

What is Content In The Cloud, Really?

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Using Cloud to Make Avatar

- ❖ 1,000 asset creators & consumers
- ❖ 12,000 performance captures
- ❖ 60,000 virtual takes
- ❖ 1,000,000 GB of data generated
- ❖ 1 Digital Asset Management System: Gaia

Rise of Cloud

- One of the most significant drivers of IT infrastructure over the past three years was the emergence of public-cloud based application and infrastructure provider.
- Many of cloud-base service provider (e.g., Microsoft, Google, Amazon, Facebook, etc..) act as content depots, which are primarily in the business of gathering, organizing, and providing access to large quantities of digital content.
- All those providers undertake massive build out of data center, as they expand service offering

Innovation in Cloud

- Cloud gives a unparalleled scale of storage & communication
 - Encourage innovations to develop sophisticated technologies to improve the efficiency, reliability and cost of storage and communication in Cloud
- Examples
 - Erasure Coding in Windows Azure Storage
 - Primary Data Deduplication in Windows Server
 - RemoteFX for WAN

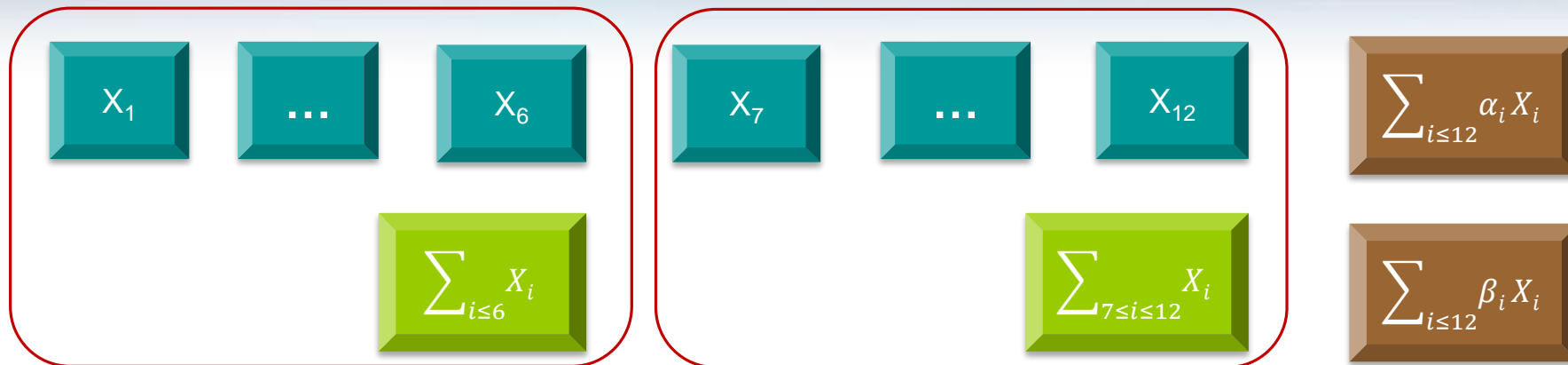
Erasure Coding in Windows Azure Storage

Massive Distributed Storage System in the Cloud

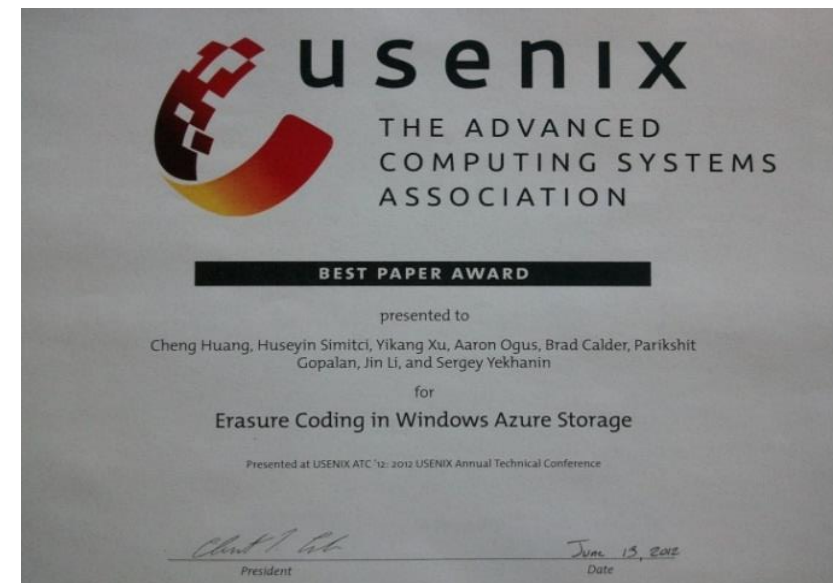
- ❖ Massive system upon commodity components
 - hundreds of thousands of disk drive
 - tens of thousands of servers
- ❖ Failures are norm rather than exception
- ❖ Redundancy is necessary to cope with failures
- ❖ Replication → Reed-Solomon Erasure Coding
- Local Reconstruction Coding (LRC)



