content.

- A centralized version of the content index database will allow searching for content and browsing by categories.

- Content will be stored on a centralized file storage system in version 1, ready for later migration to decentralized storage.

- In parallel the BitVR Academy will be launched, providing training content and tutorials on platform usage. In addition community meet-ups will be held to create platform awareness.

## Q4 2019 BitVR Version 2

BitVR Version 2 will be released as an incremental update to version 1, including, introducing mainly IPR management facilities:

- The IPR management modules will allow registering and protecting copyright of original content using the underlying blockchain.

- Content will be represented on-chain in the form of an ERC-721 content token, integrating with IPR management and allowing ownership transfers. This will also enable decentralized content indexing, replacing the centralized database.

## Q2 2020 BitVR Version 3

Rollout concludes with BitVR Version 3, which provides the full BitVR fundtionality:

- Storage will be migrated to the decentralized file storage, removing the last major centralized component.

- The third-party JavaScript integration library will enable third party content businesses to use the BitVR platform to manage and store content and embed it into their website.

# Advisors

### Dr. Stefan Beyer

Dr. Stefan Beyer is a distributed systems and Blockchain expert. He graduated from the University of Manchester in 2001 with a degree in Computer Science and obtained a PhD in 2004 from the same university.

Since then he has worked in computer science research in distributed systems, fault tolerance, ubiquitous computing and cybersecurity. He is currently head of research and development for a medium-sized cybersecurity company in Spain and an independent blockchain consultant.

He has participated in and led various national and international research projects, funded by both industry and public research programmes.

Dr. Stefan Beyer has always been interested in computer networks and distributed system and blockchain technology was a natural evolution for him. He now specialises in Ethereum smart contract development and auditing, blockchain consulting and teaching and dissemination of blockchain and related technologies in general.

Recently he has been selected for the European Union's Blockchain Observatory's Policy and Framework Conditions Working Group.

### Debbie Liu

Debbie has spent 20 years in the financial industry, primarily with leading investment banks and family office. She was a specialized Hong Kong China equity specialist for many years, and in recently years, is leading efforts in the private secondaries markets. She is well versed in corporate finance, equity capital market (public and private), family offices, fund raising and M&As.

She has been with Macquarie, Goldman, Morgan Stanley and Blackpine. She covers and maintains active working relationships with global & regional mutual funds, sovereign funds, private equity firms, family offices, corporate offices and hedge fund community. At her current role as a managing director with Blackpine & Venture Smart Financial, she has been focusing on fundraising for new funds launched with Artificial Intelligence, Fintech, Blockchain focuses.

Debbie graduated from INSEAD MBA Program in Fontainebleau in 2004. She speaks English, Mandarin, Cantonese and some French.

### Chris Lepitak

Chris has spent over 17 years working in Consulting (KPMG), Accounting and Internal Audit capacity across various different industries in Fortune 500 companies.  He worked across 6 continents (North & South America, Europe, Africa, Asia, and Australia and Oceania) on systems and financial/operational process improvements/implementations across various different platforms.

Mr. Lepitak's international experience serves as a trusted advisor helping companies with financial analysis, reporting, auditing, and strategic planning. Leader in the accounting profession influencing and driving initiatives and legislation impacting financial reporting and business operations effectiveness.

In February 2017, Mr. Lepitak joined Magic Leap, augmented reality (AR) start-up who raised $2.3 billion from investors such as; Google, Alibaba, AT&T, Temasek Holdings, Saudi Arabia Investment Fund, etc. Chris joined the Company as a Director responsible for standing up the company's business processes across the entire ecosystem from manufacturing, finance, hardware, software, and company's internally developed operating system.

### Richard Ihuel

Richard has spent his career building brands, turning around businesses and helping organizations transform. Results driven and equipped with a natural entrepreneurial spirit, Richard has a solid business acumen and he thrives in dynamic environments. He also believes that innovative ideas can deliver greater profitable growth.

Richard's is multicultural and possesses transversal skills; his international experience includes global brand leadership, operations management (EMEA and APAC), five years as European telecommunication & retail practice leader, an impressive global business development expertise, and a solid track record with technology & innovation start-ups.

For the past three years, Richard has been working as Global Chief Growth Officer for Hercules, a Havas agency of the leading media group & content provider Vivendi. In addition to his marketing and business development responsibilities, Richard has been driving Hercules' global technical systems and investments, from DAM platform through eCommerce solution to Usage Rights Management tools, to name but a few.

A jazz lover and passionate swing dancer, Richard also enjoys practicing yoga and playing the piano.

