POLYTECH
NICE-SOPHIA

MOVING THE WORLD'S DATA AT MAXIMUM SPEED

Architecture Logicielle évolution: un exemple avec Aspera

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1 Fevrier 2019

Contexte et problème

Serveurs et architectures

Autres considérations

Evolutions

Q&A

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Partie 1 : Contexte et problème

LE CONTEXTE

- Dans les années 2000 l'industrie des medias (cinema, …) se convertit au numérique
- La fabrication des films se fait numériquement : fichiers lourds
- Les fichiers voyagent dans le monde entier : rush, montage, doublage, teasers, etc..
- Les reseaux permettent le transport des fichiers, pourtant: ca bloque
- Deux ingénieurs: Michelle Munson et Serban Simu planchent sur le problème et proposent une solution technique basique, le premier client achète.

Big Data Explosion

- 90% of data today is file-based or unstructured
- Mix of file sizes—but larger and larger files the norm with video growing the fastest

Diversity of IP Networks—Media, Bandwidth Rates, and Conditions

- Variable bandwidth rates (slow to super-fast)
- Bandwidth rates increasing—costs decreasing
- Network media remains diverse (terrestrial, satellite, wireless)
- Conditions vary—all networks prone to degradation over distance

Global Workflows—moving Big Data over WANs

- Teams are geographically dispersed
- Over distance, network conditions degrade
- Contemporary TCP acceleration solutions not designed for big data transfer and replication

Cloud Computing Grows Up

- More choices: IBM SoftLayer, AWS, Microsoft Azure, Google, OpenStack, HP Cloud
- No longer a niche – Netflix (transcoding), MTV (global video distribution), BGI (genomic sequencing)

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ABOUT ASPERA

Software technology company focused on innovation in new data transfer technologies

Based in Emeryville, California

Founded in 2004, now part of IBM

Creators of the patented FASP® protocol

- Innovative, highly efficient bulk data transport technology
- Ranked first in every WAN transfer throughput benchmark
- Unique and core to all Aspera's high-performance data transfer software
- Outperforms competing software and hardware WAN acceleration solutions

Patents: FASP® Bulk Data and Dynamic Bandwidth Control issued in USA and many other countries

Global 24x7 support with direct sales and sales engineering around the world

Markets Served

Media and Entertainment	Federal Government	Engineering & Manufacturing	Architecture & Design
Life Sciences & Pharmaceutical	Healthcare	Software & Gaming	Financial Services
Oil & Gas	Enterprise IT	Advertising & Publishing	Legal & eDiscovery
Telecommunications	Cloud Computing	Consumer Products & Retail	Service Providers

ASPERA'S MISSION

Creating next-generation transport technologies

that move the world's digital assets at maximum speed,

regardless of file size, transfer distance and network conditions.

CHALLENGES WITH TCP AND ALTERNATIVE TECHNOLOGIES

Distance degrades conditions on all networks

- Latency (or Round Trip Times) increase
- Packet losses increase
- Fast networks just as prone to degradation

TCP performance degrades with distance

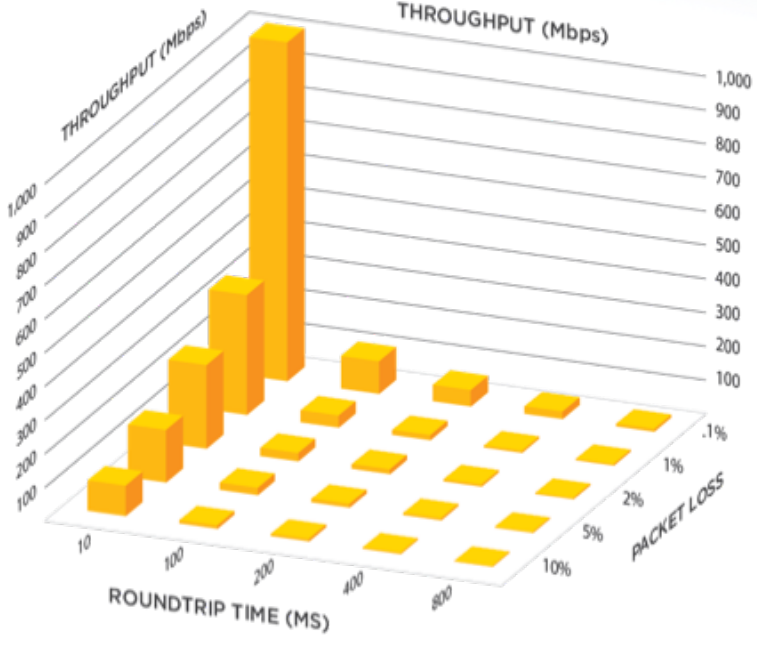
- Throughput bottleneck becomes more severe with increased latency and packet loss

TCP does not scale with bandwidth

- TCP designed for low bandwidth
- Adding more bandwidth does not improve throughput

Alternative Technologies

- TCP-based - Network latency and packet loss must be low
- UDP traffic blasters - Inefficient and waste bandwidth
- Modified TCP – Improves TCP performance but insufficient for fast networks
- Data caching - Inappropriate for many large file transfer workflows
- Data compression - Time consuming and impractical for certain file types
- CDNs & co-lo build outs - High overhead and expensive to scale



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FASP® – HIGH-PERFORMANCE DATA TRANSPORT

Maximum transfer speed

- Optimal end-to-end throughput efficiency
- Transfer performance scales with bandwidth independent of transfer distance and resilient to packet loss

Congestion Avoidance and Policy Control

- Automatic, full utilization of available bandwidth
- On-the-fly prioritization and bandwidth allocation

Uncompromising security and reliability

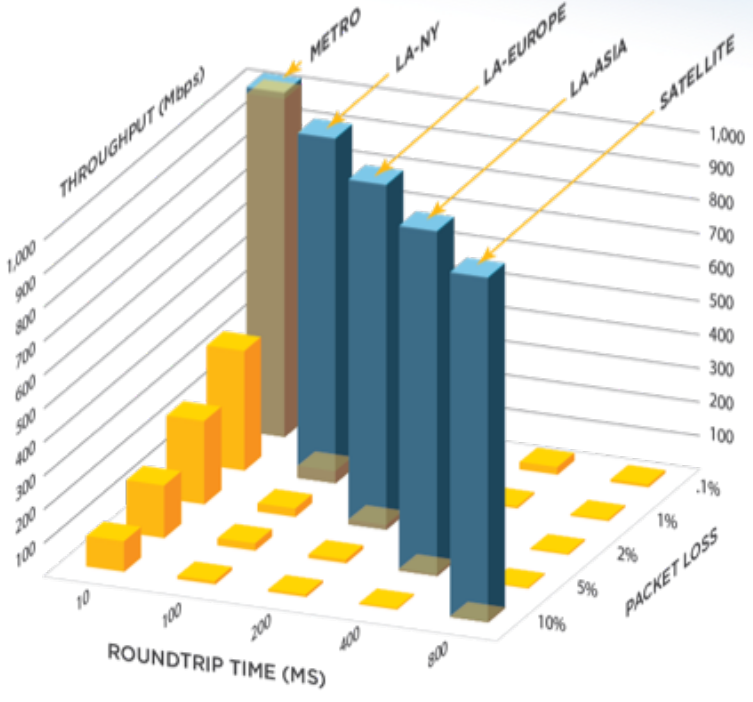
- Secure, user/endpoint authentication
- AES-128 cryptography in transit and at-rest

Scalable management, monitoring and control

- Real-time progress, performance and bandwidth utilization
- Detailed transfer history, logging, and manifest

Low Overhead

- Less than 0.1% overhead on 30% packet loss
- High performance with large files or large sets of small files



Resulting in

- Transfers up to thousands of times faster than FTP with precise and predictable transfer times
- Extreme scalability (concurrency and throughput)

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FASP® – PERFORMANCE BREAKTHROUGH

MOVING A 10GB FILE		Across US	US - Europe	US - Asia
Legacy Transport	100 Mbps	10-20 Hours	15-20 Hours	Impractical
	1 Gbps			
	10 Gbps			
Aspera FASP™	100 Mbps	14 Min	14 Min	14 Min
	1 Gbps	1.4 Min	1.4 Min	1.4 Min
	10 Gbps	8.4 Sec	8.4 Sec	8.4 Sec

- Location Agnostic: FASP transfer speeds don't degrade as transfer distances increase while FTP speeds do decrease
- Predictable & Reliable: Transfer times decrease linearly as bandwidth increases. FTP transfer times don't improve with bandwidth
- Versatile: Supports large files just as easily as and large sets of small files

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A HISTORY OF INNOVATION AND GROWTH

2004 | 2006 | 2008 | 2010 | 2012 | Today

Over 3k customers world wide

Cloud

- **Aspera on Demand** AWS
- **Aspera on Demand** Auto-Scale Platform
- **Aspera on Demand** Azure, Google, SoftLayer