Local Reconstruction Codes (Azure)



- Overhead: 1.33x
- Single failure requires only 6 reads
- Optimal failure tolerance
- Computational efficiency

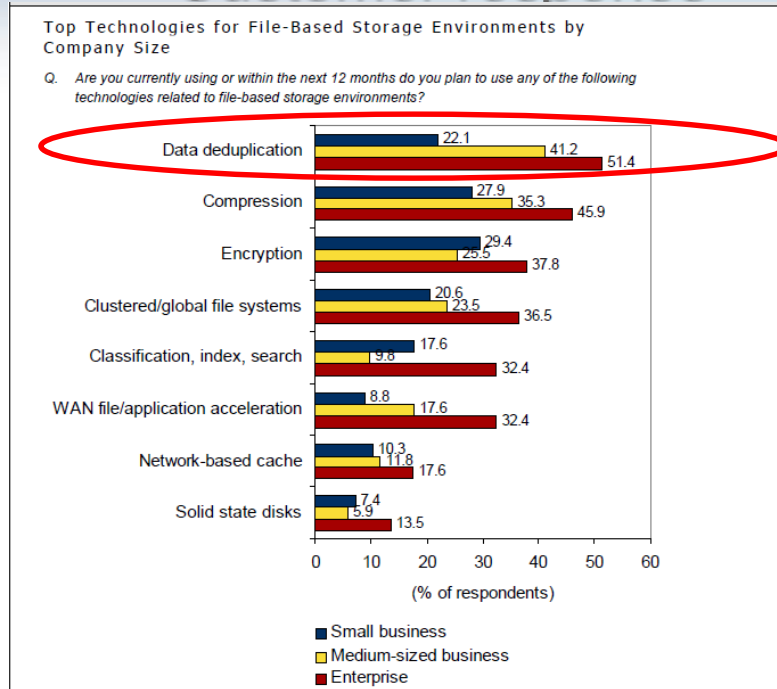


Best paper at USENIX ATC'12

Primary Data Deduplication – Large Scale Study and System Design

Primary Data De-duplication

Customer response



Market response

Major players	
EMC/DataDomain	Backup data dedup \$2.1bn acquisition
NetApp	Backup and Primary data dedup
Dell/Ocarina	Extensive file format aware optimization \$150m acquisition
Permabit	Backup and Primary data dedup
Oracle/ZFS	Native dedup support in ZFS
Linux/SDFS	Open source Linux Dedup project

❖ Storage Problems

- 60% growth 2001-2015 [IDC]
- Rising storage TCO despite declining disk drive cost
- Customers show continuous willingness to pay for efficient and reliable storage solution
- Our group activity: 1) dedup, 2) coding for storage, and 3) SSD acceleration

❖ Dedup

- # 1 feature customer request
- Need: 1) Backup → Primary data, 2) Appliance → Server

