

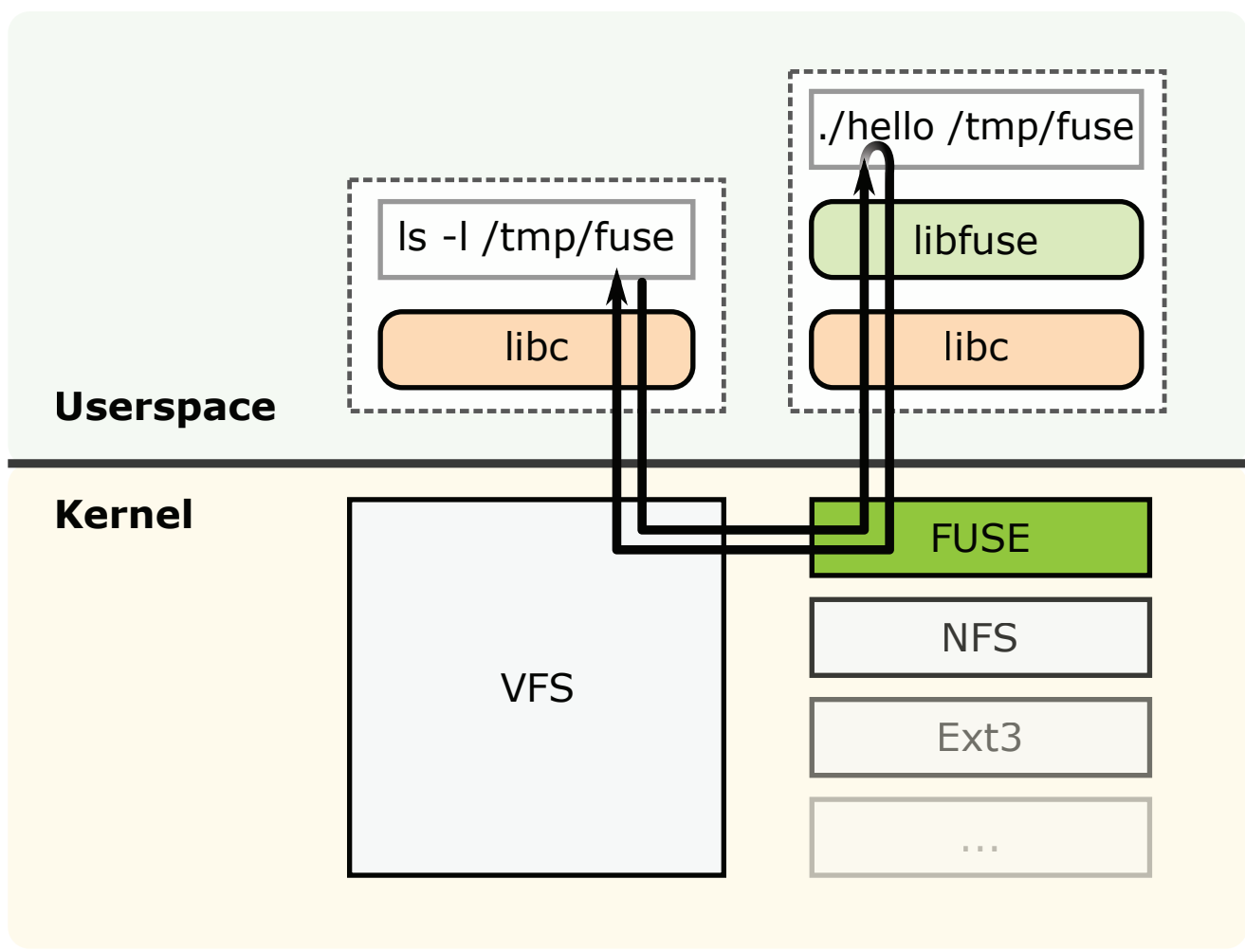


Finesse: Kernel Bypass for FUSE File Systems

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File Systems In User Space



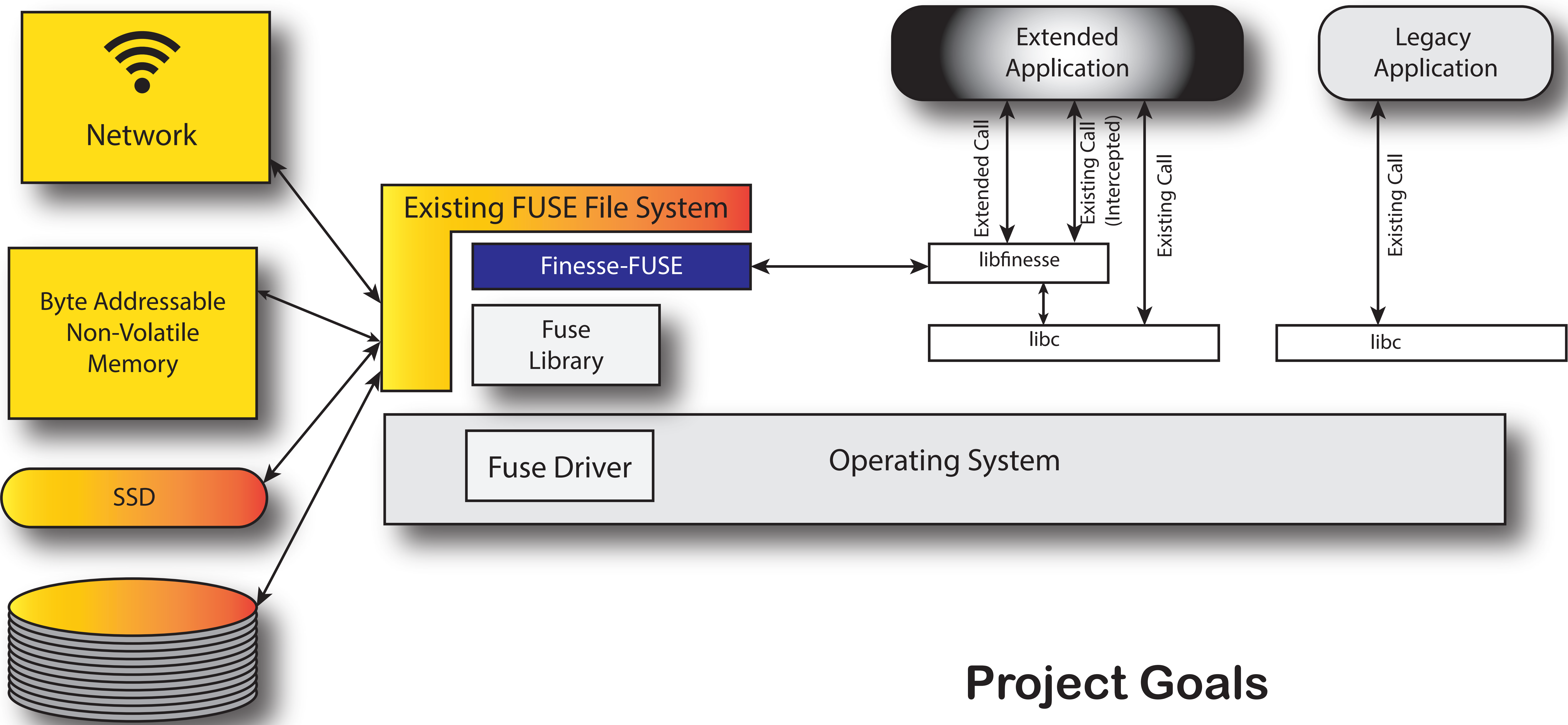
Source: <https://commons.wikimedia.org/w/index.php?curid=3009564>

Challenges

- Large body of existing applications (numerous APIs to support)
- Rigid interfaces
- Implicit state information
- Performance
- Existing semantics

Advantages

- Large body of existing applications (easy to benefit from Finesse)
- Cross-platform support
- User mode development (easier)
- Easy to prototype/build
- Well understood semantics



Project Goals

- Transparent support for existing applications
- No source code changes to existing FUSE file systems
- Optimize meta-data paths
- Extend support for more calls
- Enhance message passing performance
- Integrate with other FUSE extensions (e.g., extFUSE)
- Increase kernel bypass

Preliminary Results

Workload	I/O Size (KB)	Ext4 HDD (ops/sec)	StackfsBase HDD (%Diff)	StackfsOpt HDD (%Diff)	Finesse HDD (%Diff)	EXT4 SSD (ops/sec)	StackfsBase SSD (%Diff)	StackfsOpt SSD (%Diff)	Finesse SSD (%Diff)
files-cr-1th	4	16406	-155.16	-247.01	-151.36	25622	-21.04	-13.79	-208.01
files-cr-32th	4	20186	-1122.04	-169.25	-1654.03	46183	-17.00	-32.26	-3816.01
files-rd-1th	4	164	-22.17	-107.40	-1.03	5803	-25.87	-25.66	-480.56
files-rd-32th	4	432	-174.39	-86.68	-375.78	65779	-18.99	-18.73	-6218.78
files-del-1th	-	685	-164.54	-255.32	+97.77	21465	-11.38	-14.94	+29.21
files-del-32th	-	301	+80.38	-18.00	+98.36	20000	-14.93	-20.12	-13.34

Green class (marked with +) indicates that the performance either degraded by less than 5% or actually improved; Yellow class includes results with the performance degradation in the 5–25% range; Orange class indicates that the performance degradation is between 25–50%; And finally, the Red class is for when performance decreased by more than 50%

Workload Name	Description
files-cr-Nth	Nthreads (1,32) create 4 million 4KB files over many directories
files-rd-Nth	Nthreads (1,32) read from 1 million preallocated 4KB files over many directories
files-del-Nth	Nthreads (1,32) delete 4 million preallocated 4KB files over many directories



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