P2P-Next: Future Internet Media Delivery to CE Devices

http://www.p2p-next.eu

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Objectives of Talk

- Introduce **P2P-Next** and provide an industry perspective on P2P for Internet TV

- Present Pioneer's work integrating a BT-based P2P technology with **low-cost CE device**

- Details of **NextShare integration** for **Live and VoD streaming** of professional content

- Show some aspects of **NextShare^TV UX**

- Future directions and research challenges

1. Introduction and Context

Today's context

- **Massive growth driving innovation**
    - **Traditional CDN** (massive growth)
    - **Decentralised P2P** (30-60% of all download traffic)
    - Peer-assisted or **Hybrid CDNs** (cost reductions)
    - **Adaptive Streaming** (DASH)
- **Market outlook**
    - Successful take-up for music with **Spotify**
    - Limited window **Catch-up TV** is common model
    - Movement to **CE devices** is slow – <u>no standards</u>
    - **UUSee** and **PPLive** signal success for P2P in China!

Industry Goals

- **Ubiquitous platform** for scalable content delivery supporting Live & OnDemand

- Facilitation of a **sustainable business model** that **maximises efficiency** of **Open Internet**

- **Standards** for codecs, security and metadata that allow **trusted** and wide-ranging media **ecosystem** to develop

What do we mean by "Open" Internet?

- **No single controlling authority** or aggregator.

- Anyone with an Internet connection can make Internet TV services and content available, and will be able to access services.

- **No end-to-end management** of quality of service for content delivery.

- Internet TV content can be delivered **without resource reservation.**

What is P2P-Next?

- **Content Providers** (BBC & EBU)

- **Advertisers** (MarkenFilm) and **CDN** (Oversi)

- **CE** (Pioneer & ST Microelectronics)

- 4 x **Research Institutes**

- 6 x **Universities**

- **Steering Board**
  (ISPs and CDN Providers)

Project Statistics:
IP (Networked Media)
21 Partners
48 months
1645 man months
total budget 19.23M€
EC contribution 14.03M€

Pioneer

NextShareTV

Vision

World-leading Open Internet TV system using P2P

Open source
Efficient
Trusted
Personalized
*User-centric*
*Participatory*
Legal

NextShare^{TV}

Key outcomes

- **Living Lab deployment**: 25,000+ PC and CE

- Learning from **bootstrapping virgin overlays** and new swarms with streamed content

- Discover new **sustainable business models** in our living lab – built around legitimate content
  - **FTA, targeted ads, PayTV, DL to own, BW as $**

- Informing **standardisation activities** to drive the technology for global use (incl. **DVB, IETF, MPEG**)

NextShare™

Basic considerations

- **Live** and **VoD** streaming

- Traffic localisation (**network awareness**)

- Maximise perceived **QoE**

- **Legitimacy**

- **Monitoring** (health of system)

3rd Party OTT Services

- **Nexos** — BW as $ — Google Checkout — PayPal — µPayments
- Microsoft Silverlight — **MHEG** — ADOBE AIR — mhp Multimedia Home Platform — WEB 2.0
- **Marlin** — DVB CPCM — Watermarking — playsforsure Windows Media
- **Blogs/Forums** — myspace.com — facebook — LinkedIn — flickr

| Payments Platform | Interactivity Platform | Digital Rights Management | Social Network Platform |

1000s

| 1,000,000,000s Creators | 1,000,000s Publishers | 1,000s Access Providers | 1,000,000,000s Consumers |

Stakeholders / Value Chain

Creative / Rights Owners
- Music
- TV
- Movies
- Games
- Data
- Metadata

Advertisers

Producers / Syndicators
- *Professional*
- *Prosumer*
- *Remixer*

Aggregators
- Discovery
- Community
- Rights Expression
- Transactions

Access Providers
- Network / QoE
- Storage
- Caching

Fixed
Mobile

Consumers
- *Many Screens*
- *Many Contexts*
- *Many Networks*
- Sharing via P2P

Legal and Regulatory Bodies / Technology and Equipment Providers

Open Standard

NextShare Platform - APIs / Product Interoperability / Compliance Testing

NextShare Transport
- *Distributed / Hybrid CDN*
- *DL and Progressive DL*
- *Containers / Auxiliary Data*

Personal Domain
- *Identity*
- *Devices*
- *Capabilities / Profiles*

Mobile PC CE

Home Network I/F
Firewall Mgmt
Device Mgmt
QoS

User-User Communication
- Offline Messaging
- Online Chat
- P2P VoIP
- P2P Telepresence
- RSS

Targeted Advertising & Promotions
- Formats
- Profiles
- Accounting

Trust Platform

| Identity (Producer / Content / Consumer) | Authentication / Integrity (anti-SPAM) | GeoIP |

**Converged Infrastructure IPv4 or IPv6**

How does CE change things?

- Community of **CE peers** in early stages of life
- United by a common **Open Standard**
- **Interoperability** between multiple vendors
- **Ubiquitous** (100s millions of TVs)

Stable Overlay > Improved Economy > Improved QoE > Greater Revenue
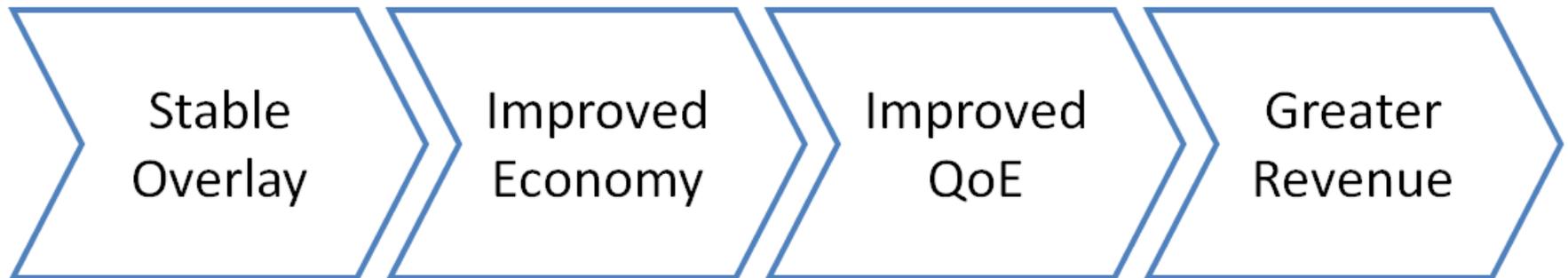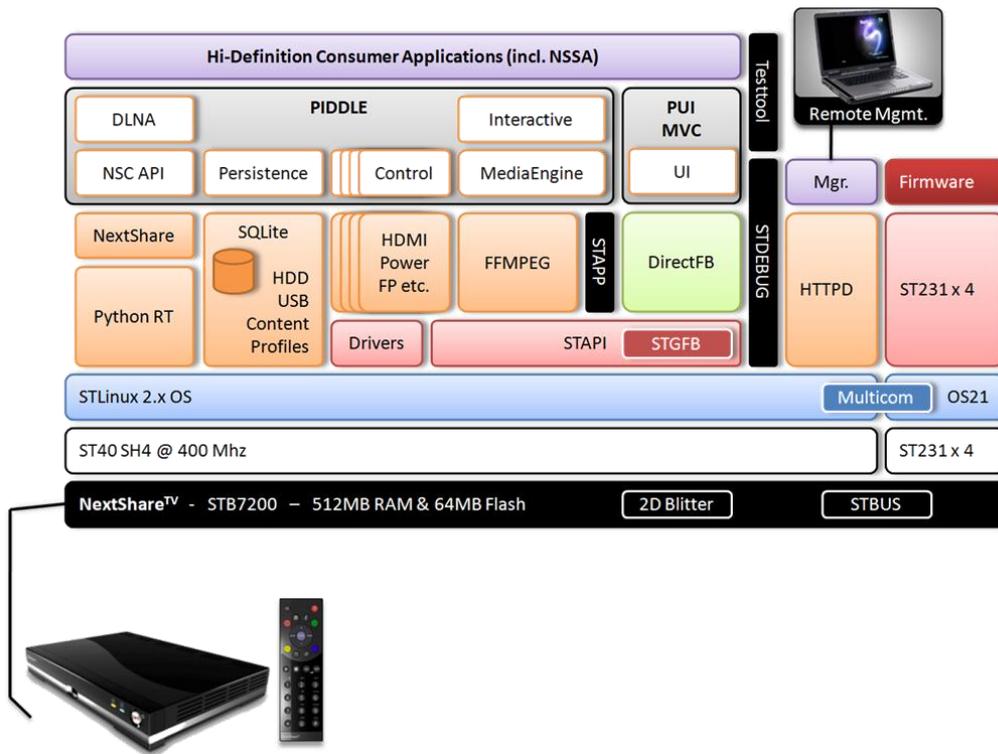
2. NextShare Architecture

NextShare Overview

- Based on **Tribler** from TUDelft
  - Support for **Live and VoD** use cases
  - Efficient **stream authentication/verification**
  - **Zero-server** with DHT-based attachment
  - **Closed-swarms** for access-control
  - **Piece Signing** for authentication/non-repudiation
- **BUT:**
  - Python interpreted == slow (relatively)
  - Memory-hog (runtime unfriendly to embedded system, fragmentation)

NextShare^{TV}

Top-Level

30 minutes window (n) based on bit rate x duration

latest piece

Python process HTTP:8000 (pulling AV)

TS out (Remux & Repackage)

VLC process

Looping

AV asset

Transcode

Multicast

1.

0 ... n

NextShare^CORE

Tracker:7701

2. **createlivestream.py**

Test File

.tstream file

3. GET() .tstream file

Name
Bit rate
Duration
Piece-size
RSA pub.key

64KB Pieces

HAVE/REQUEST BT Protocol

TCP/IP Network

Note: higher block sizes will effect service access latency especially for radio at lower bit-rates

30 minutes window of availability

latest piece

Python process

0 ... n

NextShare^CORE

.tstream file

5.