Deduplication and on-disk structures

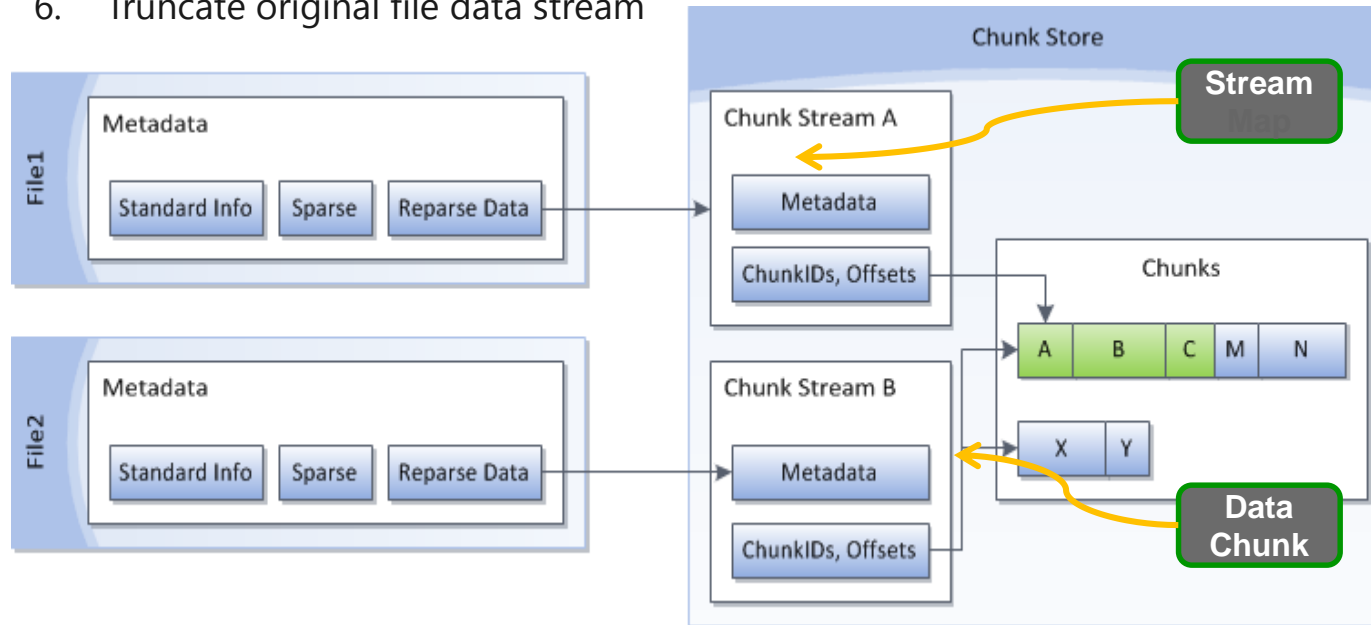
Phase I – Identify the duplicate data

1. Scan files according to policy
2. Chunk files intelligently to maximize recurring chunks
3. Identify common data chunks



Phase II – Optimize the target files

4. Single-instance data chunks in file stream order
5. Create stream metadata
6. Truncate original file data stream



System overview

Management

- Server Manager
- PowerShell
- WMI



Config

Status

Management Operations

- Enable & configure deduplication
- Manage job schedules
- Run on-demand jobs
- Query status and progress

Deduplication scope is a Volume

- Self describing portable unit
- Cluster aware: supports failover
- Efficient optimized backup/restore
- Scales to large volumes and to dozens of volumes

Windows Server

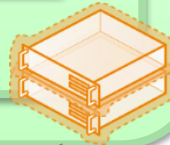
Windows volumes

D:\

E:\

F:\

.....



Cluster-aware:

