Supporting Regular and Thin LTO with a Single LTO Bitcode Format

Matthew Voss, Sony Interactive Entainment

LLVM Developers' Meeting, October 2019

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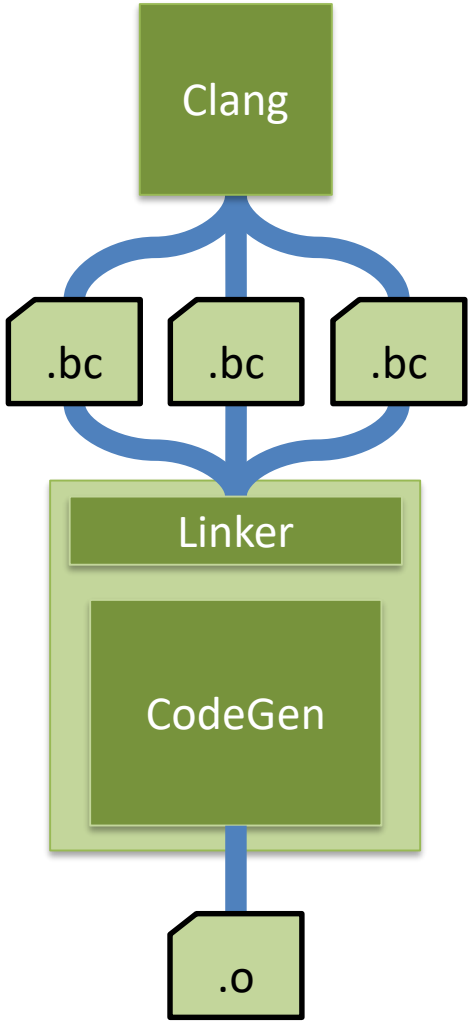
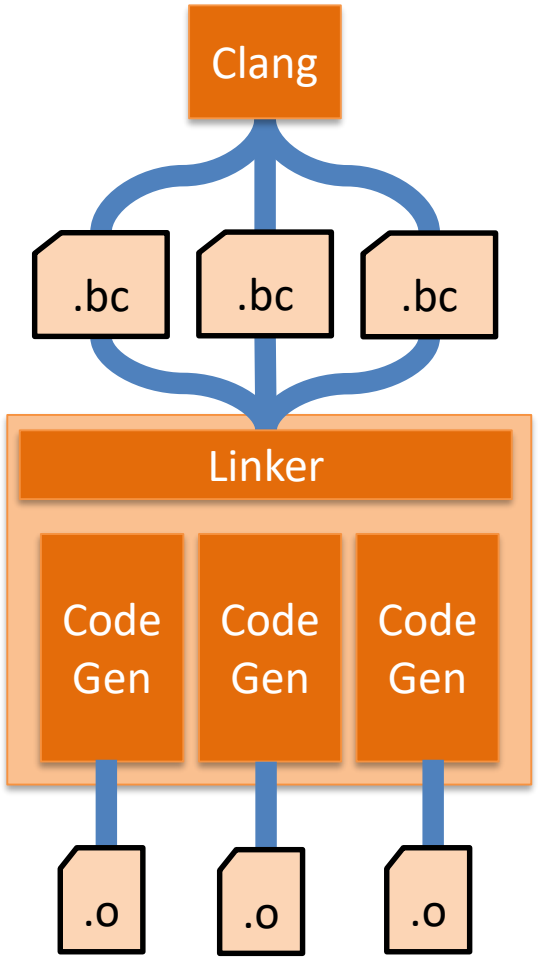
Regular LTO