# Advisors

**Adam Cheng**

Adam is a partner at Hauzen LLP in Hong Kong (in association with Anjie Law Firm in mainland China). His practice areas cover cross border M&A, investment, financing and IPO for both Chinese and international companies. Recently, he is actively involved in the cryptocurrency sector incl. ICO and cryptocurrency fund formation. Prior to joining Hauzen in 2018, Adam had 20 years of experience in leading UK and US firms.

**Oscar Tuet**

Graduate, Bachelor of Science in Business & Information Systems, Indiana University Bloomington
Board Member and Director of Environmental Services Group Hong Kong (ESG)
Former Director and General Manager of Watson Hong Kong

Mr. Tuet spent 10 years of his career in the business consulting and Information Technology sector, overseeing and executing group strategies for company CEO offices and serving as project manager for various large scale corporate projects.

In 2009, Mr. Tuet was appointed as the director and board member of Environmental Services Group Hong Kong (ESG), leading one of the largest integrated property and facility management companies in Greater China. Mr. Tuet played a key role in the company as he managed a team of over 2,500 employees to provide a wide range of property & facility management services for various 5 star properties in both Hong Kong & China. Mr. Tuet was also later appointed as the head of IT for ESG to spearhead the group's ERP implementation as well as other group IT initiatives.

Mr. Tuet joined SMD Group (a property developer company in Kuala Lumpur Malaysia) as Executive Director in January 2015. Responsible for overseeing the group's operations as well as continuous management of various property development projects totaling up to a GDV of 1 billion ringgit.

# Team

### Harvey Tsoi  Founder & Executive Director

A believer in Blockchain technology and active investor in crypto field.

"Empowering people, celebrating creativity, craftsmanship and technology, therefore unlimited possibilities."

Harvey has over 18 years' experience in creative and Virtual Reality (VR) industries. He is the Founder and Executive Director of 360central Limited (A Google Trusted Agency) based in Hong Kong with offices in Beijing, Shanghai, Fuzhou, Xiamen, Taipei, Macau and Kuala Lumpur. Founded in 2011, 360central Limited is a virtual tours/VR company producing and sharing premium virtual experience for many Fortune 500 companies, such as Tesla and PetroChina.

Tsoi is also one of the top exclusive content suppliers for Getty Images, Inc. and iStockphoto, two leading providers of digital media worldwide since 2003.
Harvey has received many awards by numerous professional organizations and publications. He earned his B.F.A. in Graphic Design, minor in Photography from Cleveland Institute of Art, USA in 2000.

### Alan Li  Co-founder & CTO

Alan is the ambassador of Waves (an open-source blockchain platform), co-founder of Quantech Co., Limited (previously Quanli Technology Group) and an extensive creative thought leader in technology markets and innovation projects. He has played a significant role in the adoption and application of new technology.

Alan holds a MA of Economics and International Relations Theory with over 7 years' experience in software consulting, digital marketing and e-commerce businesses. He has successfully completed 3 ICO blockchain projects in the past year and advised various projects in utilizing blockchain technology into their products.

### Peter Lau  Co-founder & CUX

Enthusiast of design thinking and innovation, has been working in the user experience design industry for 18 years in Hong Kong and China. One of the several most experienced Chinese UX experts in Hong Kong.

He has design experiences in various industry sectors, worked as design leader in several multinational companies. Including financial institutes, Smart home and building automation products, aviation products and government projects.

He was the UX architect and application manager in UBS Asia (the #1 private bank), the Director of UX group in Honeywell greater China (Fortune 100). Currently is the Head of Experience Design in a multinational insurance company in Hong Kong. Besides he also has experiences in running his own consulting business.

Peter is proficient in design methodologies and product strategy, own 10+ design patents and several design awards from Red Dot, G-Mark.

# Team

### Bruce Xian  VR/AR/MR Technical Director

Graduated from Information and Computing Science of Beijing University of Technology in 2003. Bruce is passionate in photography and visual art, with over 15 years of experience in program development and project management. He worked as product director and development director for IT companies. Bruce is also the development team leader of a number of large software systems in the banking and media industries, specializing in technical architecture and design. Apart from his rich leading experience, he also succeeds in distance cooperation and remote development & management.

Major large projects: China Central Television (CCTV) equipment management system, Postal Saving Bank of China international payment system, China Industrial Bank Co., Ltd. international settlement system.

### Vera Zhao  VP, China Business Development & Partnerships

Over 16 years of experience in Internet/mobile internet operations. Vera has worked at Guoxin Communications and is responsible for the management of multiple technical criminal investigation projects. She later worked for Lakara, a well-known third-party payment company in China, and was responsible for the overall operation and business development of the company's payment brand "Home-pay". In 2011, she entered the mobile/internet industry and served as director of Yaxun's LBS business unit of the 33rd Electronic Research Institute's central company. The business platform established for the company led independent teams to sign up over 2,000 businesses.