NSC API

Read while loop (16KB)

```
while not self.server.finished:
    available = ns_stream.available()
    data = ns_stream.read(blocksize)
    if dlen == 0:
        break
```

read position

start() | stop() | status()

pddglue

HTTP GET (pulling AV)

Note: HTTP GET held open for reading a la HTTP streaming triggers while loop

PIDDLE_NextShare

IPC (socket)

4. Callbacks

stffmpeg

playrec

Player Task

http.c

PIDDLE_Sentinal

Push

2.5MB buffer

Internals

NSTV Process (Application)

play()

Decoder/s

Passive (fed frames at FPS)

NextShare 2G == libswift

- **Generic** multi-party transport
- Comprehensive **NAT traversal** solution
- **Zero-server** and **zero-metadata**
- **PEX** for peer discovery / **LEDBAT** congest. Ctrl.
- Promises: **rapid start-up & ad-hoc seeking**
- **BUT:** some negatives to overcome:
  – Space overhead of MHT
- See http://www.libswift.org/
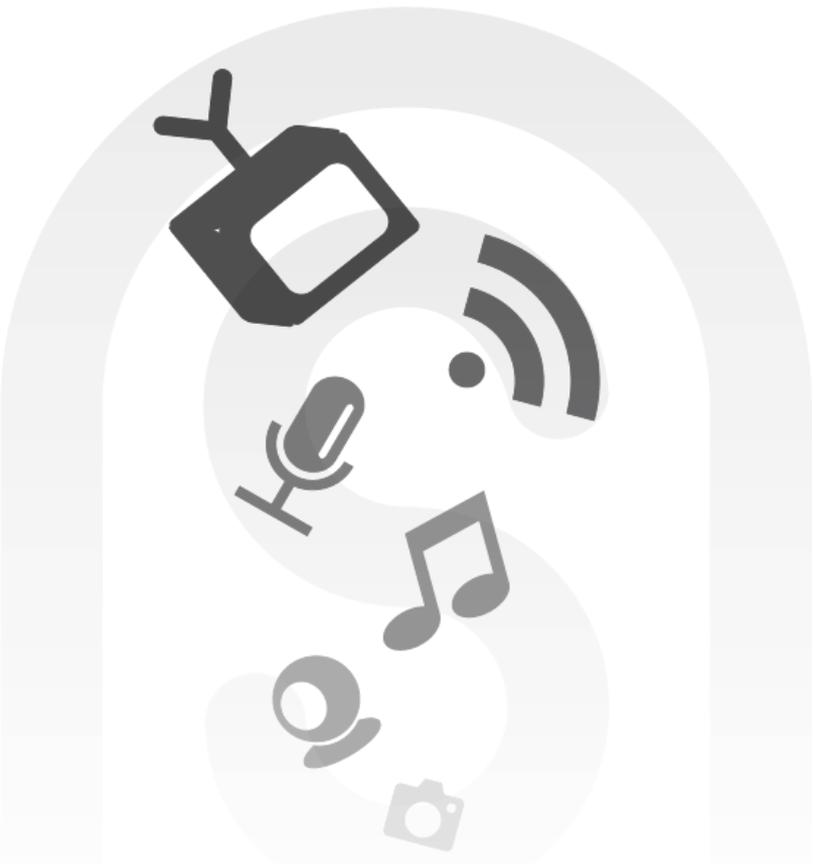
3. The NextShare^{TV}

Hardware - NextShare^TV

Features: **Identity and Entry Point**
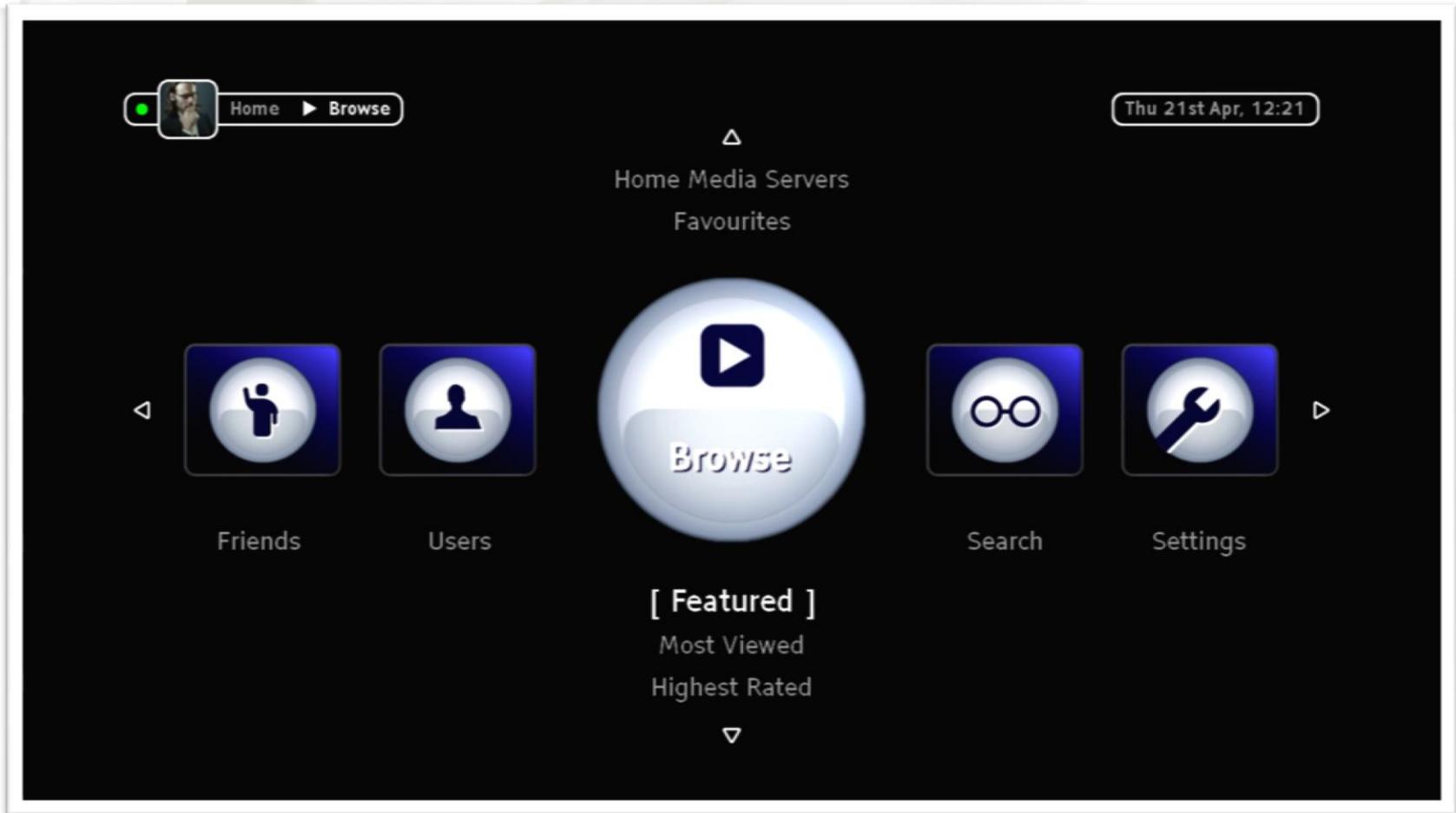
Features: **Featured content & catch-up**

Favourites Browser

- **Favourites collections** can be **user-defined**
  - Sport
  - Music
- …or **system-defined**
  - Features
  - Watch-list
  - Most recent
  - Most popular
  - Recommended