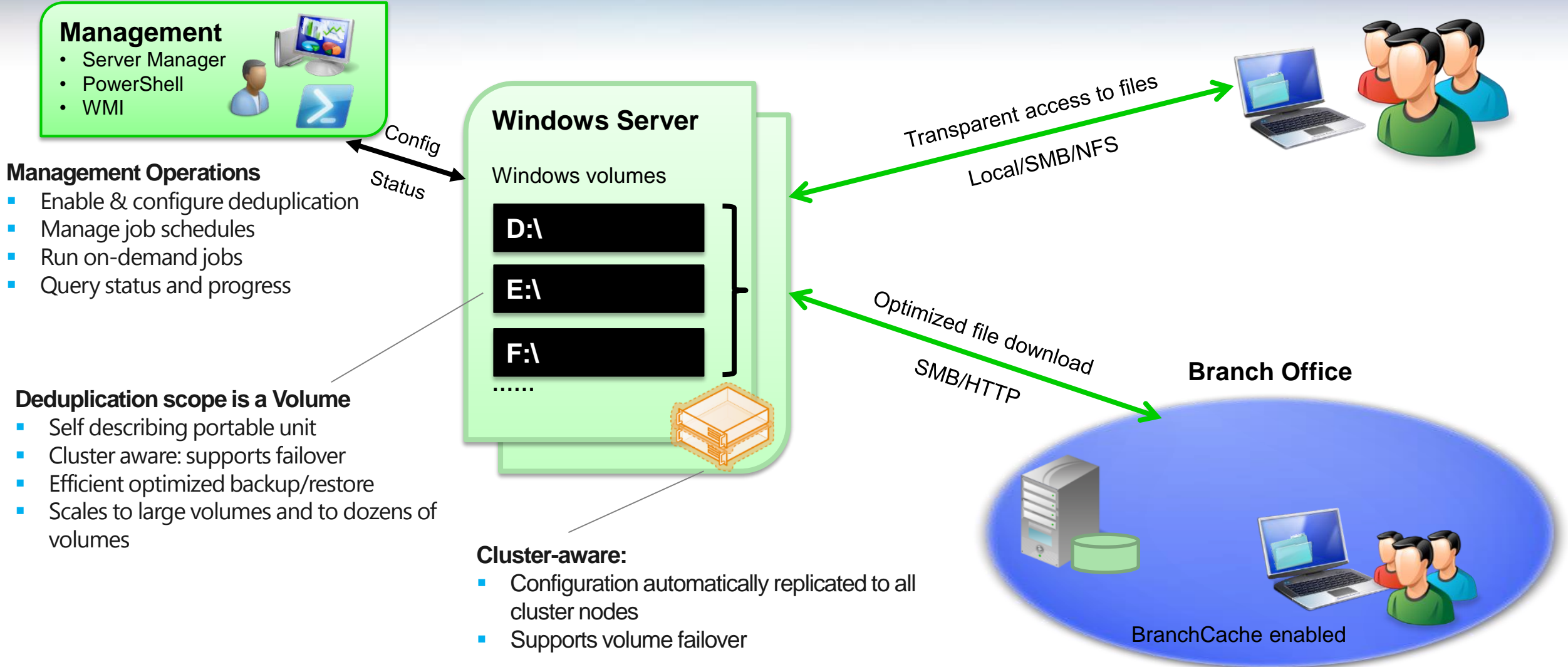
- Configuration automatically replicated to all cluster nodes
- Supports volume failover

Transparent access to files
Local/SMB/NFS

Optimized file download
SMB/HTTP

Branch Office

BranchCache enabled



Primary Data De-duplication (Deployment Impact)

❖ Top 3 ranked features in Windows File Server 2012

- MSIT deployment with significant saving
- External deployment:
Convergent, EdgeNet, Sporton, US Airforce, etc..
- Applicable in diverse scenario:
e.g., it is discovered that it can provide significant saving to laptop by dedup multiple document version & outlook pst/ost file against document attached

❖ Rave reviews

ITWorld: "... My personal highlight of the entire three days of the Windows Server 8 reviewers workshop were the talks about Storage. The **killer-feature** to me is the new and built-in data deduplication, ..."

❖ Customers paying for it

Target Workloads

VHD Library



Windows Server
Build lab: 82%
savings

Software
Deployment



ProductsWeb:
67% savings

File shares



MSIT File shares:
64% savings

Home Folder
(MyDocs)



