MORE FASTER LESS LESS
The Business Drivers for IEC 61850

Presented By
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Sponsoring Organization:

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Supporting Organization:

Organizer:

iKnowledge
IT'S A SOLUTION

Australian Market

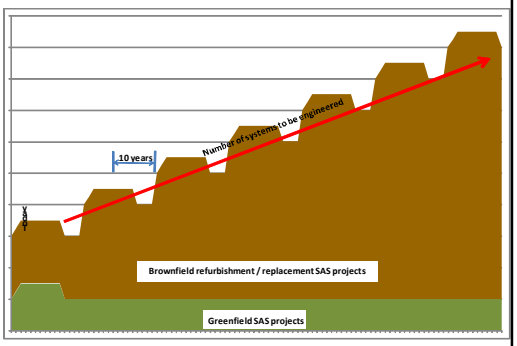
- Capital expenditure programs increasing
  - double last 5 years
- Deliver projects more efficiently with lower costs to yield direct benefits to shareholders and stakeholders of their operations
- Pre 2009 small IEC 61850 deployments
  - Waiting for maturity
  - "Solution waiting for a problem"

The problem is here

- CIGRE Technical Brochure 246 : "The automation of new and existing substations: why and how" 2004, chapter 1
  - "Primary equipment has an average lifetime of approximately 40 years and secondary equipment such as protection, control or communication equipment approximately 20 years. Consequently, the secondary equipment has to be refurbished *(at least)* once during the lifetime of the substation."

A Growing Workload

- Ageing assets
- Shorter operation life spans
- Continuous replacement of several substation secondary systems per year



More Faster Less Less Higher Lower

- Innovation in technical and project delivery strategies in a resource constrained market using IEC 61850

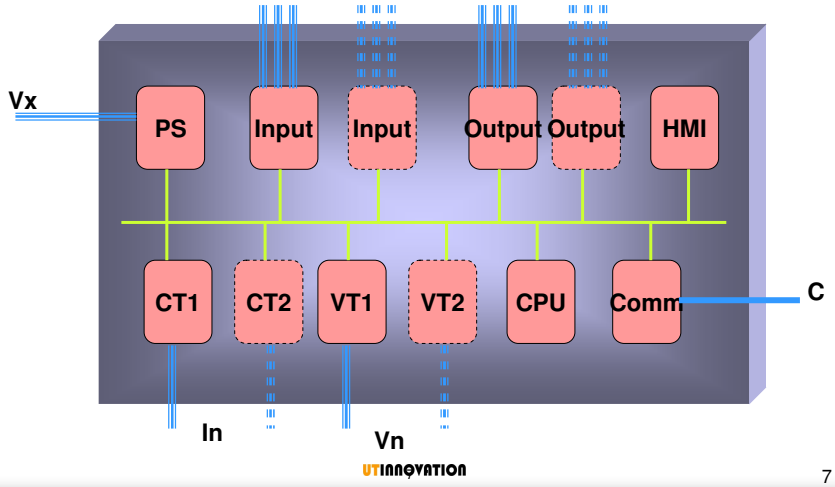
- **More** projects (with enhanced functionality)
  Faster timeframes
  Less money
  Less resources

  Higher reliability
  Lower operational costs

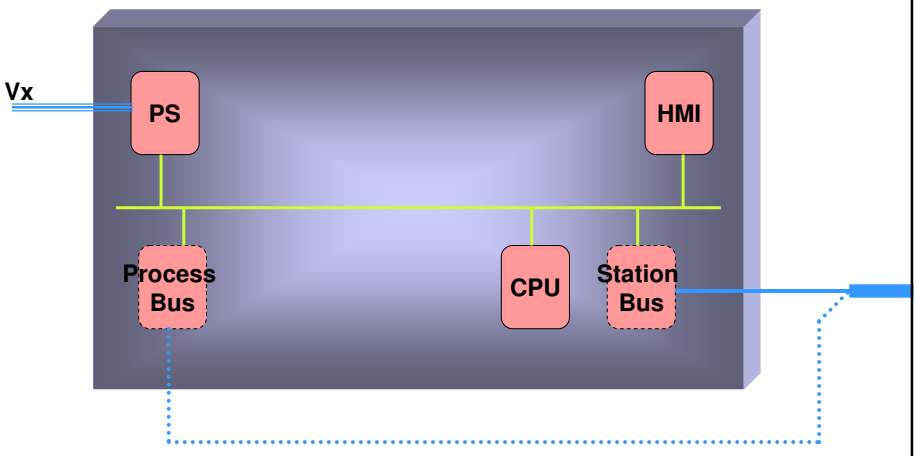
What does IEC 61850 look like?