Features: **Search**
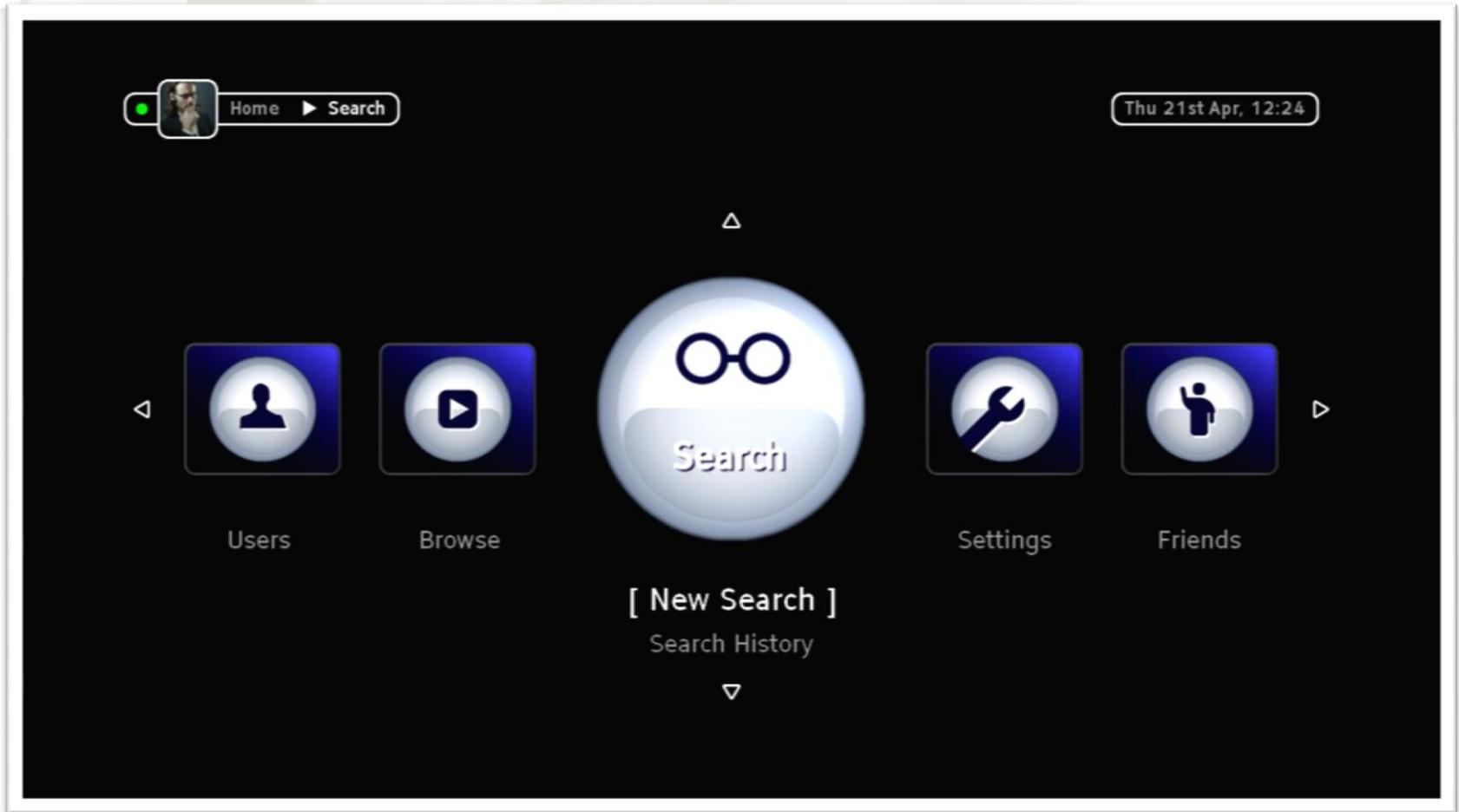
Features: **Search > Enter Query**
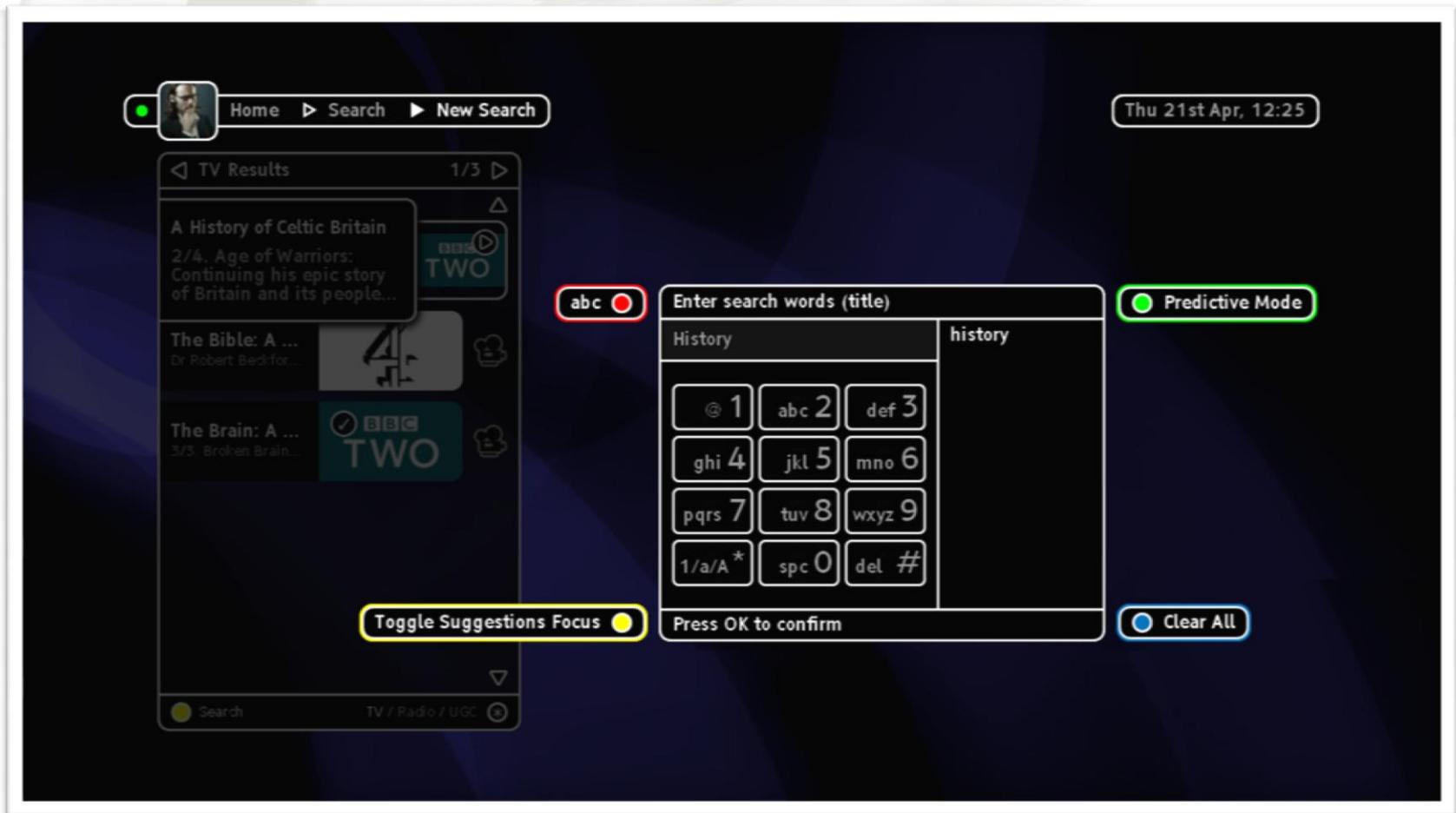
Features: **Search > Results**
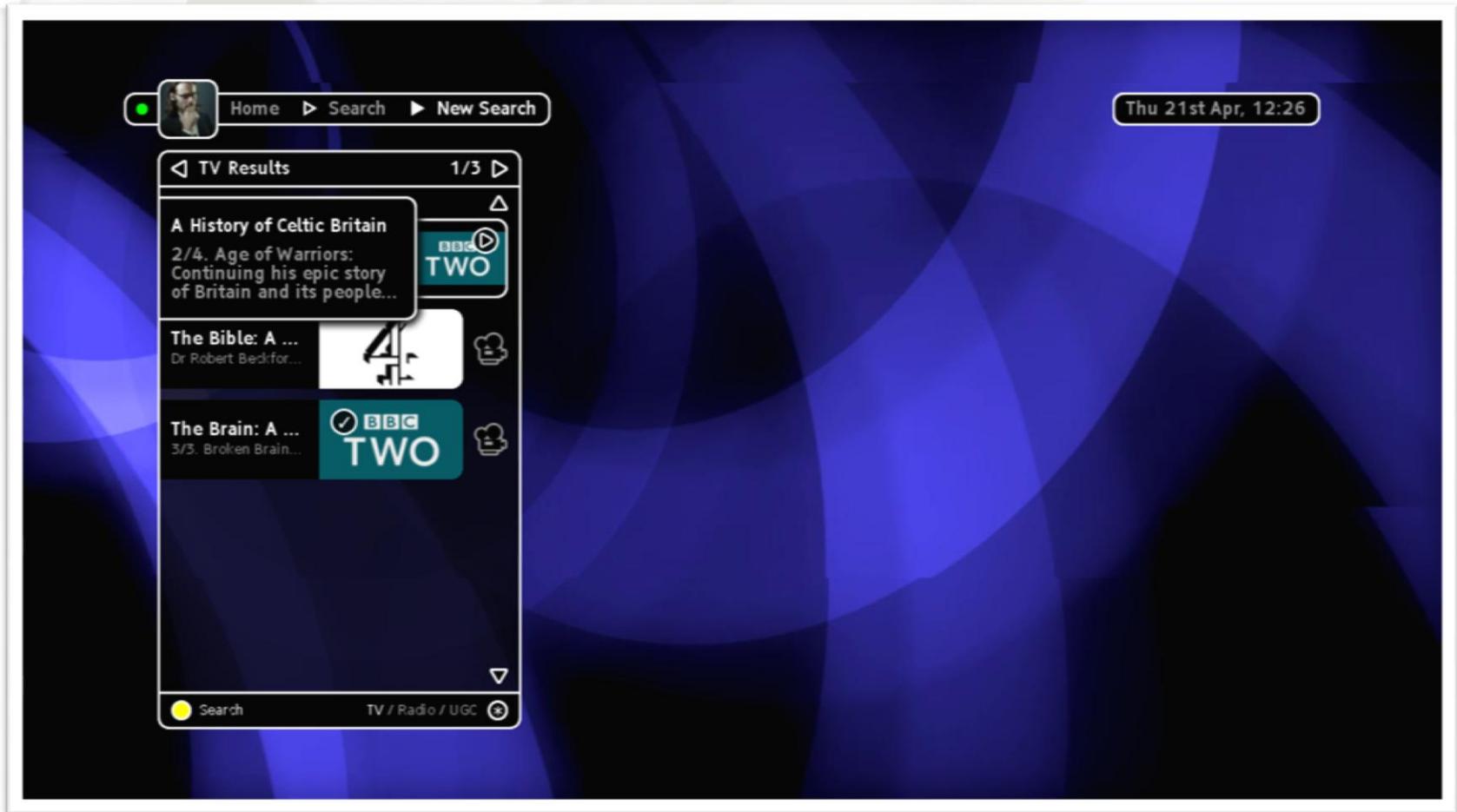
Features: **Search > History**
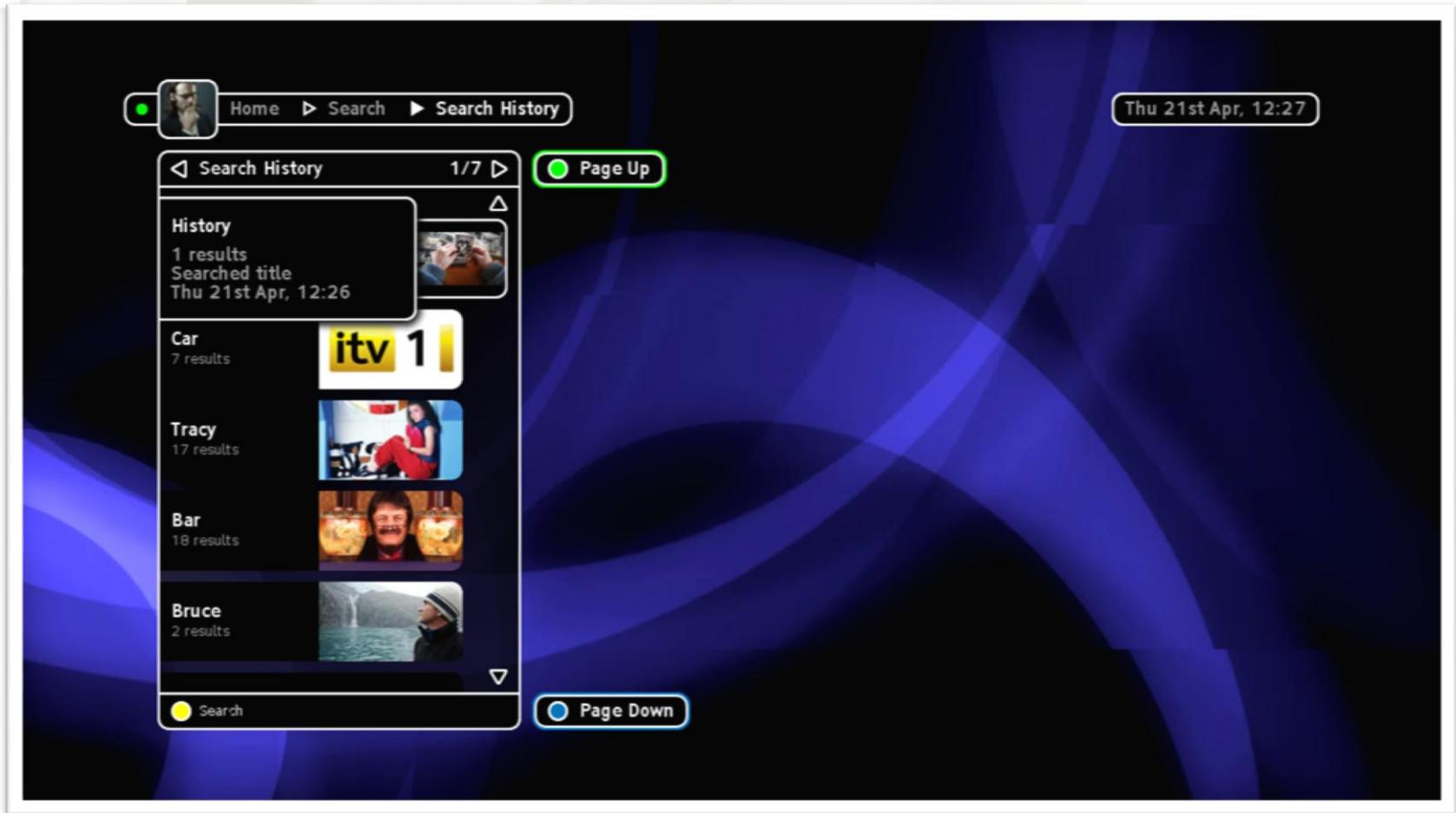
Note: can toggle between TV, Radio and UGC results