Management and Automation

- **Console** Centralized Management
- **Orchestrator** Workflow Automation
- **Cargo** Auto download

Distribution and Collaboration

- **Point-to-Point** Transfer clients
- **Enterprise Server** Universal file transfer
- **Connect Server** Web-based interface
- **Connect** Web-based plug-in
- ***faspex*™ Server** Person-to-person
- **Outlook Add-in** Email attachments
- **Shares** Web Sharing
- **Sync** High-performance sync
- **Drive** Desktop Integration
- **Proxy** Secure DMZ
- **Mobile Uploader** Mobile App
- ***faspex* Mobile Client** Mobile App

fasp™ Next Generation Core Transport

- ***fasp*™** - Next generation high-speed bulk data transport
- **Aspera *fasp*™** Developer SDK
- **Aspera Developer Network** Developer Subscription
- ***fasp*Air™** Mobile devices
- ***fasp*MC™** IP Multicast
- ***fasp3*™** next generation for any bulk data

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ASPERA PRODUCT PORTFOLIO

TRANSFER CLIENTS

Web, Desktop, Email, Mobile, Embedded

WEB APPLICATIONS

Distribution, sharing, collaboration and exchange

MANAGEMENT & AUTOMATION

Transfer management, monitoring and automation

SYNCHRONIZATION

Scalable, high-performance synchronization and replication

TRANSFER SERVERS

Private On Premise | Public and Private Cloud | Hybrid

FASP® PATENTED HIGH-SPEED TRANSPORT

Any Data Size, Any Distance, Any Network Conditions | Any Infrastructure: Block, Object, On Premises, Cloud

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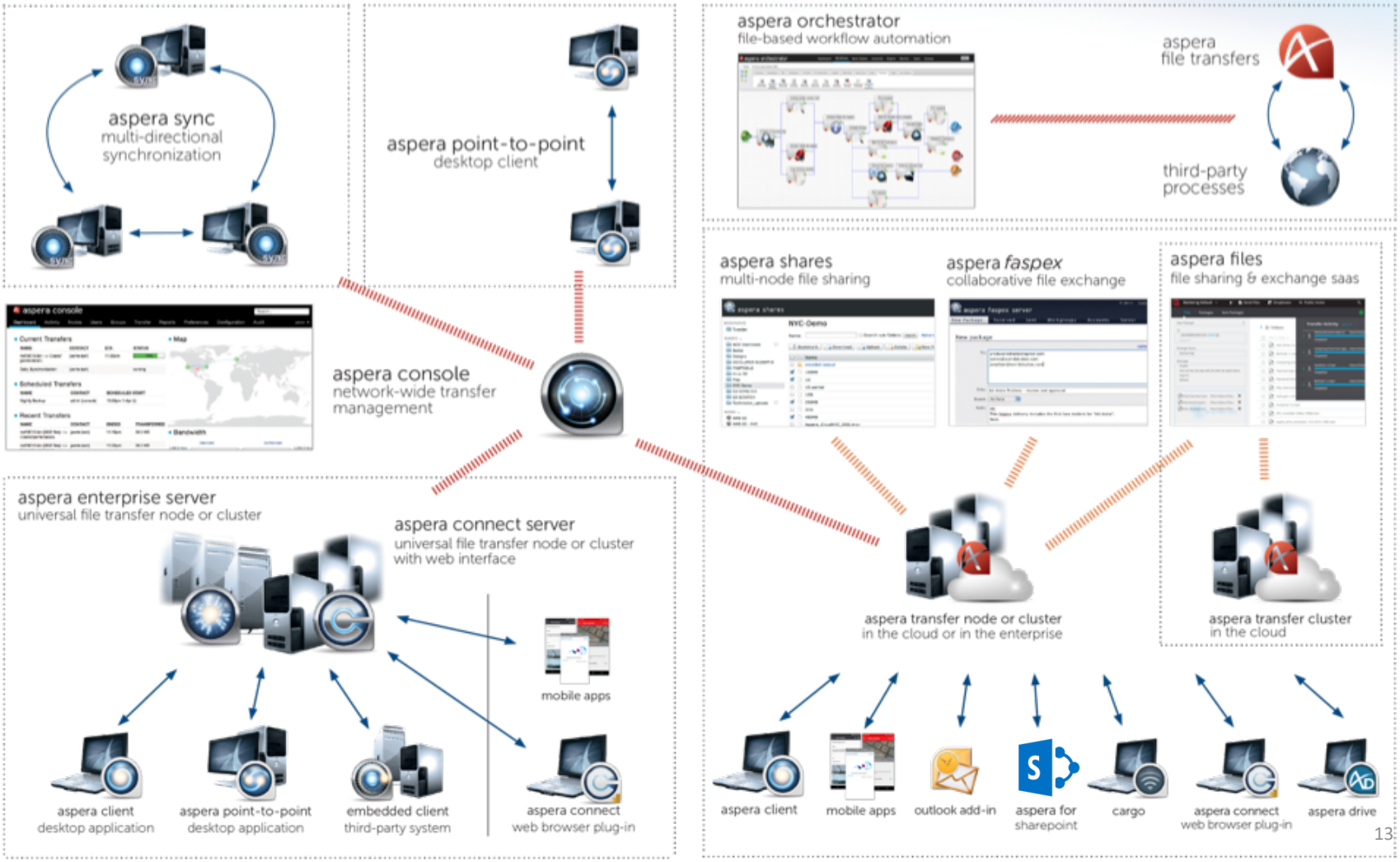
FASP® SOFTWARE ENVIRONMENT



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Partie 2 : Produit coeur : serveur