MSIT Intellimirror:
20-35% savings

- Criteria/Tools available for on-site assessment

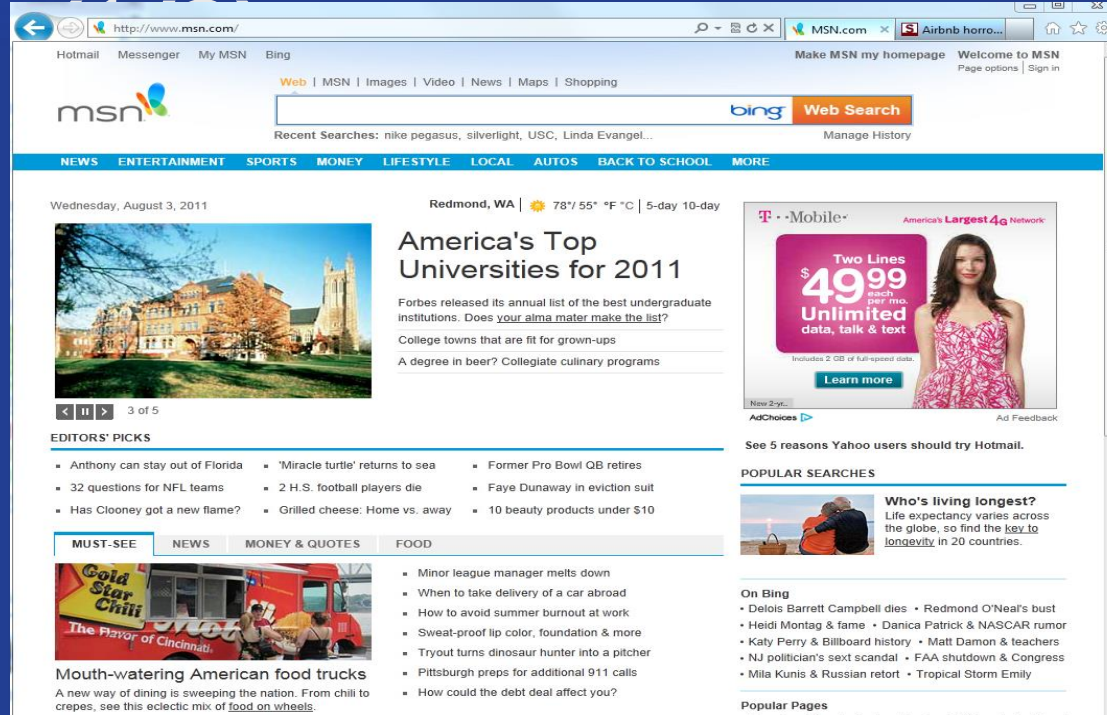
RemoteFX for WAN: A Full Fidelity Remoting Experience in Windows 8