Features: **VoD Seeking**
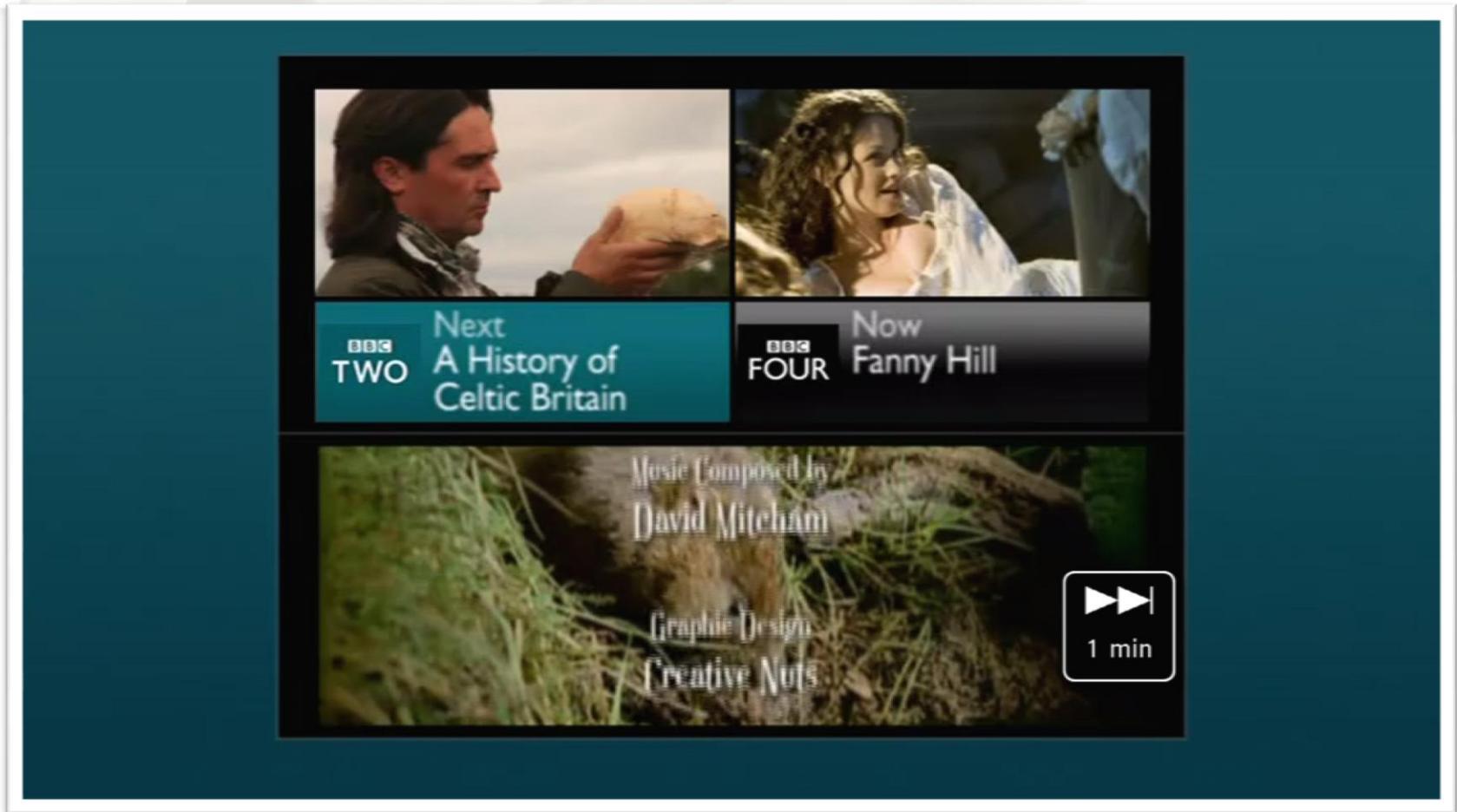
Features: **VoD Resume**