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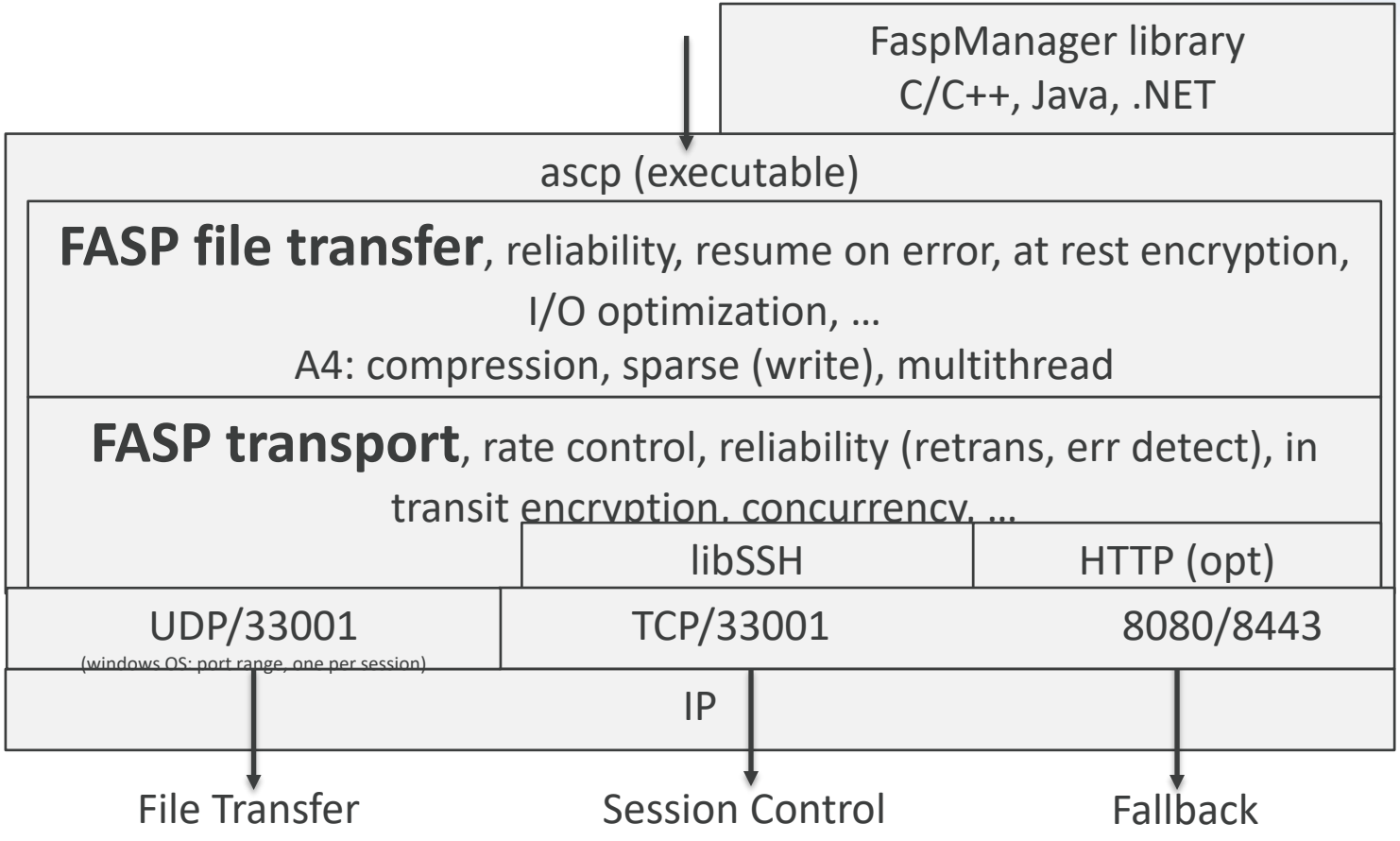
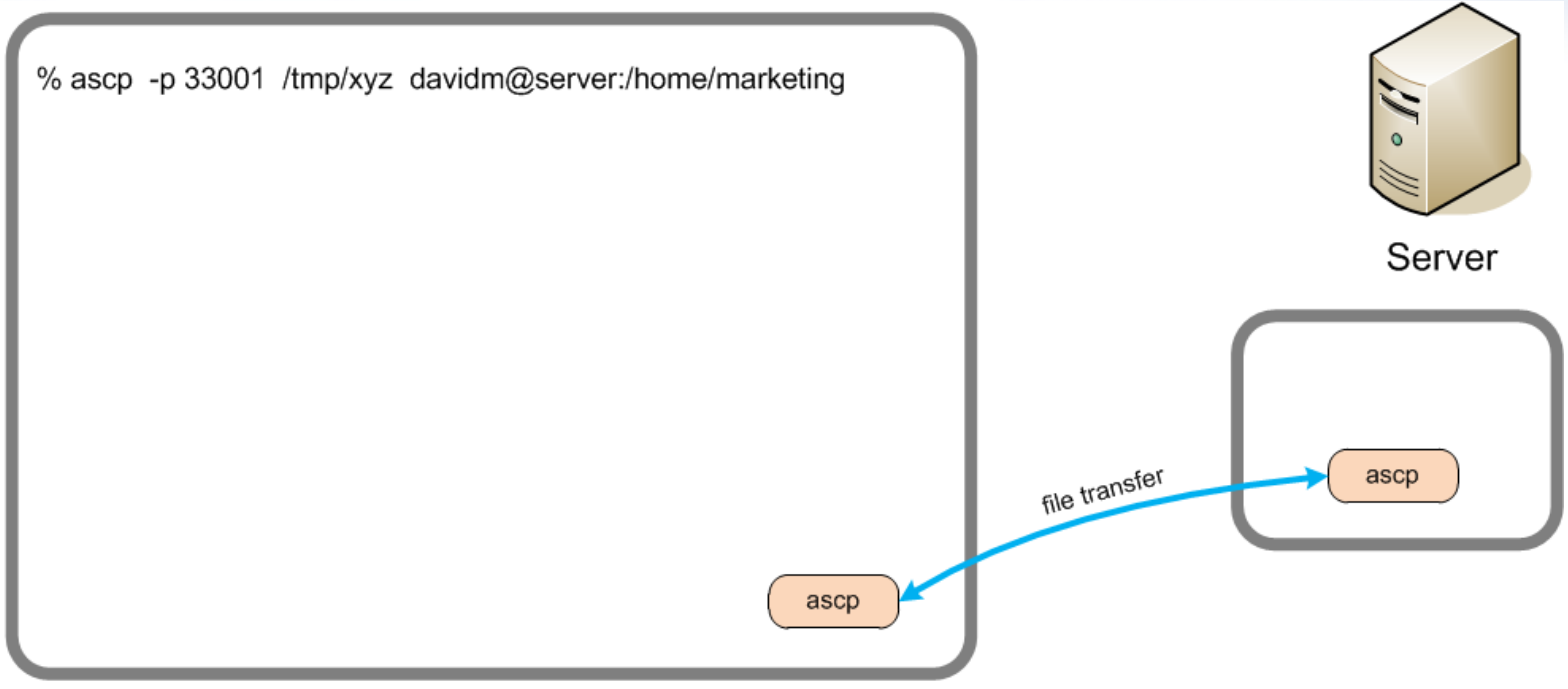
FASP architecture

Command used by all products to transfer files



*all ports are configurable

EVOLUTION OF ASPERA SERVER SOFTWARE: ASCP

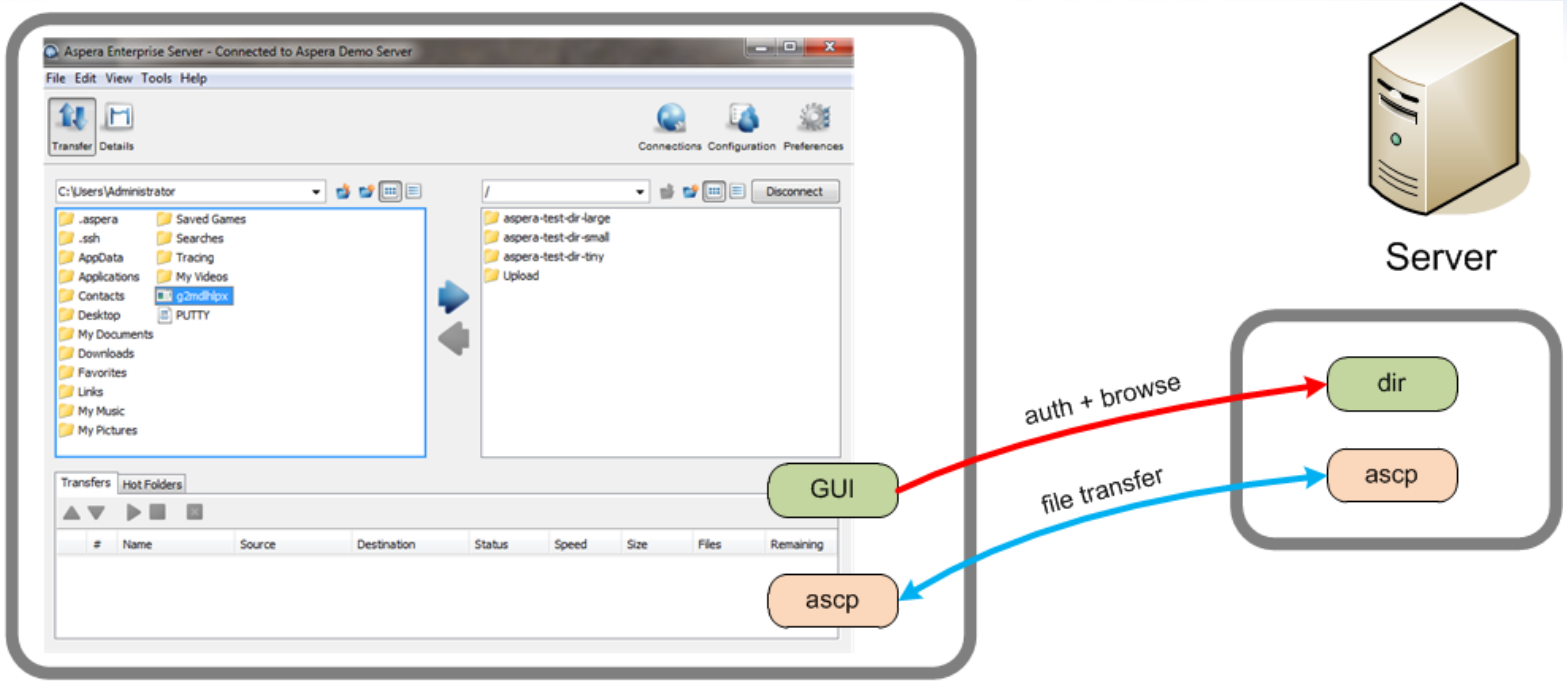


Client

Key features:

- **Maximum transfer speed**
- **Distance-neutral**
- **Adaptive rate control**
- **Secure, reliable, scalable**
- **Resume from point of interruption**