ThinLTO



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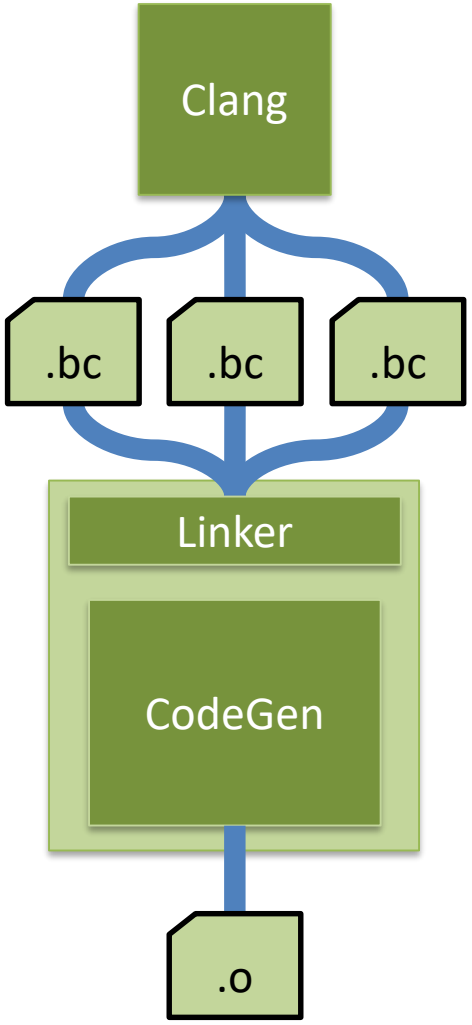
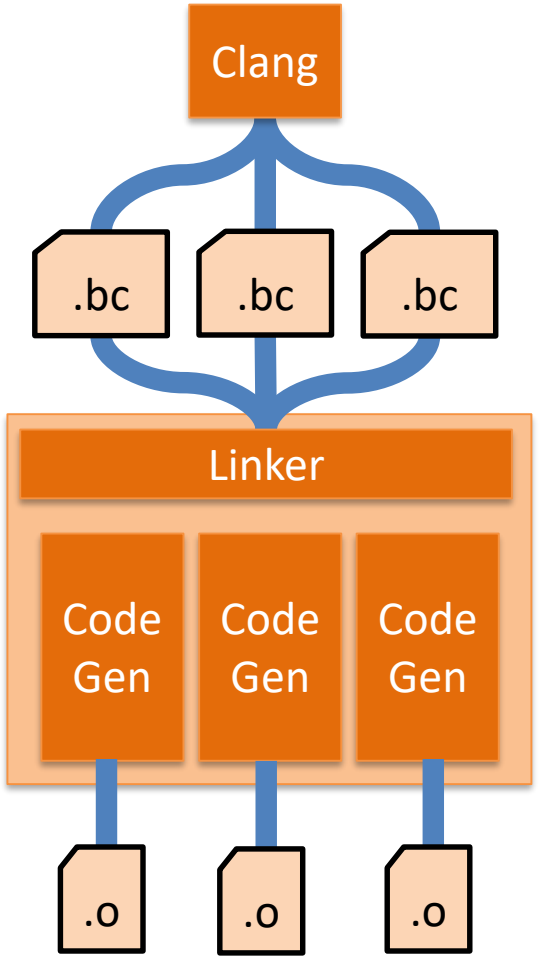
Regular LTO



- LTO Backend chosen before link time.