Features: **SocNET > Rating**
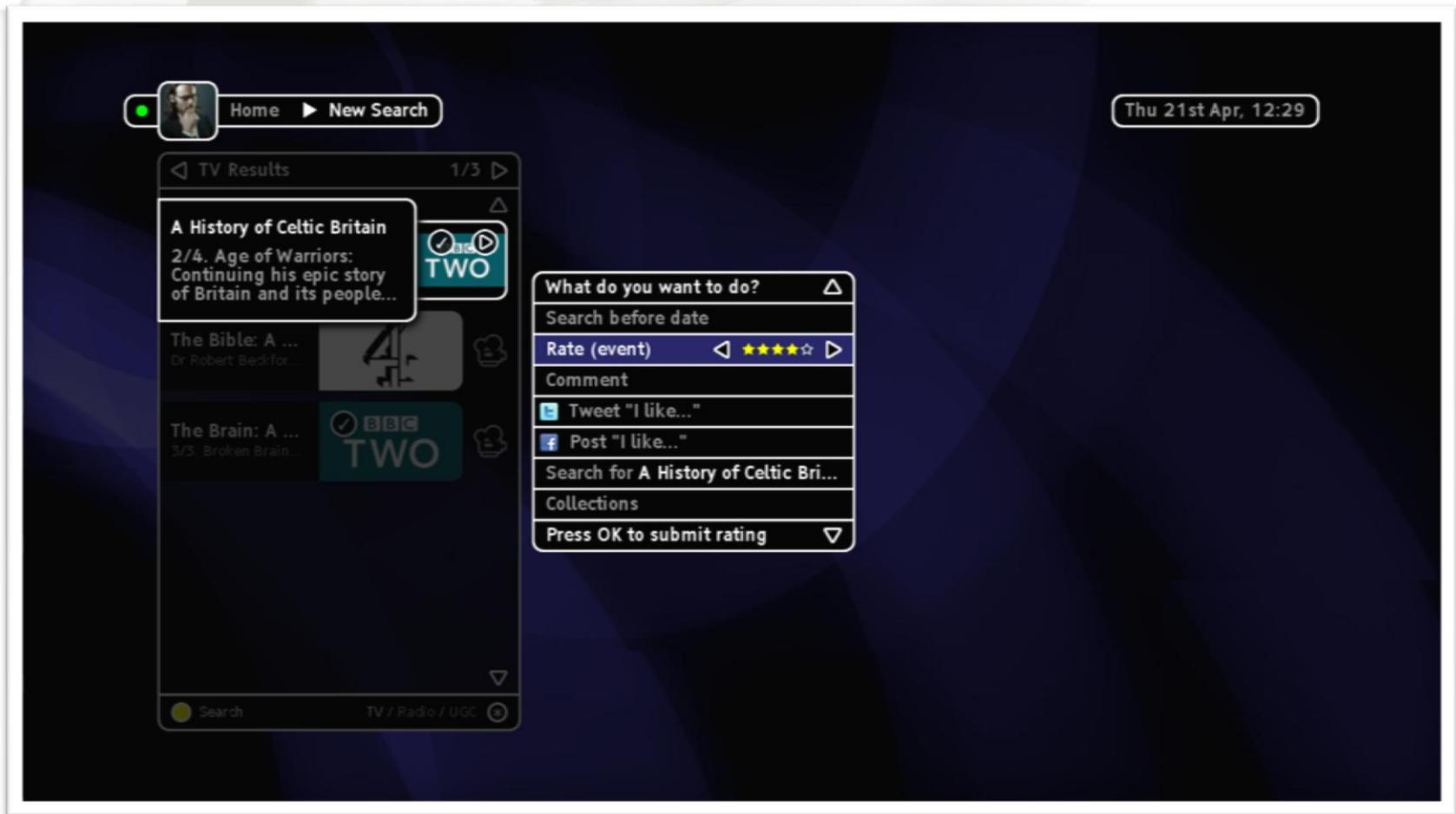
Features: **SocNET > Commenting**
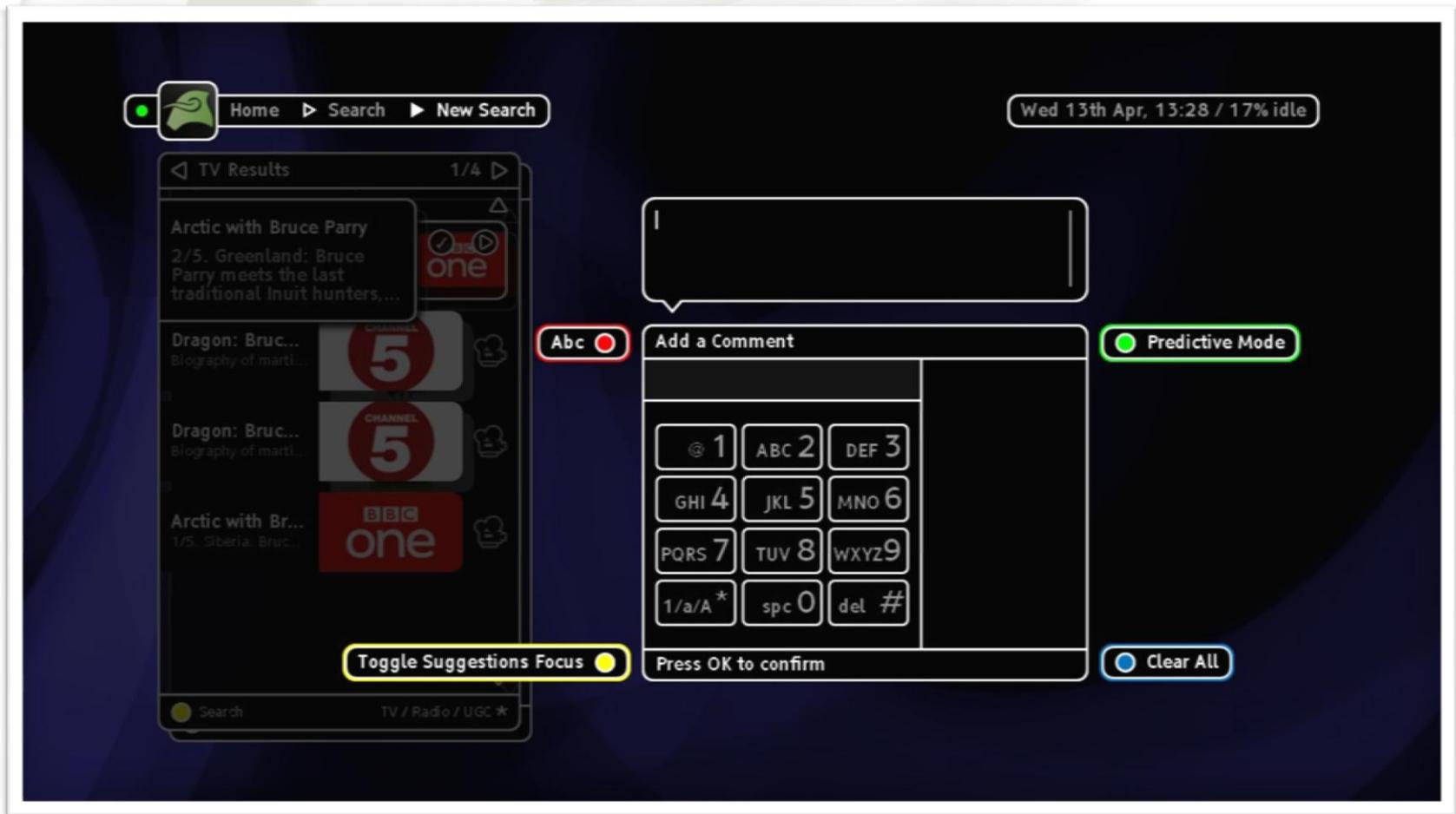
Features: **Twitter and Facebook Integration**
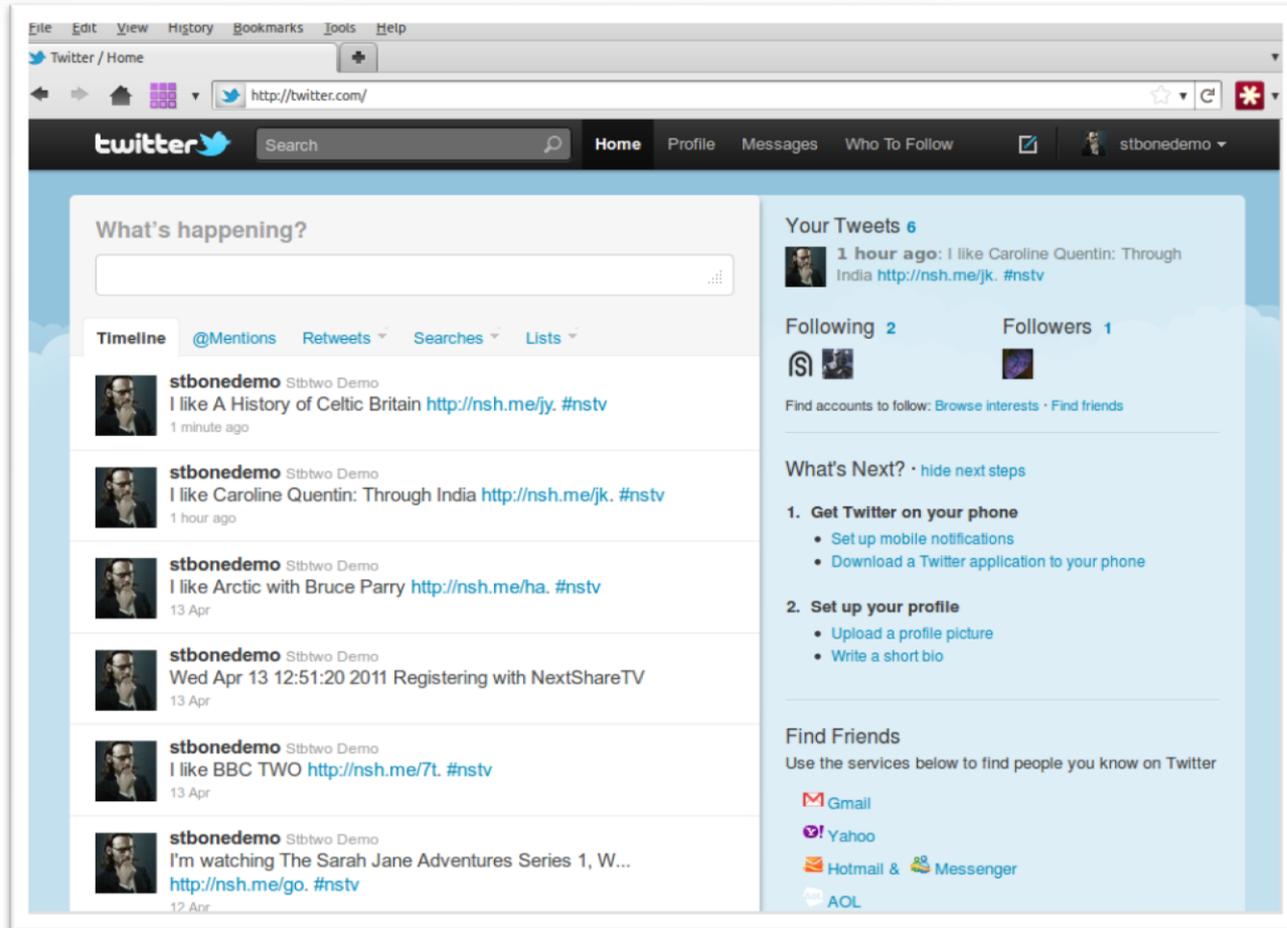
Features: **Live Tweets**
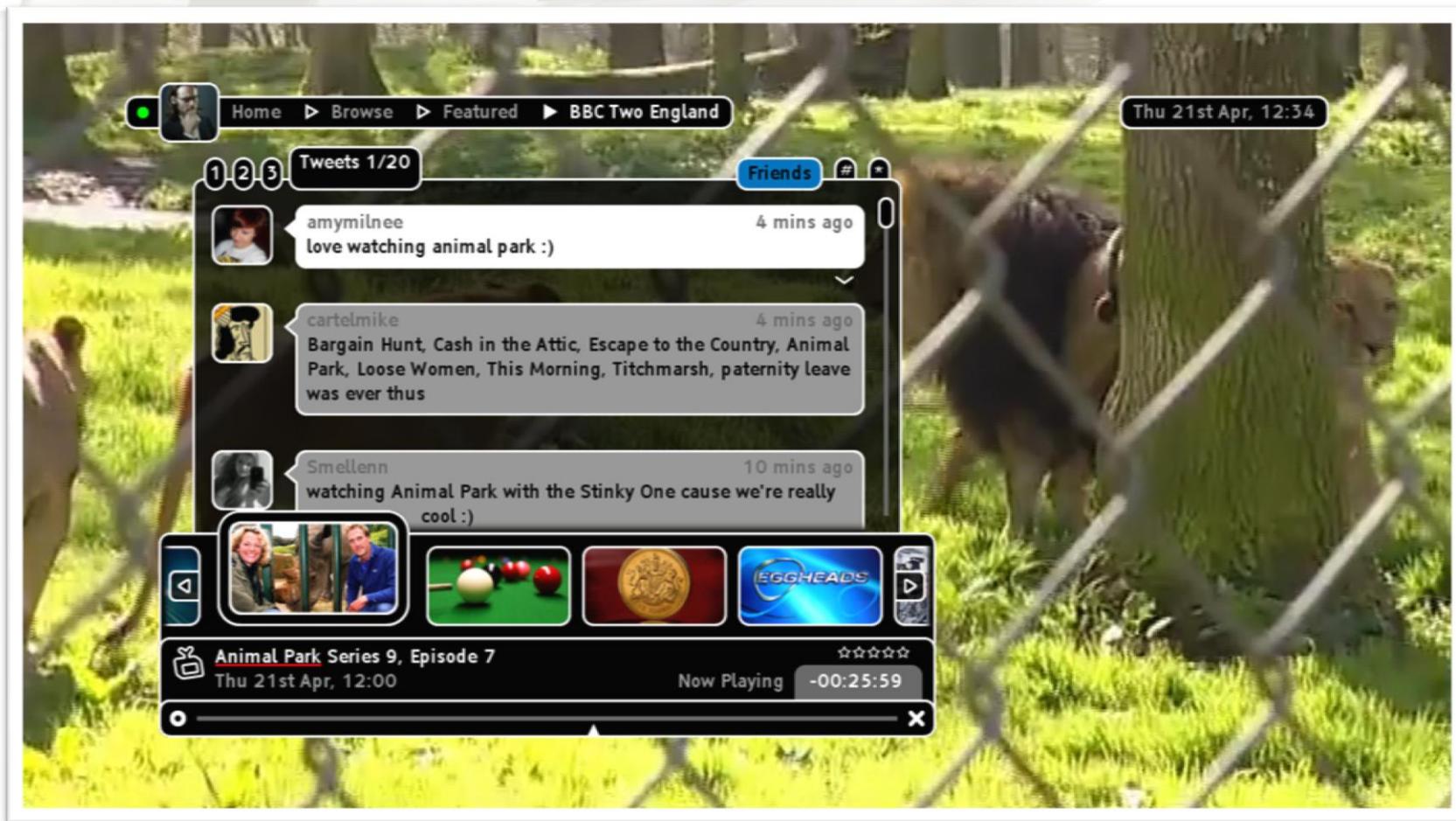
Features: **Live Tweets (Tear-off)**
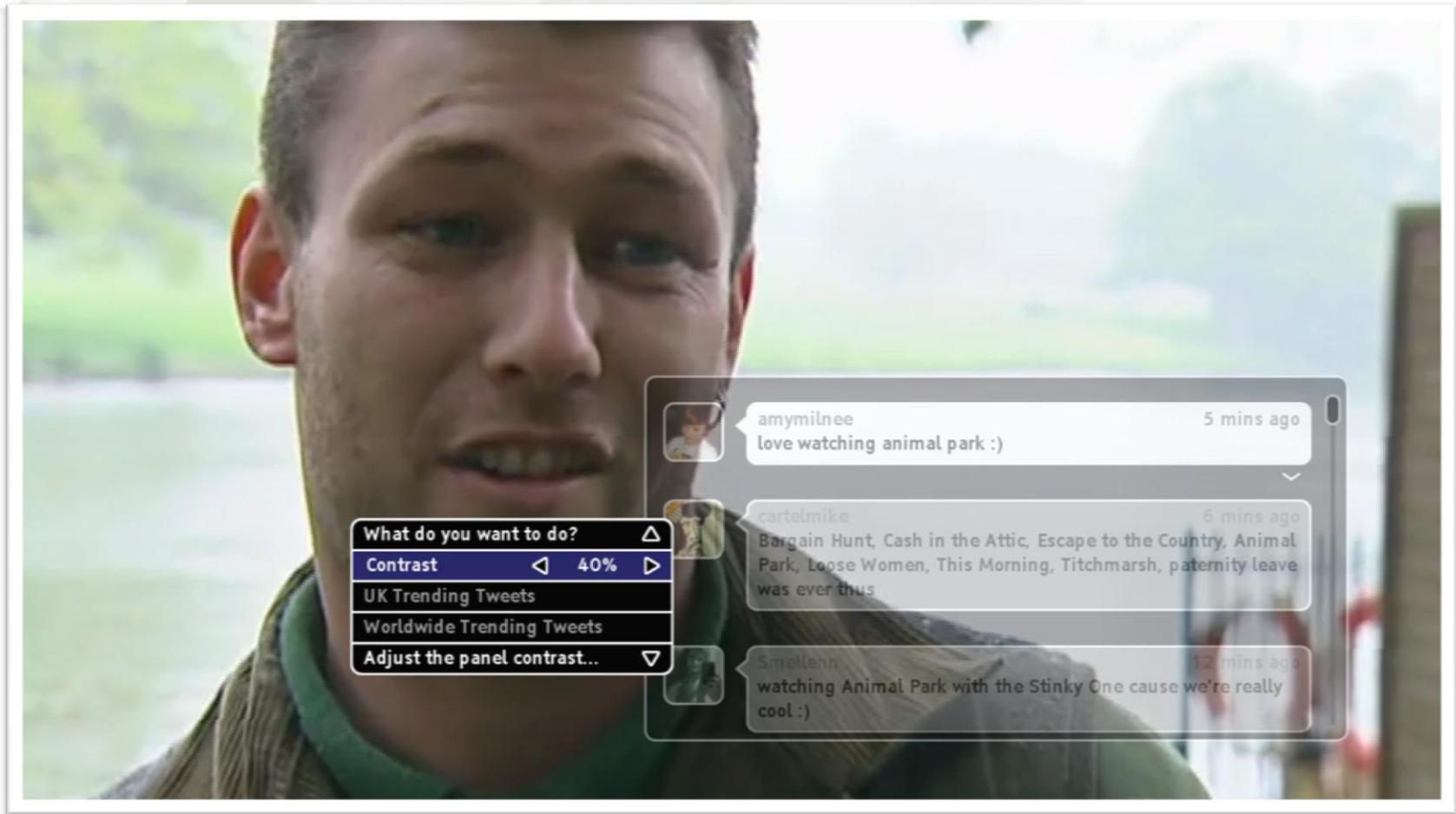
Features: **Live Tweets (Trending)**