EVOLUTION OF ASPERA SERVER SOFTWARE: ENTERPRISE SERVER

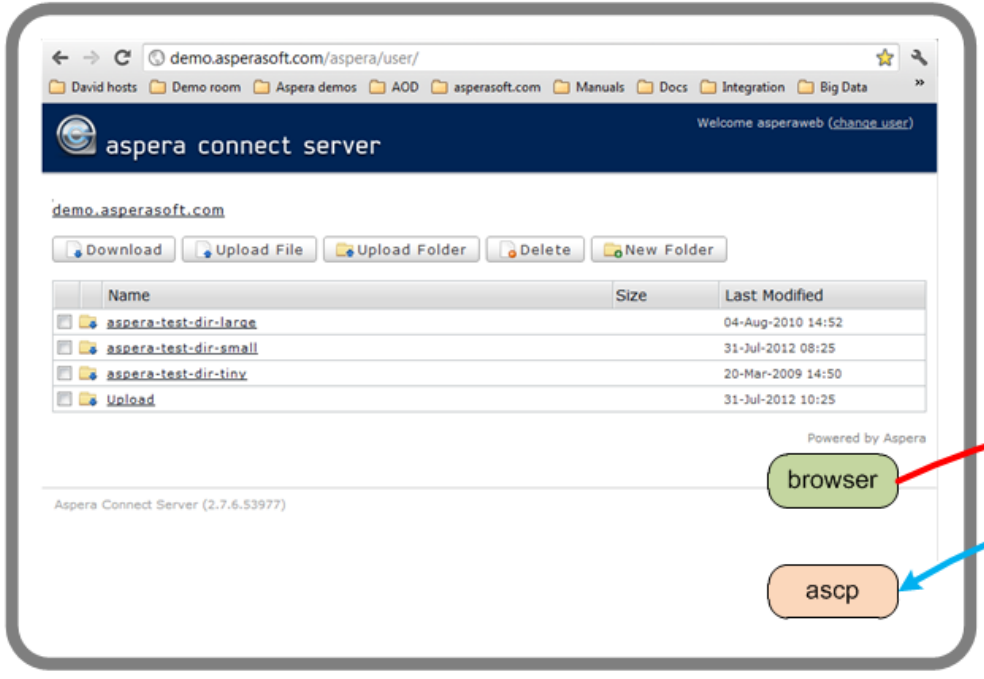


Client

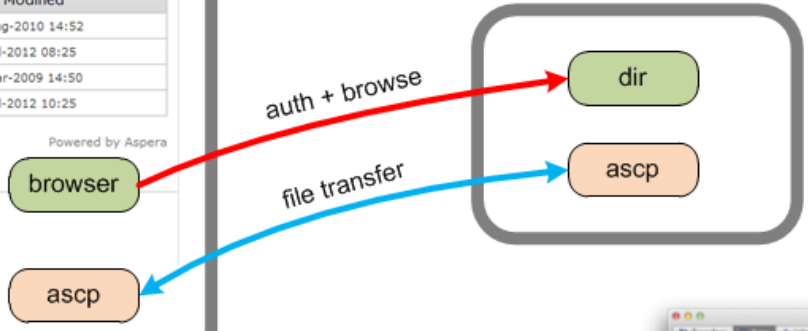
Key features:

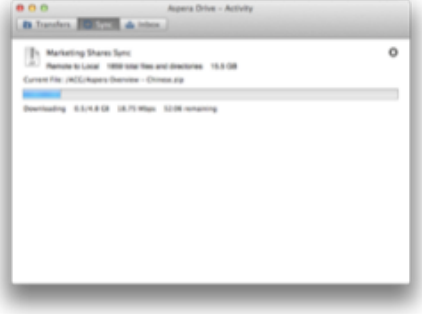
- Browse remote filesystem
- Graphical progress display
- Hot folders
- Configure server via GUI
- Client-side queueing

EVOLUTION OF ASPERA SERVER SOFTWARE: CONNECT SERVER



Server





Client

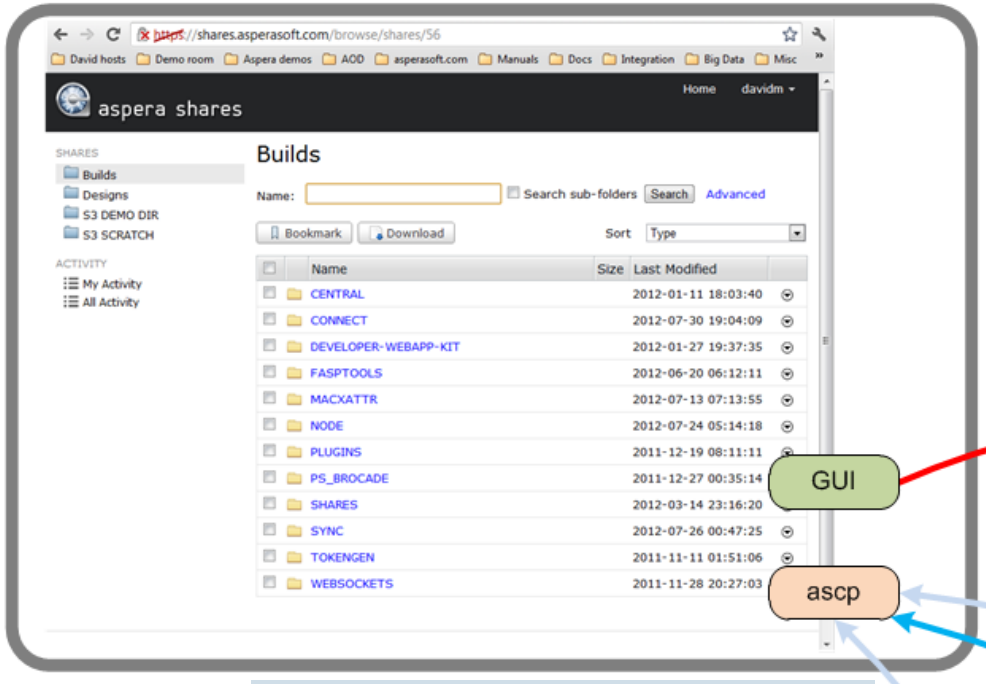
Key features:

Client s/w is a free browser plug-in

Transfer decoupled from browsing

Rich set of transfer APIs

EVOLUTION OF ASPERA SERVER SOFTWARE: SHARES



Shares front-end

auth + browse

dir

GUI

ascp

file transfer

Designs

ascp

transfer server 1

S3 Scratch

ascp

Builds

ascp

transfer server 2

Client

Key features:

- Node API
- Multiple transfer servers
- Multiple docroots (shares) per user
- Multiple directory services
- Seamless cloud support (S3, Azure …)
- Granular user permissions
- Application-layer user database