ThinLTO



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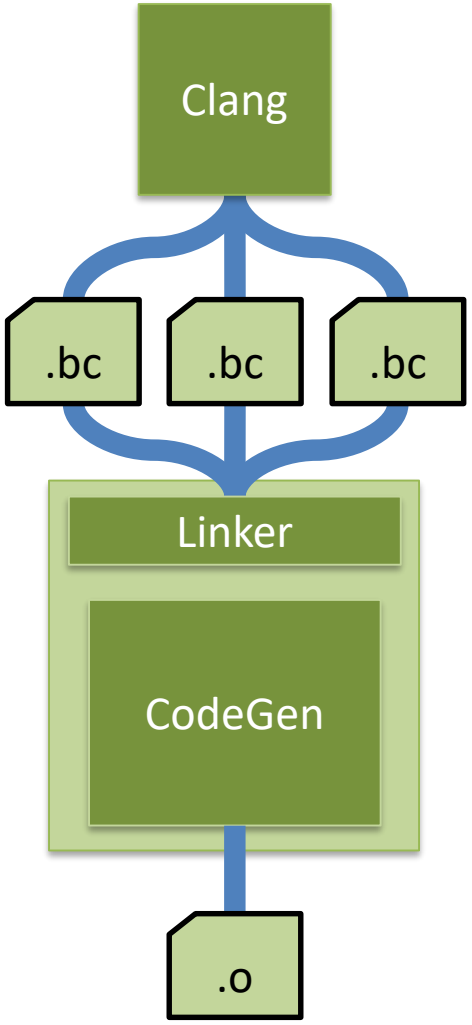
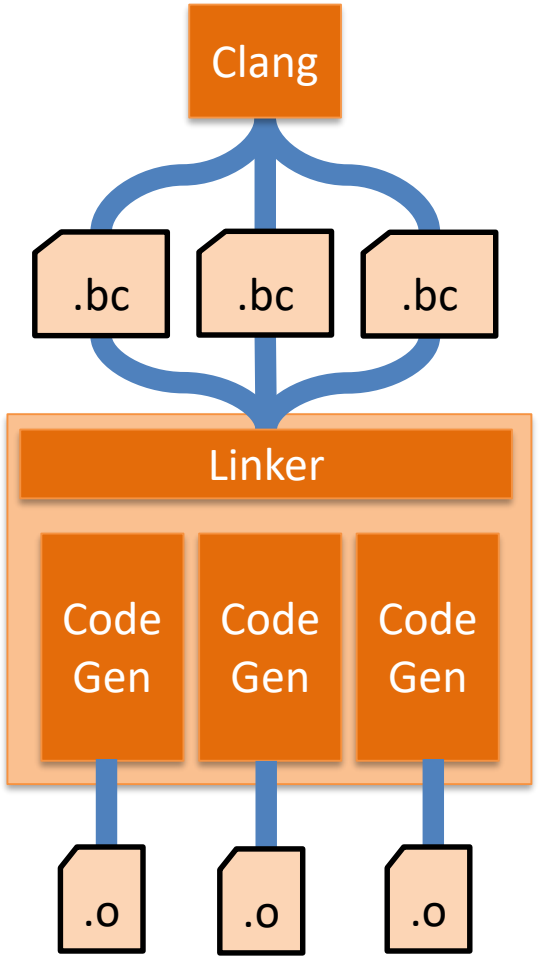
Regular LTO



- LTO Backend chosen before link time.
- Thin and Regular Bitcode files can’t cross-optimize.

ThinLTO



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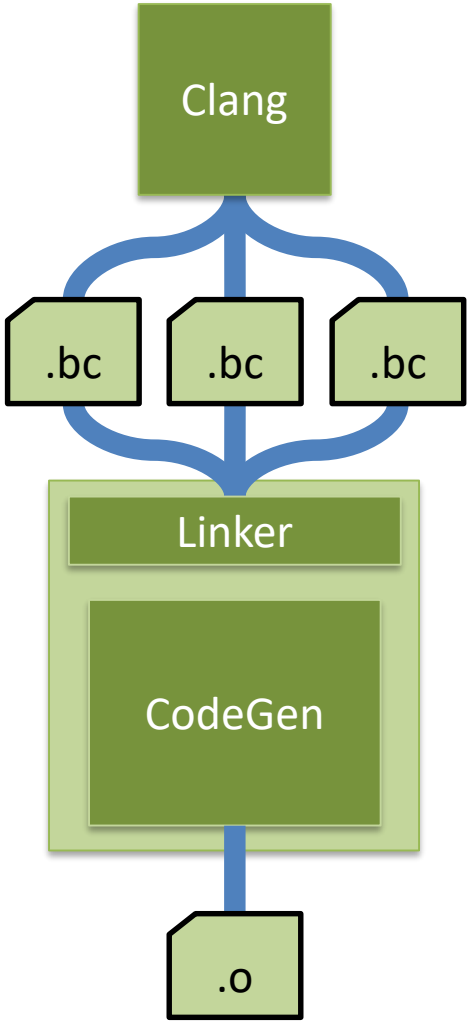
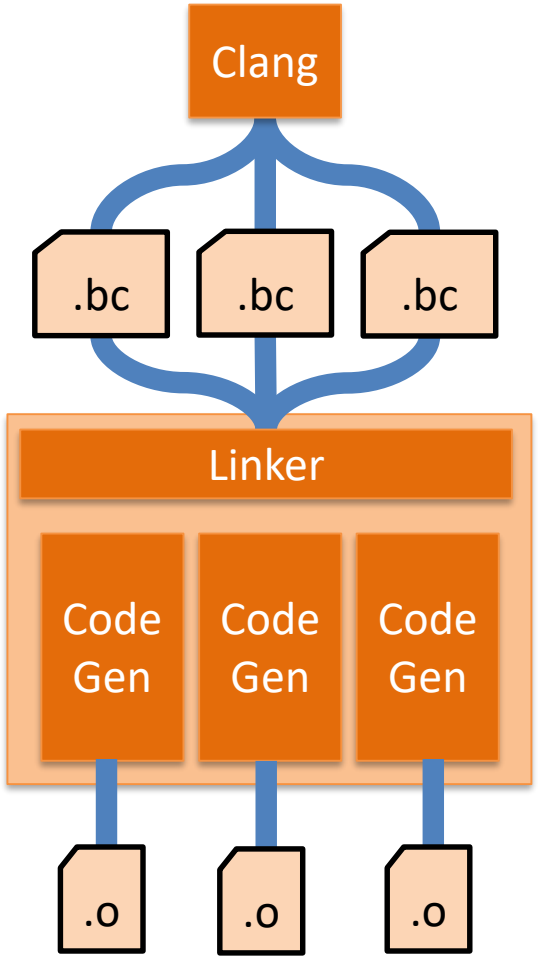
Regular LTO