Features: **Friend Management**
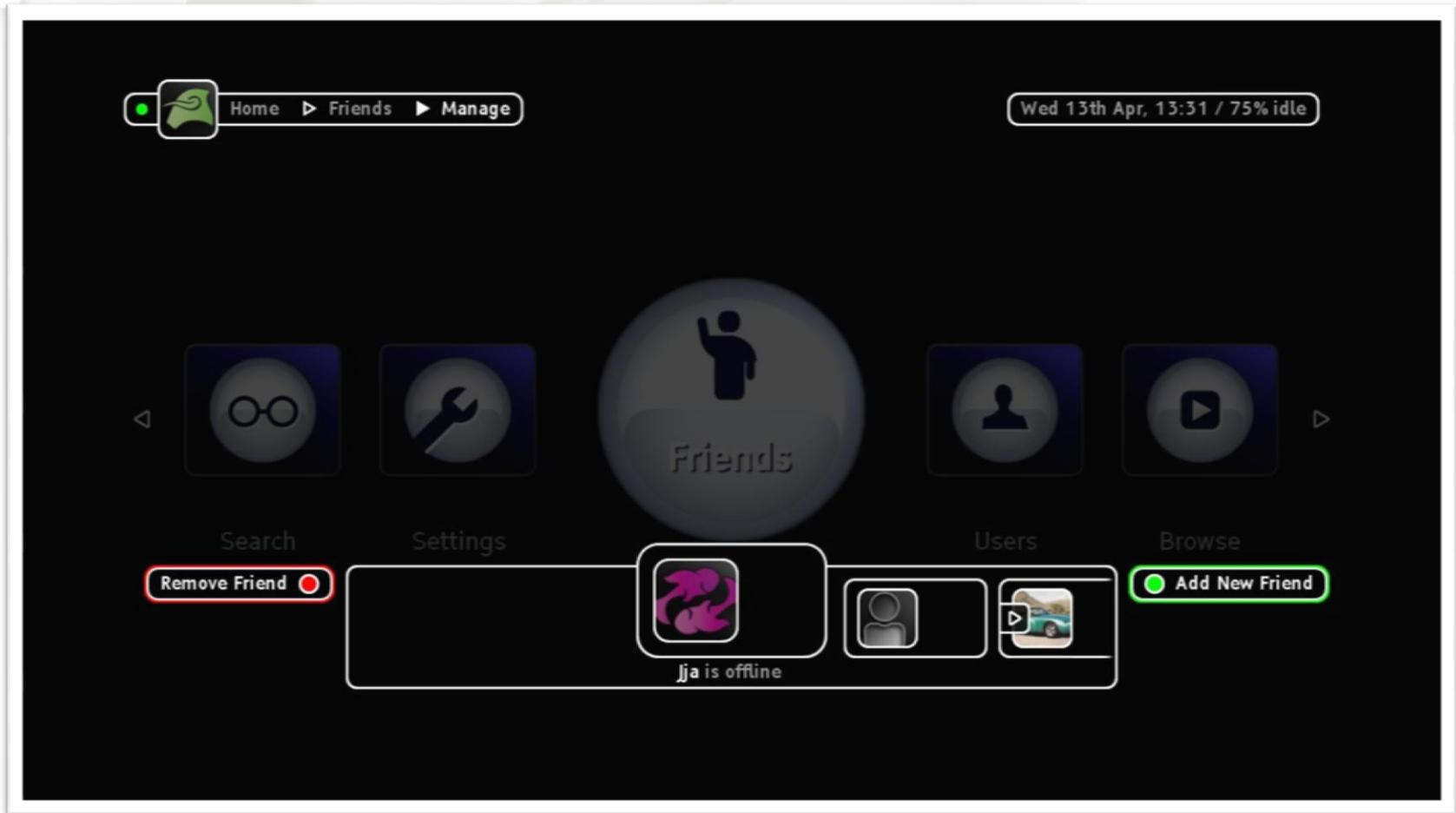
Shared-Experience TV