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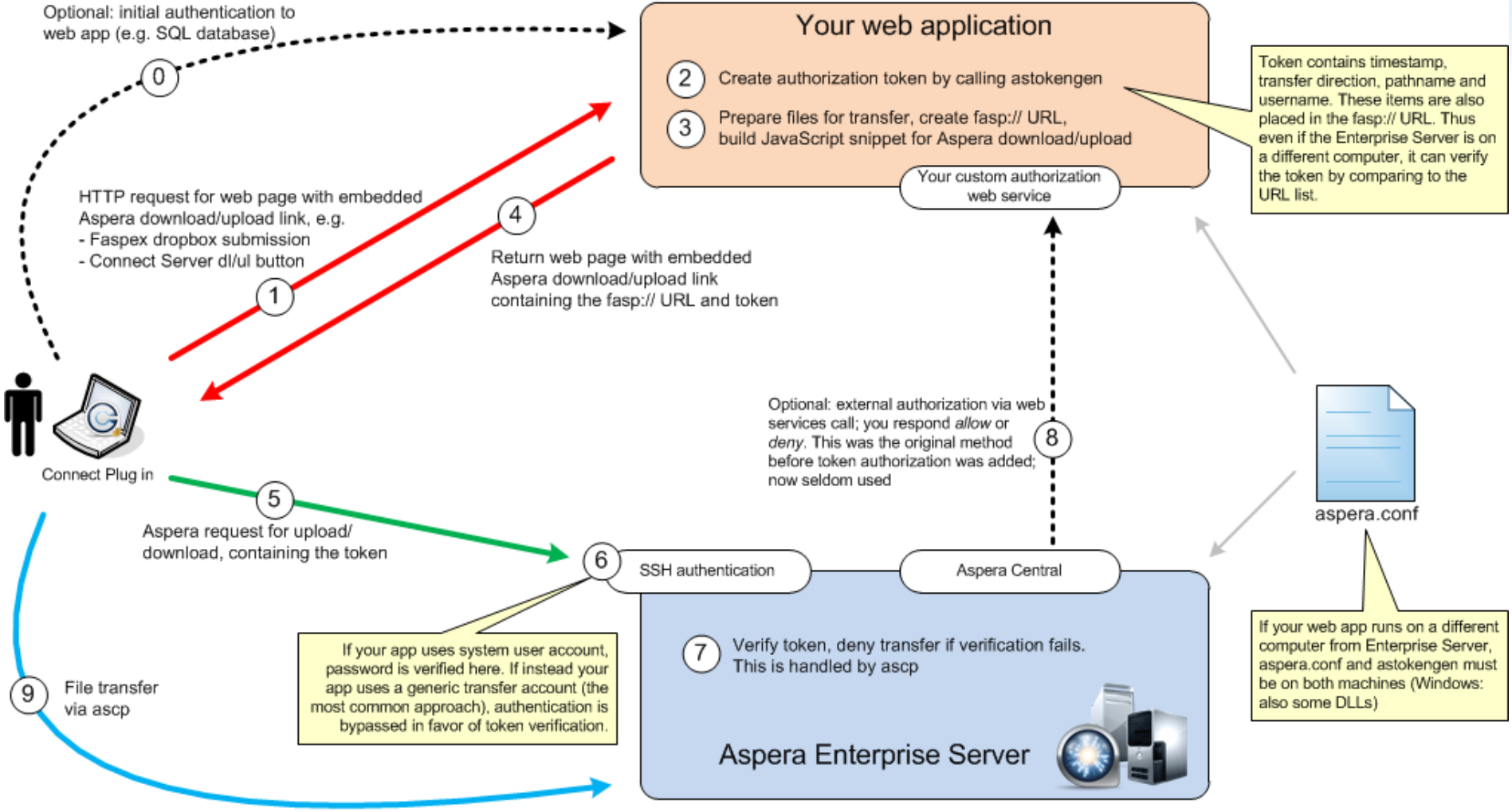
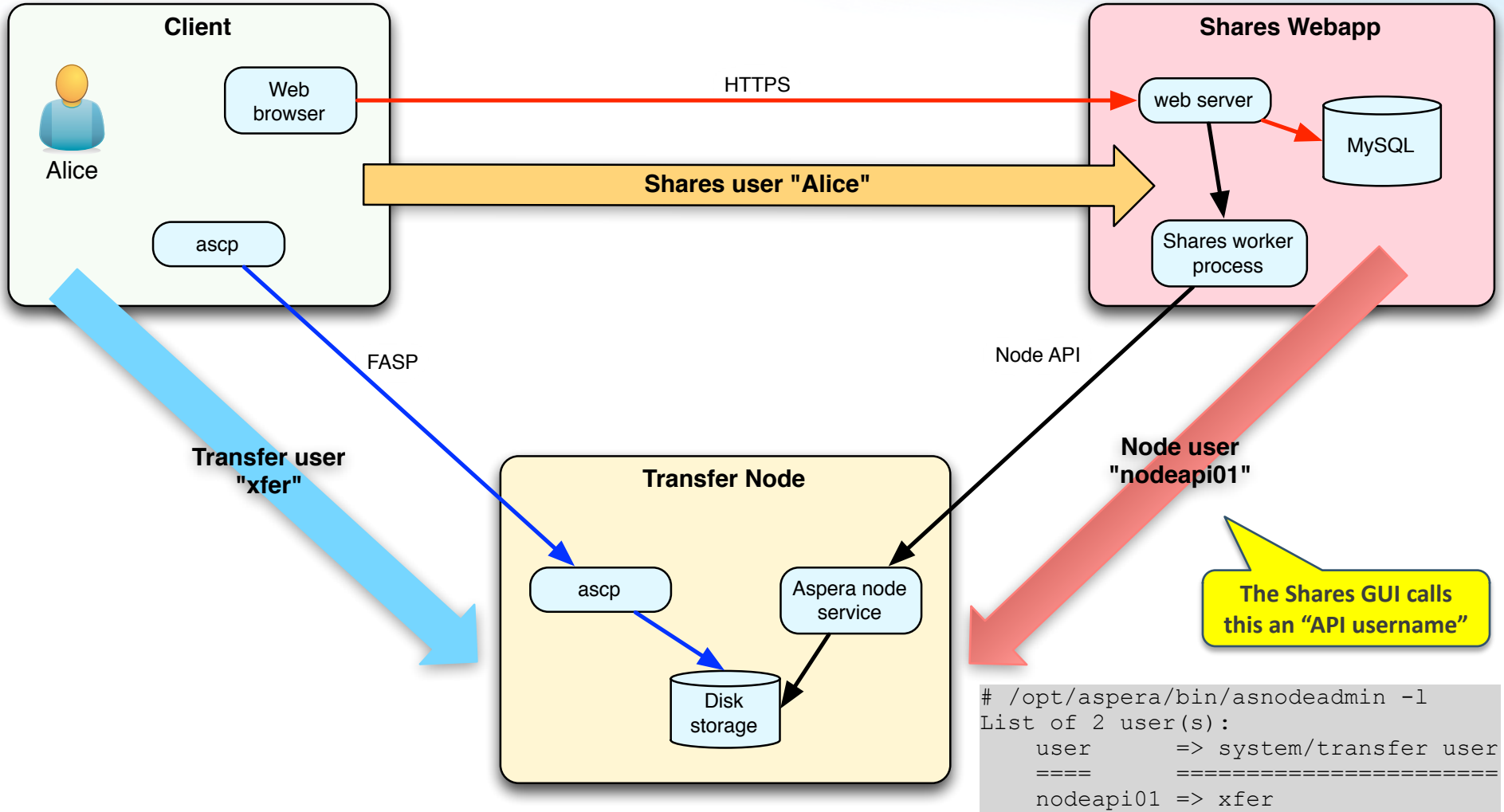
TOKEN AUTHORIZATION



THREE DIFFERENT KINDS OF USERS




```
# /opt/aspera/bin/asnodeadmin -l
List of 2 user(s):
    user       => system/transfer user
    ====       ======================
    nodeapi01 => xfer
```

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Partie 3 : cloud et Autres considerations

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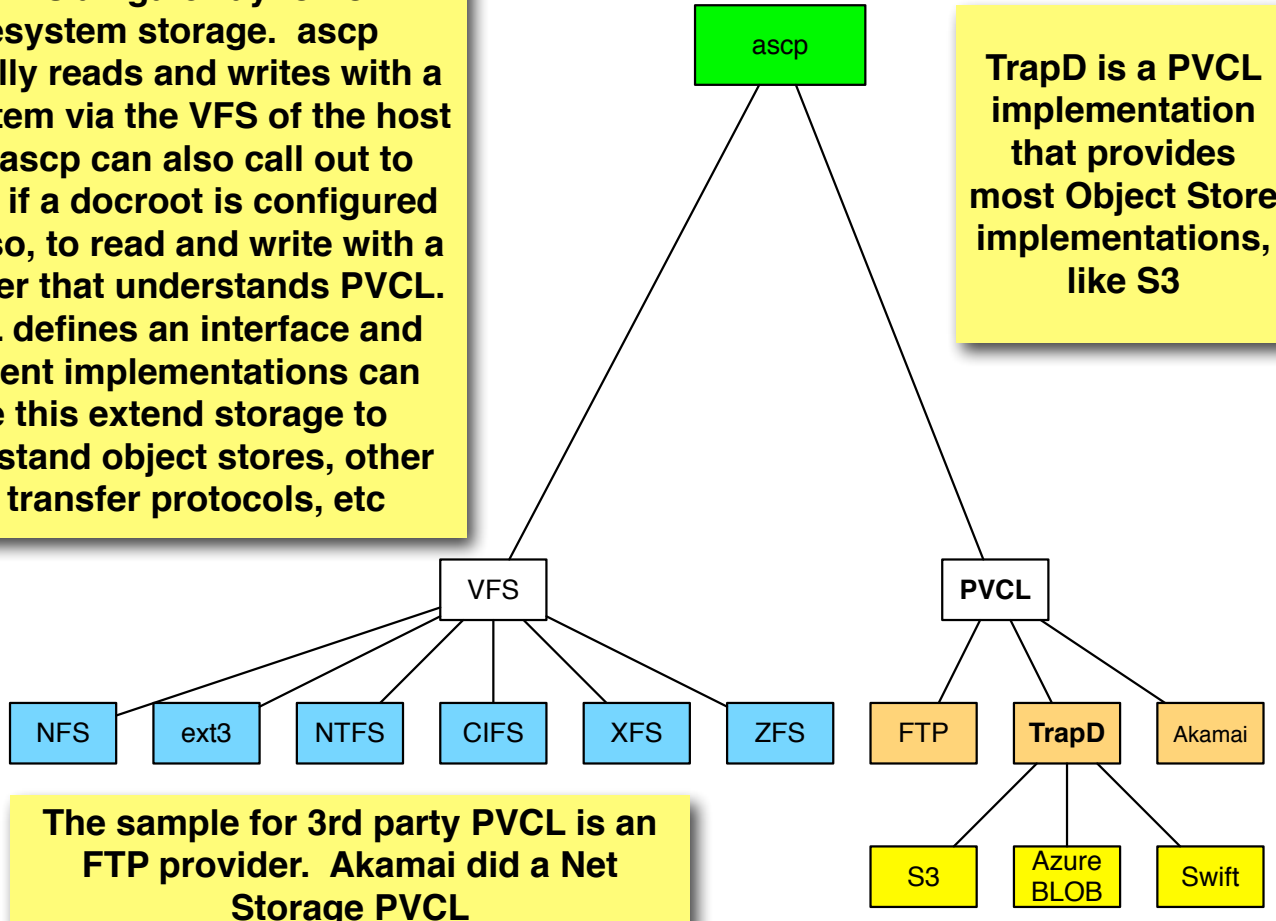
ACCESS TO CLOUD STORAGE (OBJECT STORE)