In 2013, the joint venture "Easy Carpooling" was approved by Cai Wensheng, a well-known investor in China. Upon her focus on operations in VR panoramic image production since August 2015, Vera became the co-founder of 360central China which is merged from Grid9. The joint brand is committed to high-end panoramic and VR image production across Asia.

### Max Cheung   Smart Contract Developer

Max is an experienced IT consultant and systems architect with years of experience dealing with both enterprise solutions and startups. He is an active member in the blockchain communities where he provides industry perspectives and insights.

Max is an early adopter and developer in the cryptocurrency space, he brings to the team with an in-depth knowledge as a developer, IT security researcher and project manager to successfully launch products.
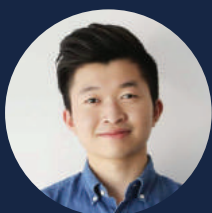
### Jason Pang  Smart Contract Developer

Jason is a professional developer and crypto-investor. He has over 3 years of  experience in building smart contract and blockchain protocols.

Through these projects, Jason acquired intimate knowledge with inner-workings of ICO development from conception to execution. He has good knowledge of current Blockchain technology and likewise good understanding of business requirements in this space.

# Team

**Lucas Zheng**  **GM, China**

Lucas has more than 15 years of experience in corporate management and corporate planning. In 2003, he successfully founded Radar Equipment Co., Ltd., and later invested in the establishment of a cultural media startup during incubation period. In 2006, he participated in the establishment of a well-known Fujian outdoor sports club with a large number of high-quality member base. In 2013, he invested in the A-one Sports Park, a famous sports park in Fuzhou. He is currently the executive director/general manager of A-one Sports Park.

He also has multiple identities as an established stock photo creator for Gettyimages and iStockphoto, co-founder of 360central China responsible for the development and integration of the general planning and related resources in Mainland China.

**Lian Wai**  **VR Production Director**

Lian graduated from Nanjing University of Science and Technology majoring in journalism. With many years of visual art experiences and focused on the field of photography, image retouching, design, and 3D. He is an iStockphoto contributor, 720yun, Baidu, Tencent and VRWAY Panorama Certified Photographer.

With over 10 years' experience in 360 pano photography & post production, Lian has a unique vision and understanding in visual communication, balancing flexibility and practical in providing solutions for projects large and small. He has over 100,000 fans on a well-known VR community platform 720yun, and is top of the list among outstanding panoramic/VR photographers in China.

Participation cases: A number of high-end panoramic/VR shooting productions, such as: Petro China, "Water Cube" The Beijing National Aquatics Center, JFC, Aston Martin, Mercedes-Benz, Air China, etc. Participated in the commercial photography: Tencent Games, Sohu Changyou, Netease Games, Tencent Literature, Uniform Lubricants, Mulinsen, Enbao, Kerimo, Jeep Wrangler, Tissot, etc.

**Gary Yeung**  **Strategic Business Development Director**

Gary has more than 14 years' experience of business development in various ventures and international trading industry. He graduated from University of Western Sydney in 2004 and recently earns his Master of Business Administration at IPE Management School of Paris, France.

Gary was invited to join SMD Group (a property developer company in Kuala Lumpur, Malaysia) as Business Development Director in 2013. Responsible for the Group's sales, corporate branding and marketing strategies.

In 2016, Gary joined 360central Ltd. as partner and established 360central (M) Sdn Bhd in Kuala Lumpur. He managed a sales team to excel the business in different cities of Malaysia.

# Team

### Géraldine Jippé  Associate Marketing Director

Géraldine is a Paris-born and Montreal-based Digital Marketing specialist, Graduated with a Master's degree in Management and Marketing from Groupe Esc Troyes, France. With more than 10 years experience behind her belt managing digital projects of all sizes such as Yellow Pages and many startups. She recently joined BitVR team as Associate Marketing Director.

With her passion for technology and her understanding of the importance of community management, she will help BitVR to scale throughout the international scene with a strong focus on American and Pan-European markets.

### Ivan Cheung  PR Director, China

The former Channel News reporter, a well-known documentary photographer in China, the first group of Magnum master class student in China. He was also a contributor for the Associated Press, AFP, Tencent, NetEase, Sina and other media.

At the age of 18, Ivan was on his own in shooting the Nepalese war. His shots include the Wenchuan earthquake, the Japan earthquake, the Nepal earthquake, and the Iranian nuclear crisis. His photos are frequently used by well-known media around the world.

After joining the 360central China, Ivan is mainly responsible for the company's media relationships, and applies his outstanding documentary photography and stock photo techniques with his special sense and structural characteristics that display structure and space.

# Companies We Worked With

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