- LTO Backend chosen before link time.
- Thin and Regular Bitcode files can’t cross-optimize.
- Library deployment becomes more complex.

ThinLTO



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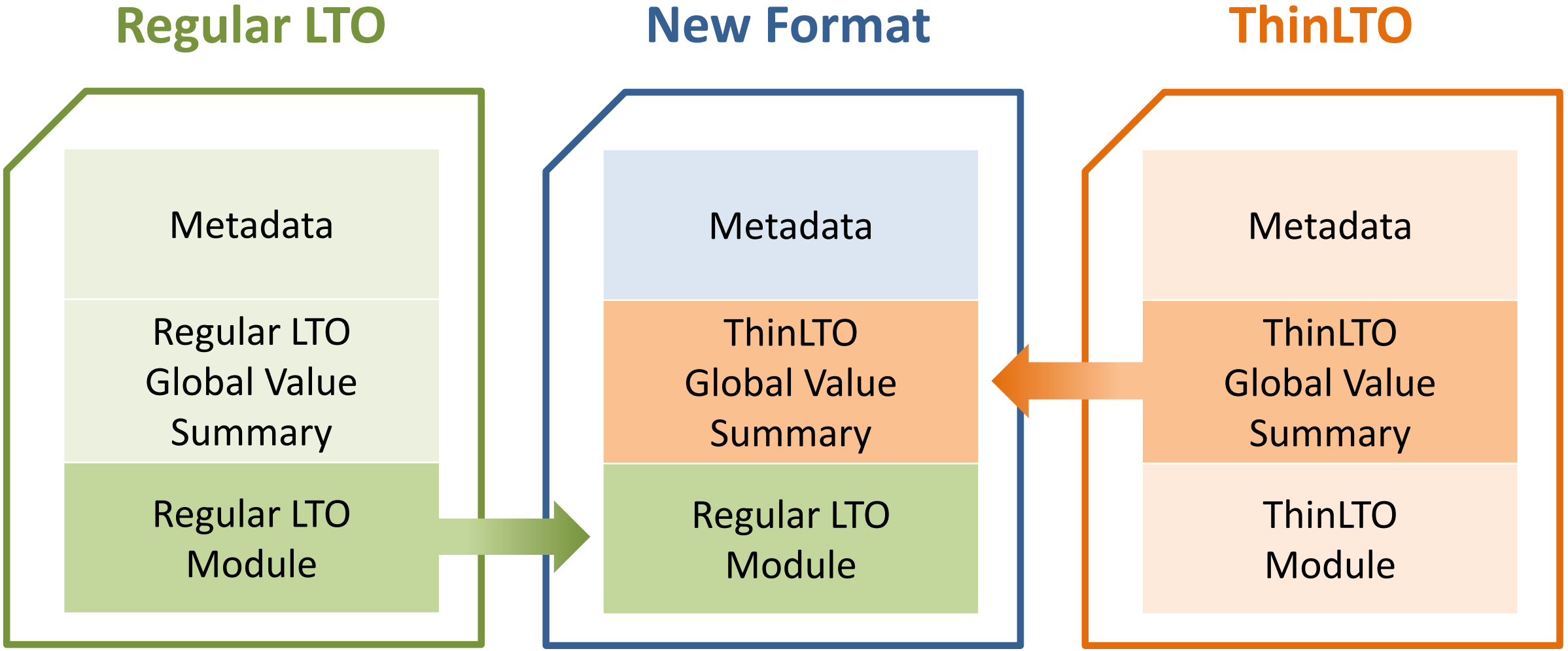