PVCL is an gateway to non-filesystem storage. ascp normally reads and writes with a filesystem via the VFS of the host OS. ascp can also call out to PVCL, if a docroot is configured to do so, to read and write with a provider that understands PVCL. PVCL defines an interface and different implementations can use this extend storage to understand object stores, other file transfer protocols, etc

TrapD is a PVCL implementation that provides most Object Store implementations, like S3



The sample for 3rd party PVCL is an FTP provider. Akamai did a Net Storage PVCL

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ASPERA ON DEMAND
WITH DIRECT-TO-CLOUD

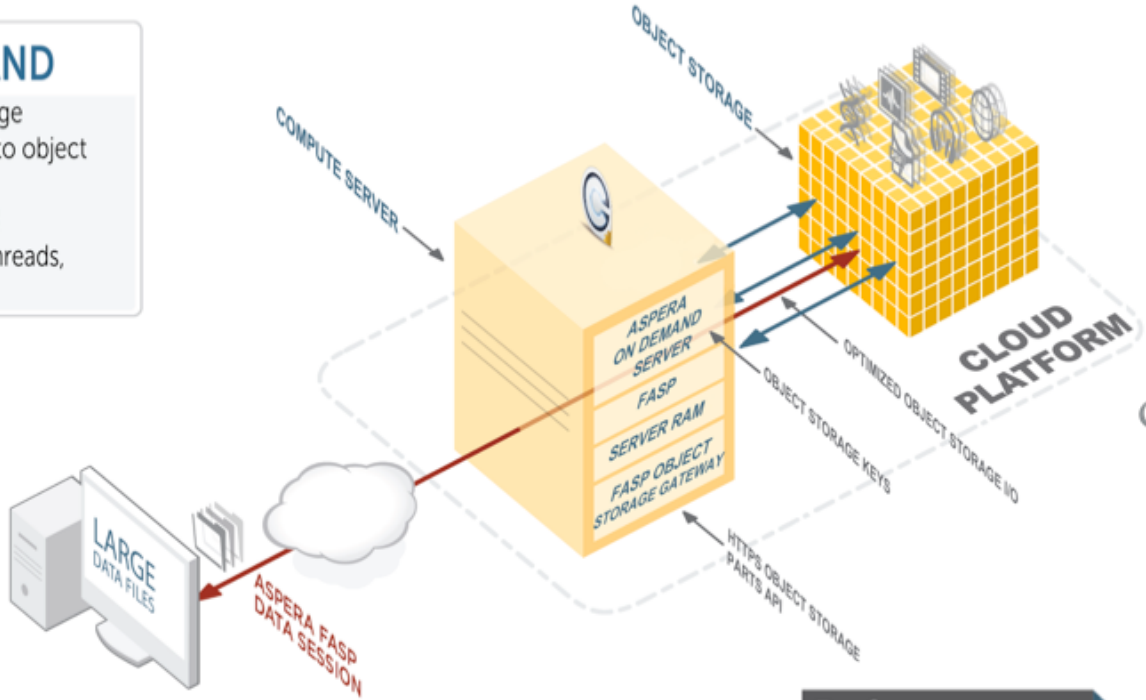
THE SOLUTION

ASPERA ON DEMAND

- Full client-side r/w of object storage
- Synchronous transfer from client to object storage (via Aspera On Demand)
- *fasp*™ transfer speeds end-to-end
- Real-time optimization of HTTP threads, chunk size, interfaced to *fasp*

Client Software

client
connect plug-in
point-to-point
cargo downloader
mobile apps



amazon web services™
SOFTLAYER® an IBM Company
Microsoft Azure
Google Cloud Platform
Akamai
Limelight NETWORKS

Road Map

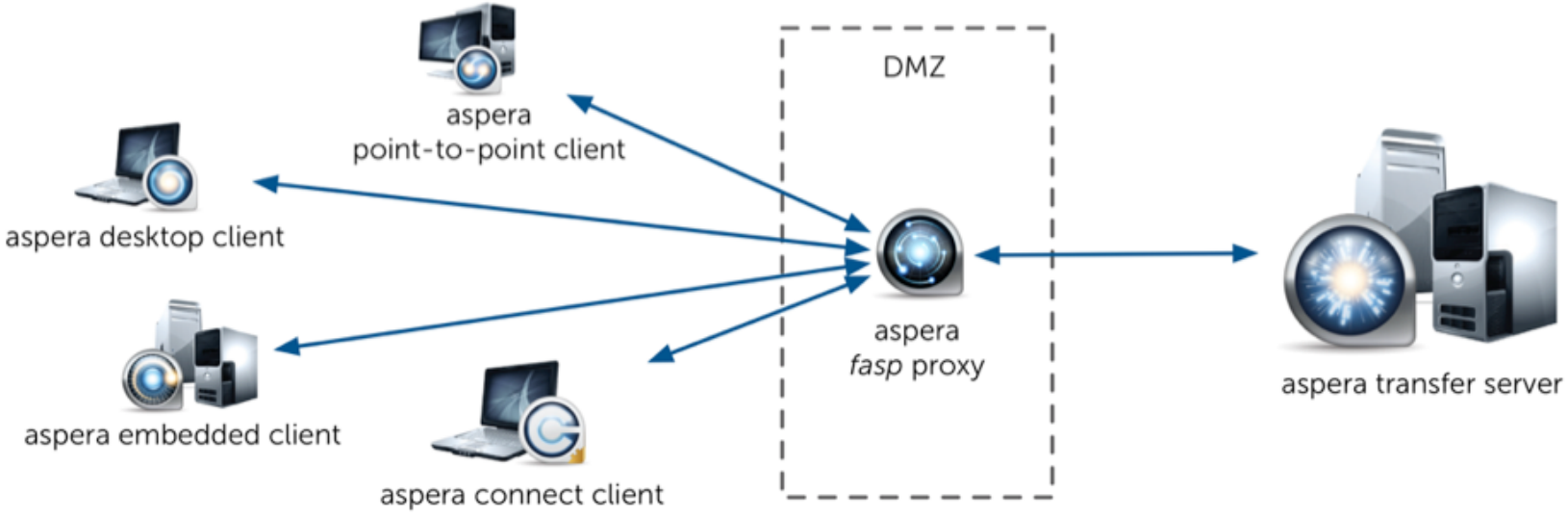
BT
openstack
rackspace® the open cloud company