- Simple presence solution allows detection of friends' status

  1. EndUser watching BBC One

  2. Friend turns on NextShareTV

  3. EndUser notified

  4. EndUser prompts Friend to start watching BBC One

  5. Friend accepts invitation, commencing viewing at position synchronised with EndUser

  6. Interactions overlaid with video chat

Second Screen Interaction
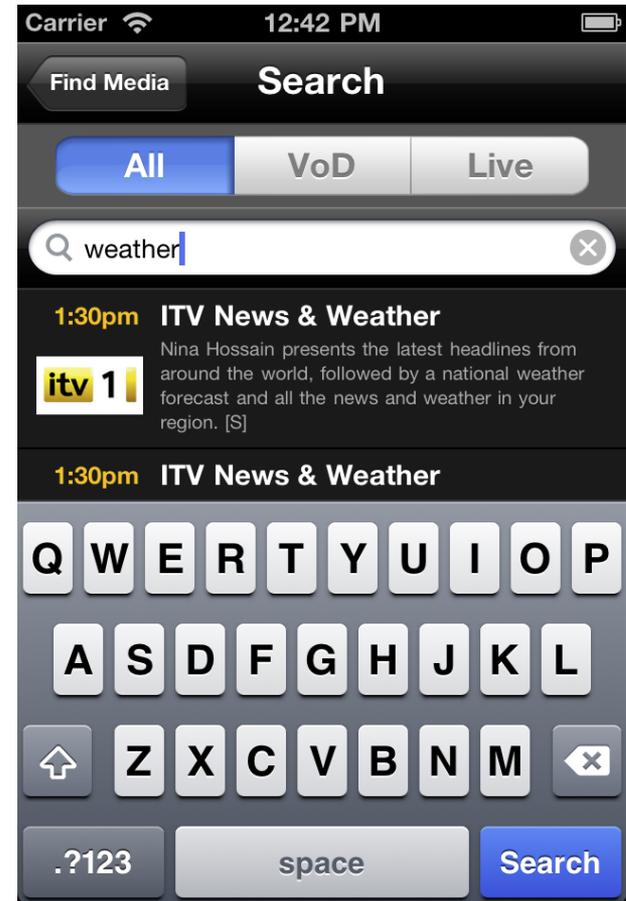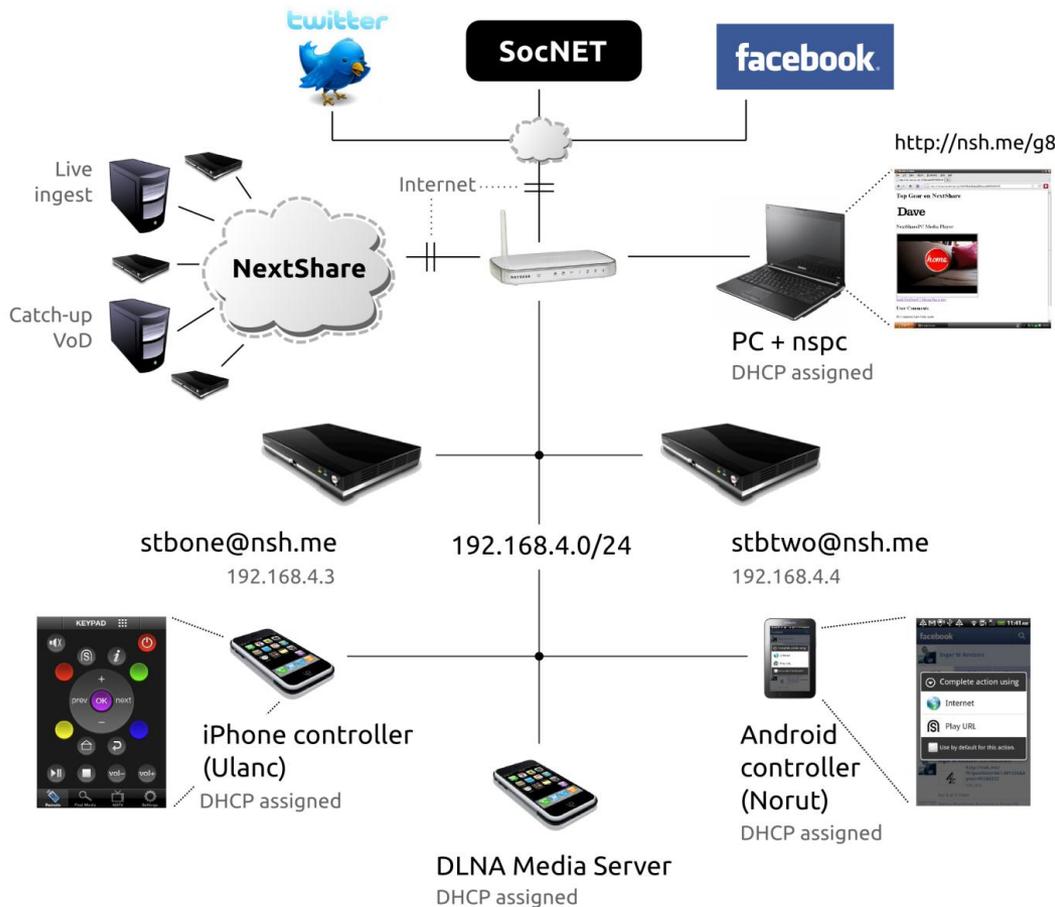
5. NextShare^TV Lab-based Testing

System Testing and QA Framework

- 16 x STB + virtualised peers
- In-depth real-time packet analysis

[S] NextShare™
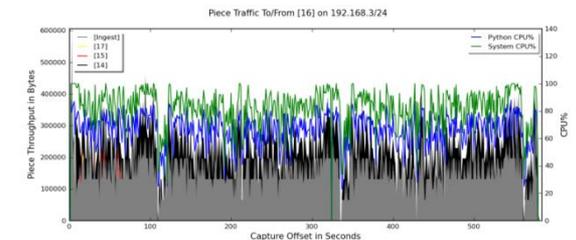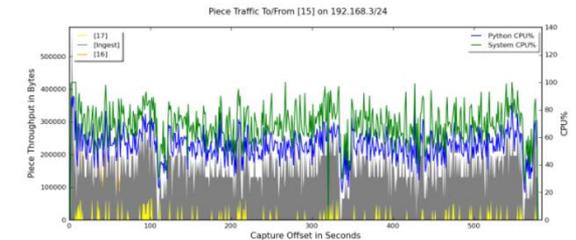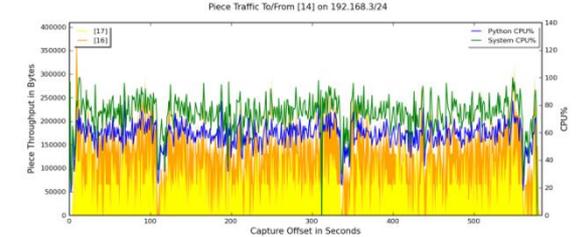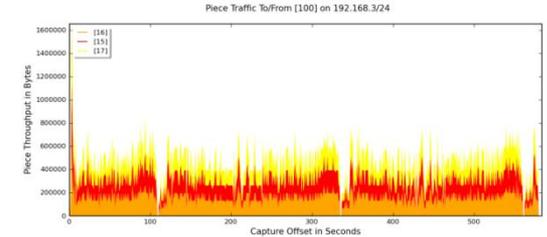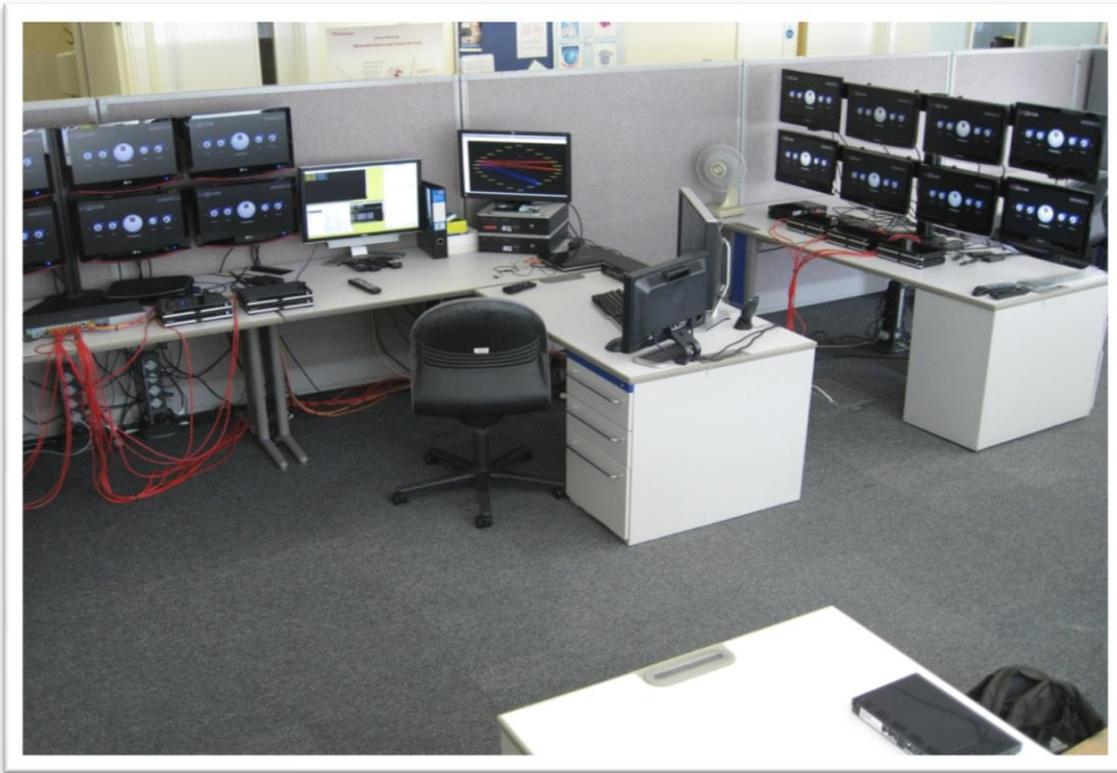
6. Living Laboratory