RemoteFX is the name for the full fidelity remote experience in Windows Server 8

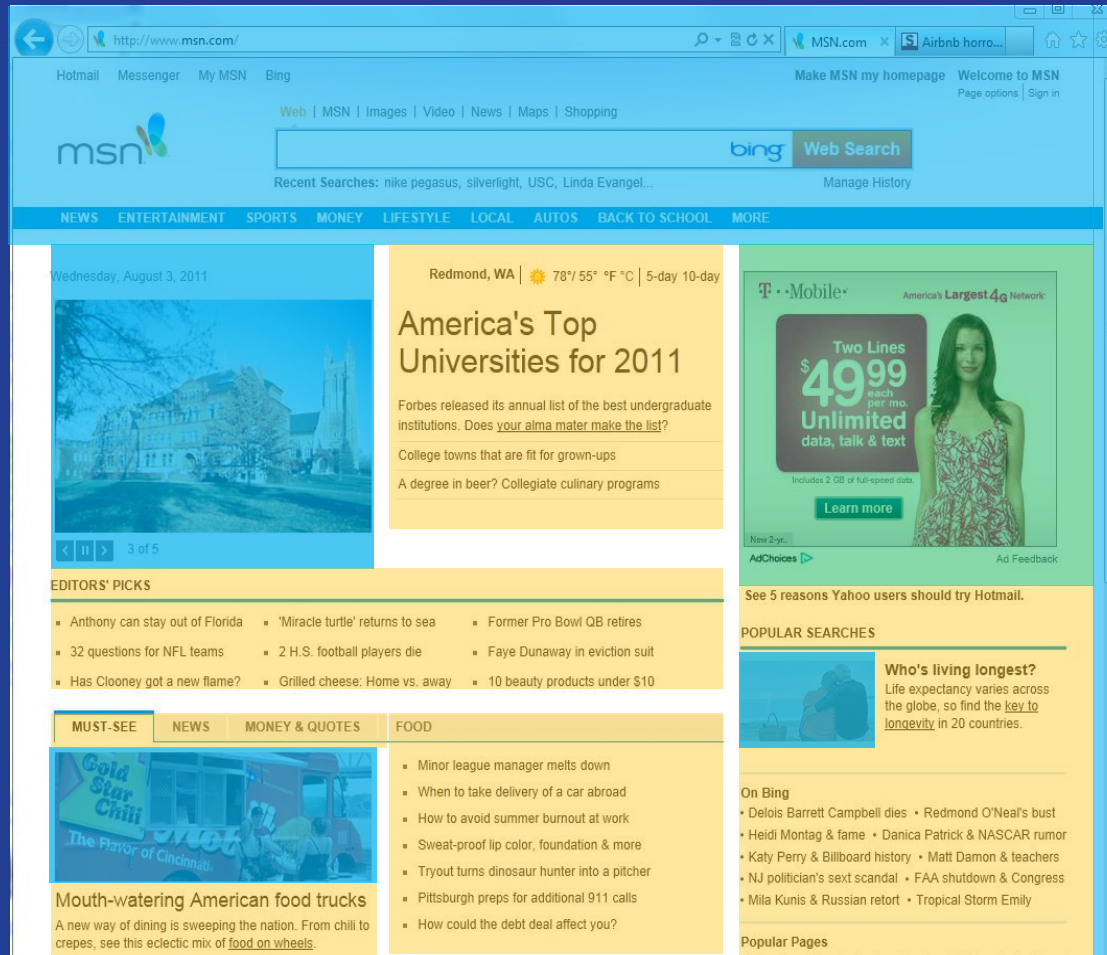
On Remote Desktop

- X Window & Windows Remoting up to RDP 6
 - Primitive (text, menu, graphic entity, etc.) based remoting
 - Unable to deliver a full remoting experience (e.g., video, game, antialiased render, etc..)
- RemoteFX
 - Full fidelity remoting via the use of bitmap codec and media redirection
 - Enables rich desktop remoting

Remote FX Adaptive Graphics



Remote FX Adaptive Graphics

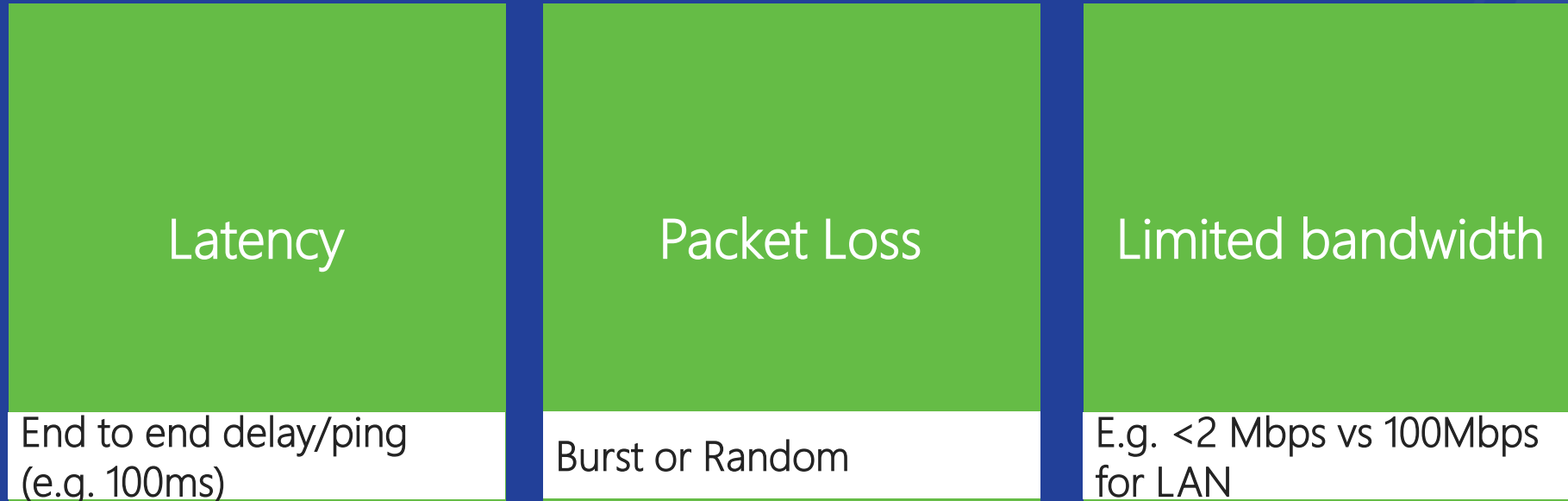


Text Content

Image Content

Video/Animations

Remoting on WAN : Deliver a Great User Experience beyond Corp Net



- Intelligent WAN aware transports
 - Automatic choice of TCP or optimized UDP transport
 - Dynamically auto detects and tunes encoding to network
 - Hybrid Windows + Rate based congestion control
 - Integrated with Remote Desktop Gateway

Looking Forward

- Virtualization of Compute, Network and Storage
- Big Data
- Innovation to improve the efficiency, reliability and cost of data storage and communication.