Performance

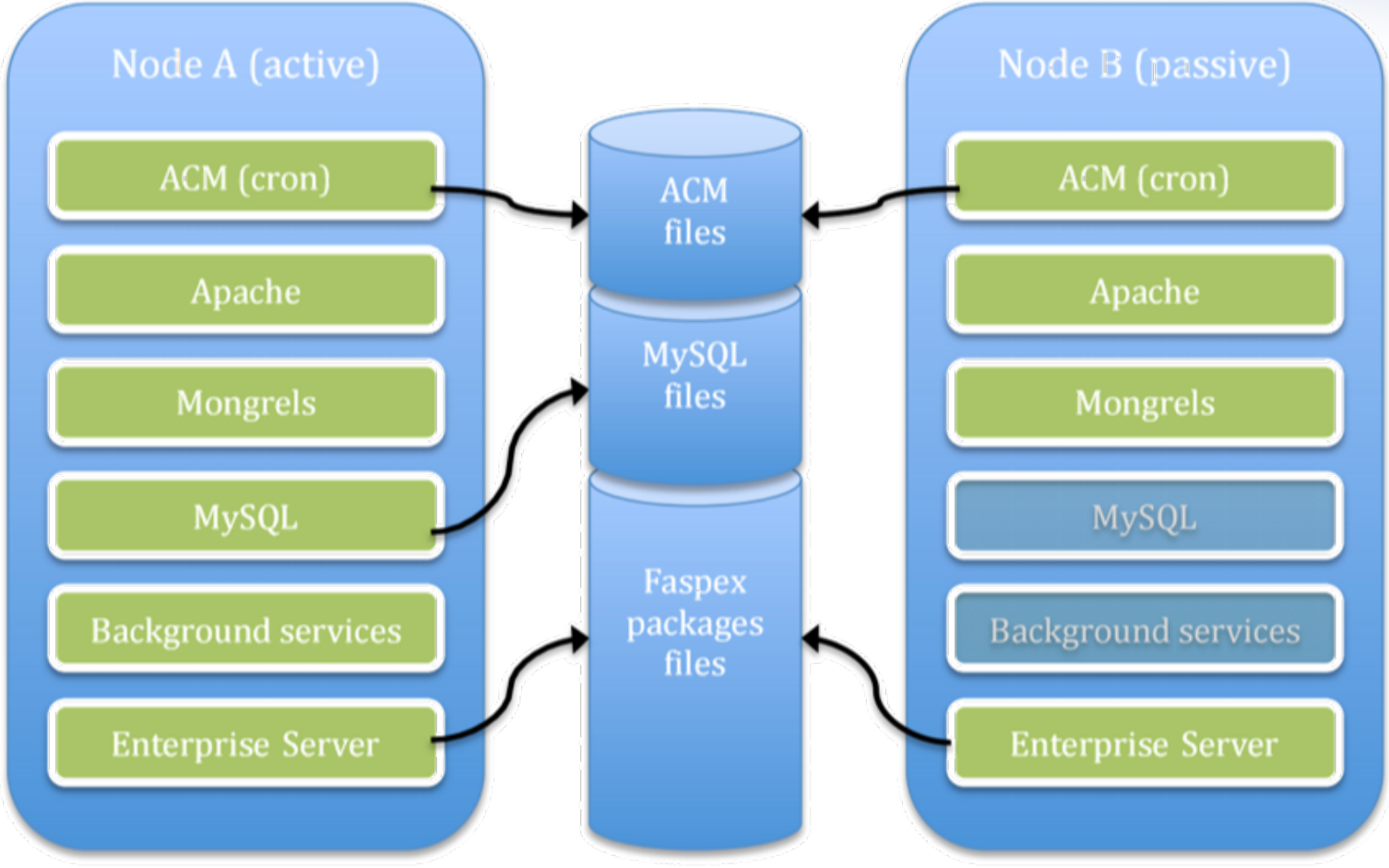
EFFECTIVE THROUGHPUT

up to 1Gbps
(per server Extra Large Instance)
10TB per 24 hours

RÉSEAU, FIREWALL ET DMZ



HAUTE DISPONIBILITÉ



ASPERA MOBILE APIs

Android SDK (java)

Aspera Android SDK provides a Java API to transfer files using FASP

iPhone SDK (obj-c, swift)

Aspera iPhone SDK with Objective C API to transfer files using FASP

ASPERA BROWSER APIs

Connect API (JavaScript)

JavaScript API exposed by Aspera Connect for integration of FASP based file transfers into web applications for a complete in-browser experience

ASPERA APPLICATION APIs

Shares API (REST)

Full programmatic control over browsing Shares, transfer authorization, and upload / download.

faspex™ Web API (REST)

A set of services that enables users to create and receive digital deliveries via a Web interface, while taking advantage of FASP high-speed transfer technology.

Console API (REST)

Full programmatic management of transfer sessions including initiation, queuing, control and management through a REST API.

Files API (RESTful)

Full programmatic control through a RESTful API.

ASPERA TRANSFER APIs

Aspera Node API (REST)

A REST API that allows initiation, monitoring and controlling of FASP based file transfers. (also includes a SOAP based web service)

FASP Manager (C/C++, java, .NET, python)

A class library that allows intiations, monitoring and controlling of FASP based file transfers.

Aspera FASPStream (C/C++, java)

Enables the transfer of bytes as they are being created or captured and allows access to portions of a file in memory during the transfer process.

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Partie 4 : Axes d’évolution

ASPERA FILES: UNE PLATEFORME SAAS

Inclue les fonctionalités de Shares et Faspex, transfert FASP

API first, interface moderne

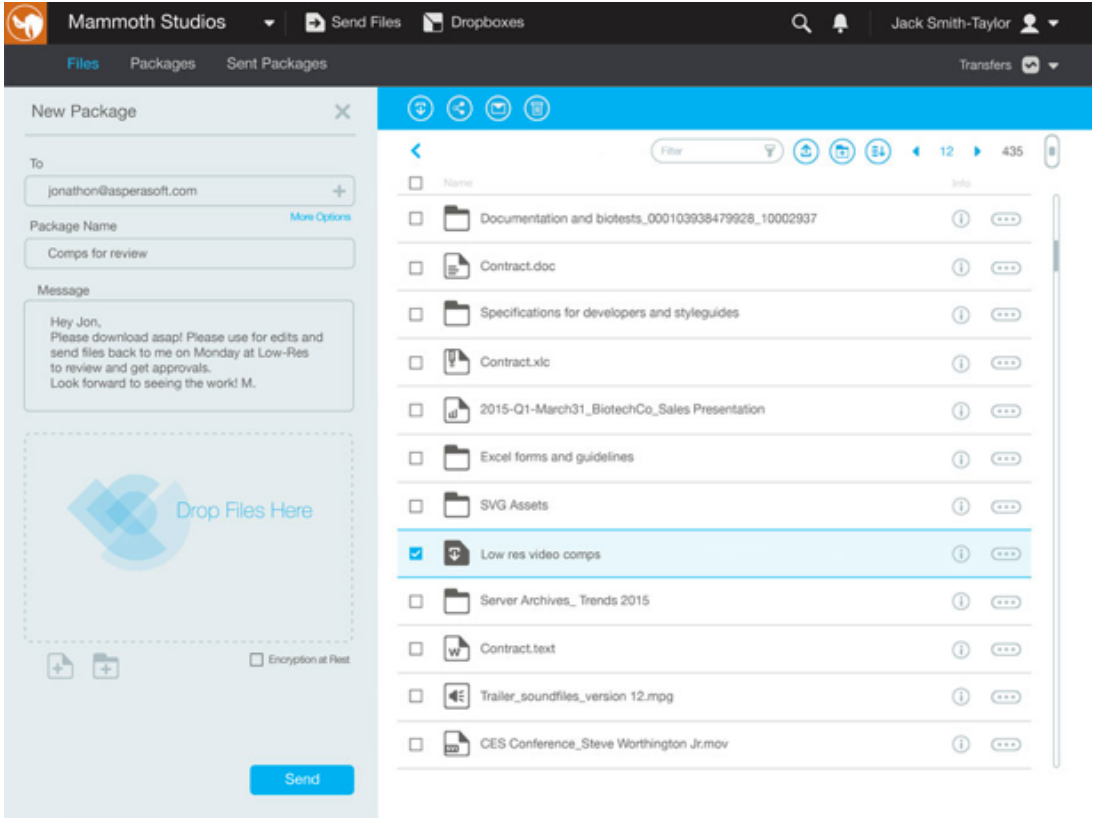
SAAS-> HA, autoscale

Any cloud

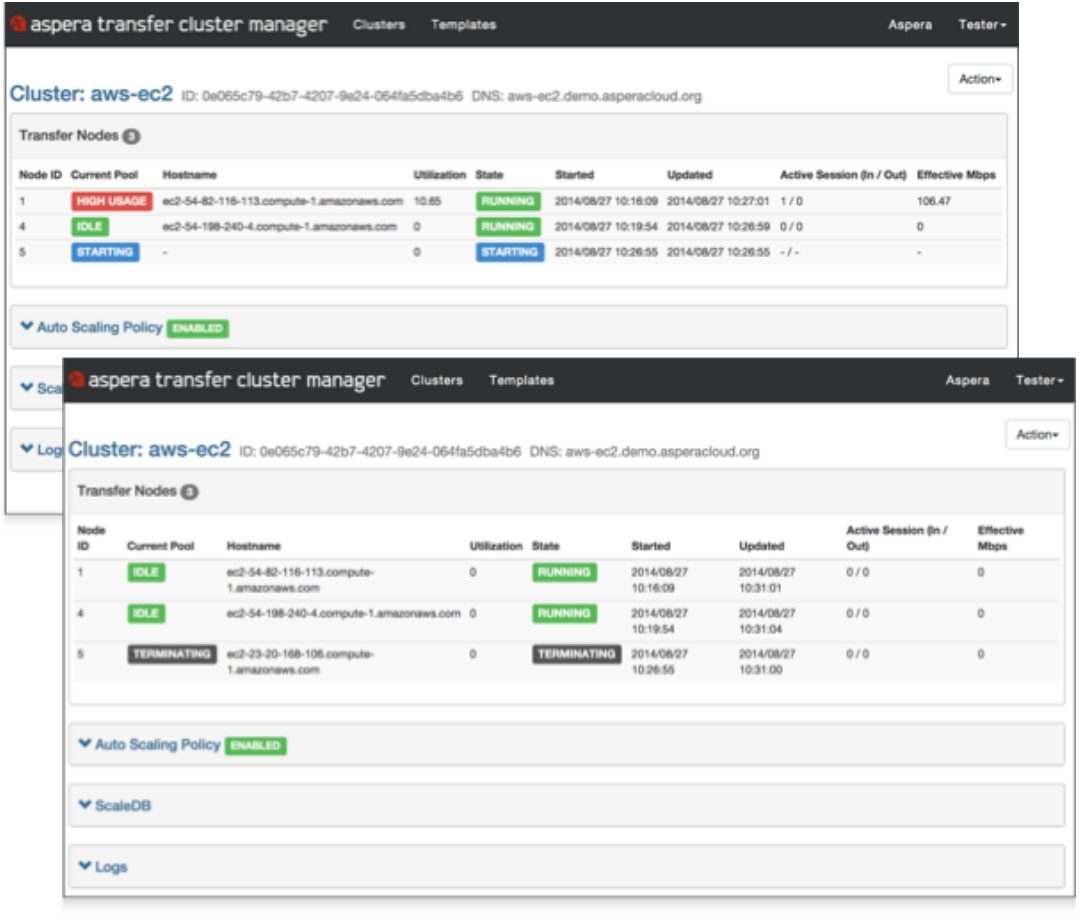
Multitenancy -> access key

(node API)