Living Lab Deployment

- **300+ STBs** in Lancaster-based deployment
- Real-users / feedback steering research
- Comparing P2P with tradition multi-cast
- **Multiple European sites…**
  - UK
  - Slovenia
 - Finland
  - Norway
 - Germany …

Deployment A: **ResNet**

- 1Gb link, NATed, 400Mbps upper limit across all users. Traffic between hosts is not limited

- **Challenges:** operation of NextShare in unconstrained network (stress test)
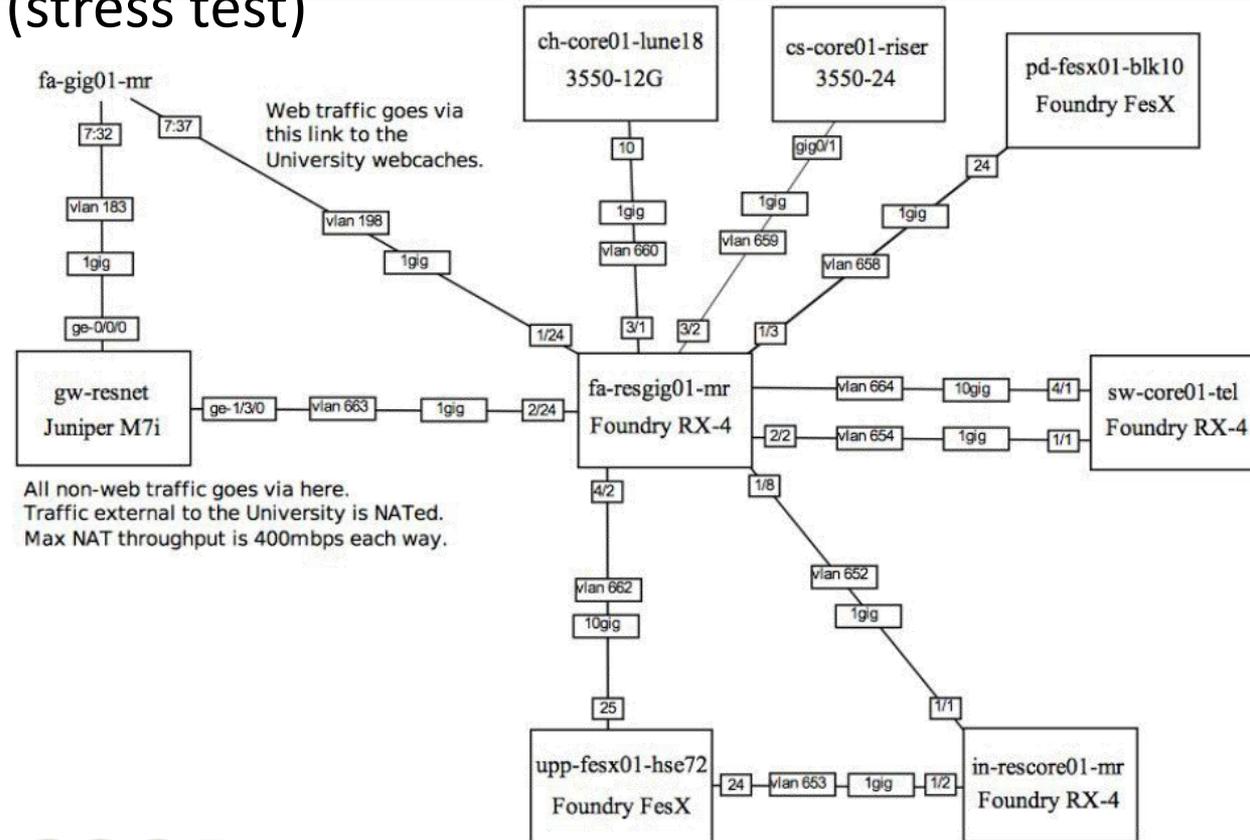
Deployment B: **Wray Wireless Mesh**

- Connectivity 100Mbit fibre circuit. Connections between the mesh routers within the village are at 40Mbps, while consumers are given **20Mbps connectivity**

- **Challenges:** asymmetric bandwidth, strict NAT and a resource contention.

Existing Infrastructure

Mesh Infrastructure

Mesh Router

Mesh Router

Wireless Network Client

Wireless coverage area
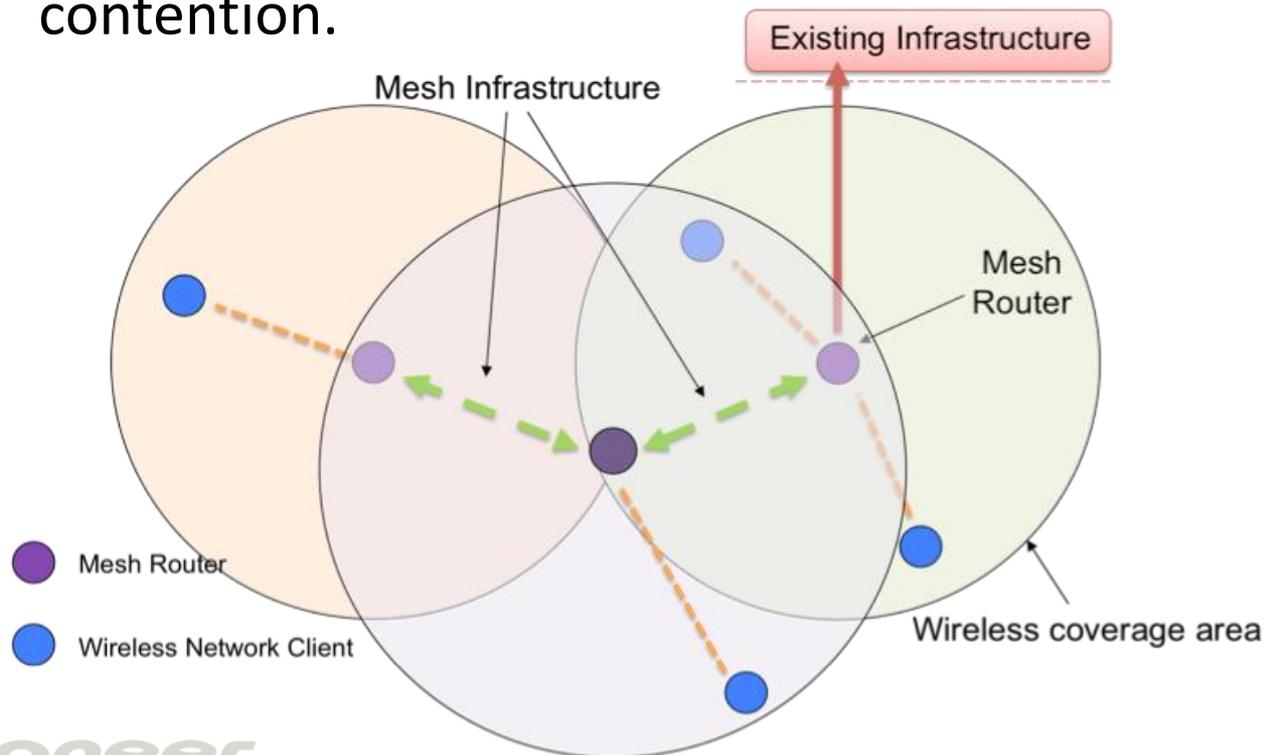
7. Visions for the Future

Revolutionary change

- Abundant choice – the **Universal Catalogue**
- **Everything On-Demand**
- **Zero Management => Self-organising Storage On Edge**
- **Passive & Individual** becoming **Active & Social**
- **Participation**! Everyone is a broadcaster…
- **Open standards** a key driver for CE industry!
- **Customer relationships** between CP and consumers more important than ever before!

NextShareTV

Thanks for listening

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