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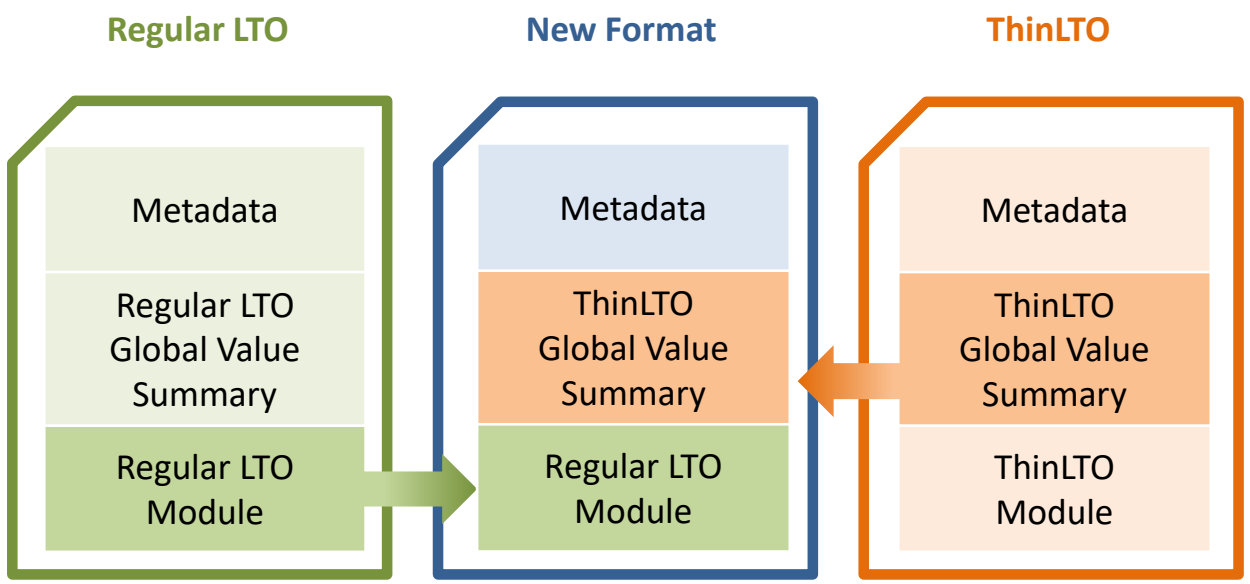

When comparing the new and the existing Regular LTO pipeline, we see *identical build time and code quality.*

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ThinLTO Performance Tests

	Clang		
Pipeline	Existing ThinLTO	New ThinLTO	Δ%
Build	2020 sec	2051 sec	+2%
Run	1565 sec	1560 sec	<1%

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ThinLTO Performance Tests

	Game 1		
Pipeline	Existing ThinLTO	New ThinLTO	Δ%
Build	145 sec	149 sec	+3%
Frame Time	21.74 ms	21.17 ms	-3%

	Game 2		
Pipeline	Existing ThinLTO	New ThinLTO	Δ%
Build	603 sec	632 sec	+5%
Avg. CPU Usage	35.9%	36.2%	<1%

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Summary

- LTO Mode Chosen at Link-time
- LTO Libraries Support Both LTO Modes
- Equivalent Regular LTO Performance
- Small Differences in ThinLTO Build Time
- Equivalent ThinLTO Runtime Performance

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Status and Future Work

- Released as a private change in the PS4™ compiler
- Update to use new LTO API (C++ API)
- Testing and performance tweaks
- Release the feature to LLVM for possible integration

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