API compatible -> Drive



AUTO-PROVISIONING AND TERMINATING A NEW NODE



Automatically scales up

- Provisions a third node after the transfer capacity demands cause the first node's utilization to cross the policy's high usage threshold

Automatically scales down

- If transfer capacity demands on the first node fall below the Auto Scaling policy's high usage threshold, the Cluster Manager automatically de-provisions the third node since the other two
  are deemed available.

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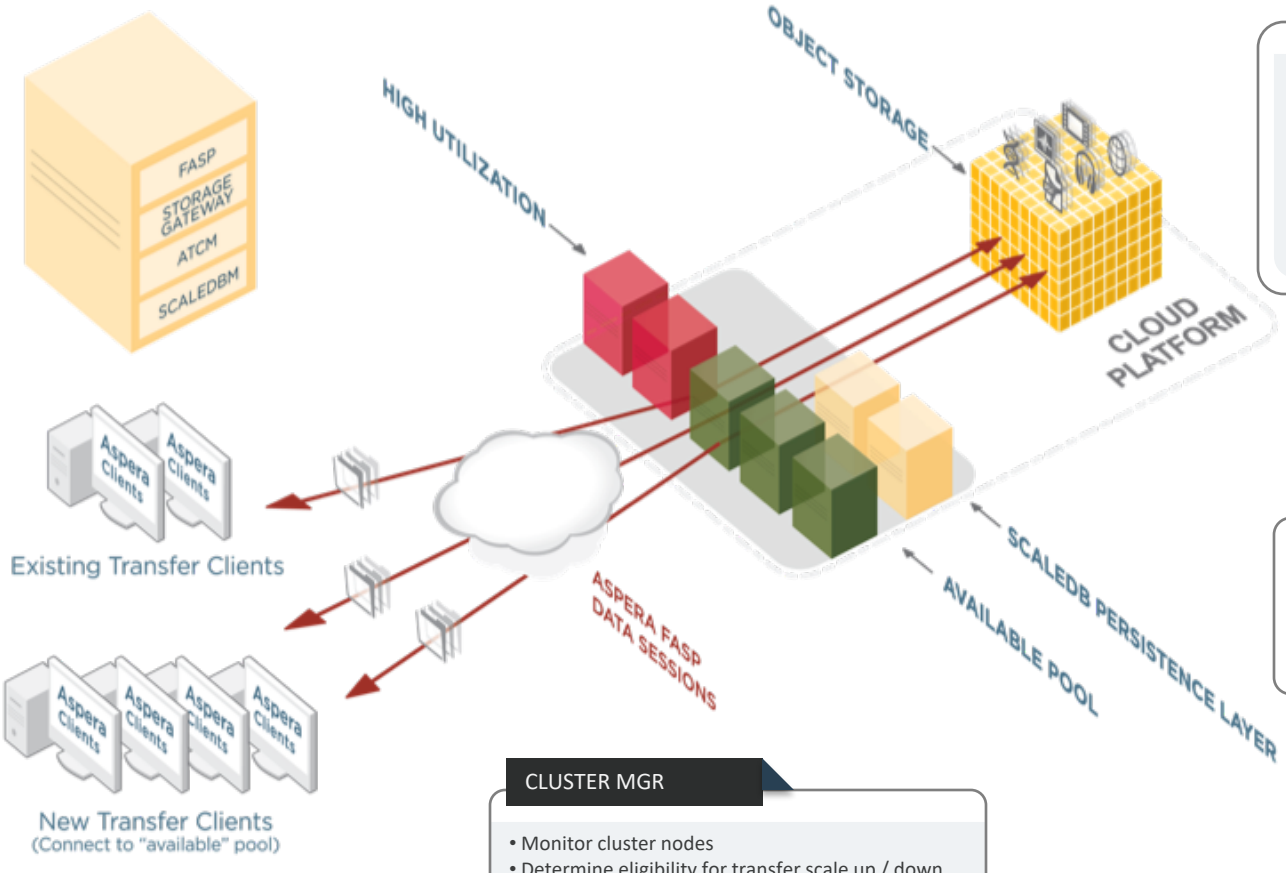
ASPERA AUTO-SCALE PLATFORM



KEY COMPONENTS

- Cluster Manager for Auto-scale and Scaled DB
- Console Management UI + Reporting API
- Enhanced Client for Shares Authorizations
- Unified Access to Files/Directories (Browser, GUI, Commend Line, SDK)

AUTO SCALING

- Min/max number of t/s
- Utilization low/high watermark
- Min number of t/s in "available" pool
- Min number of idle t/s in "available" pool

CLUSTER MGR

- Monitor cluster nodes
- Determine eligibility for transfer scale up / down
- Create / remove db with replicas
- Add / remove node

Une nouvelle implementation du protocole

Les meta donnees sur UDP (probleme des petits fichiers)

Parallelisation des I/O -> meilleure utilisation du multicore

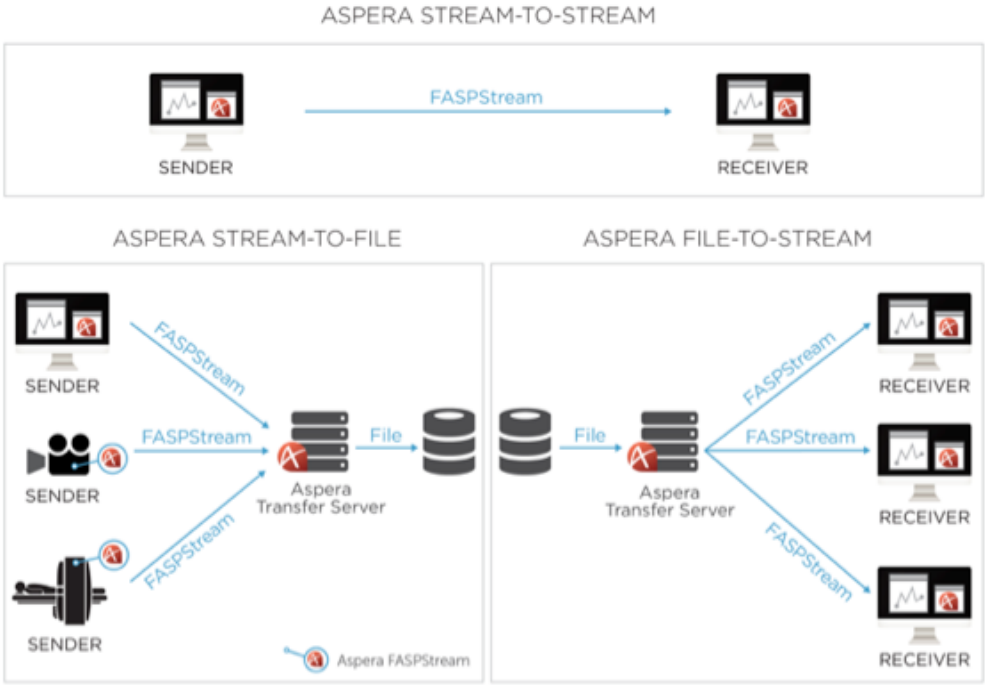
Un meilleur controlleur de vitesse

Compression

Support des sparse files

Question : compatibilite ascendante ?

Extraction de la partie transport, permet de transporter un flux de donnees sans perte et a vitesse maxi.



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Conclusion

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Un problème simple a la base: le transfert de fichiers volumineux de point a point

Une solution simple pour le problème initial

Des contraintes externes nécessitant la mise en place d'une architecture complexe:

- Cloud, multitenancy, hybride
- Evolution des technologies (web, cloud, vitesse des réseaux, API first)
- Complexité des réseaux
- Nécessité d'innovation
- Contraintes industrielles (validation, test, développement)
- Diversité des applications (grand nombre de petits fichiers)

L'architecture peut évoluer et être améliorée au fil de l'évolution des contraintes

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Q&A