- Logical Nodes
- Interoperability
- SCL XML files – SSD, SCD…
- Use cases
- Abstract Communications Services Interface
- PICS
- ……

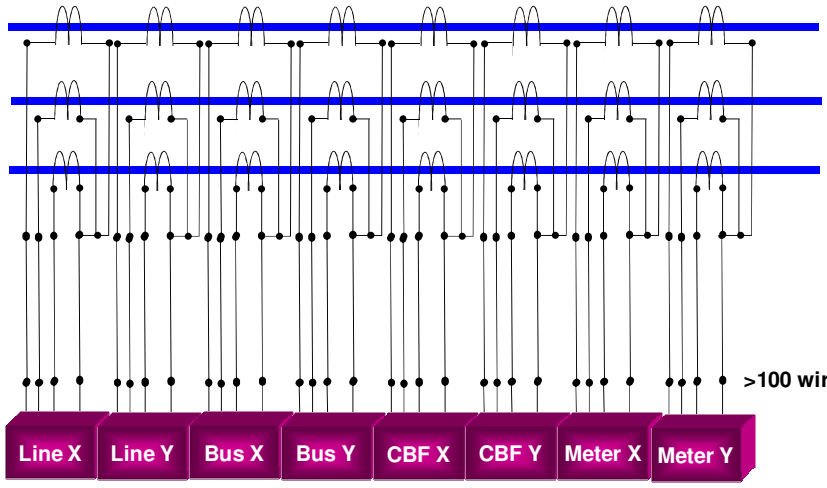
Conventional IED



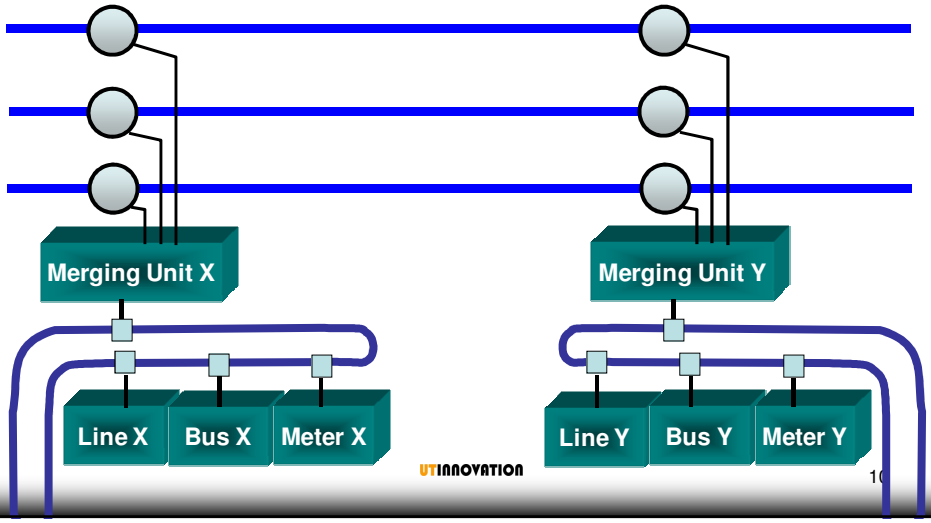
IEC61850 IED



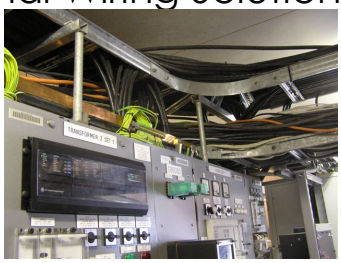
Conventional CT circuit

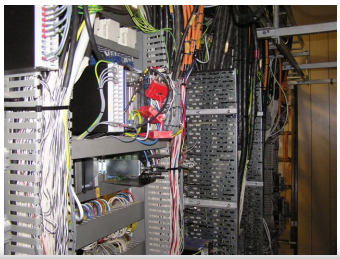


IEC61850 CT circuit



Conventional Wiring Solutions



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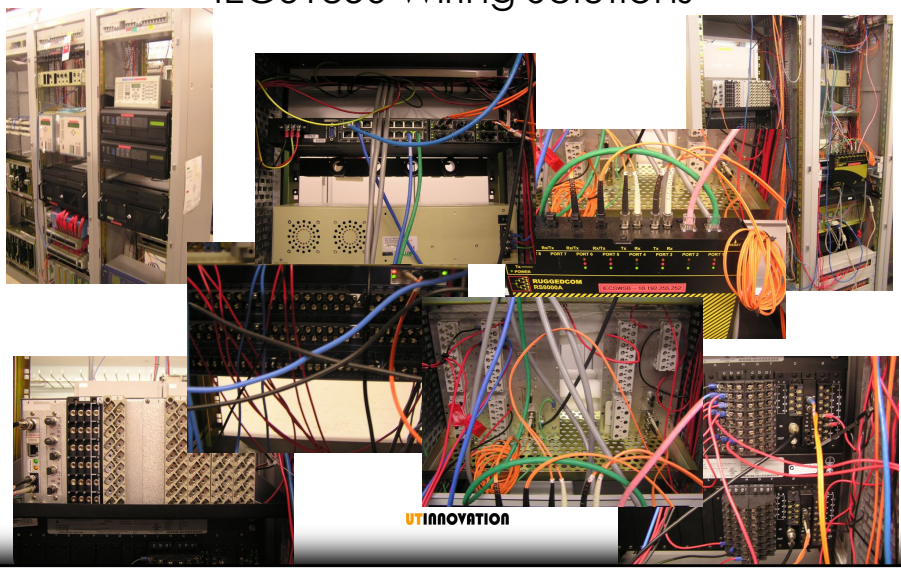
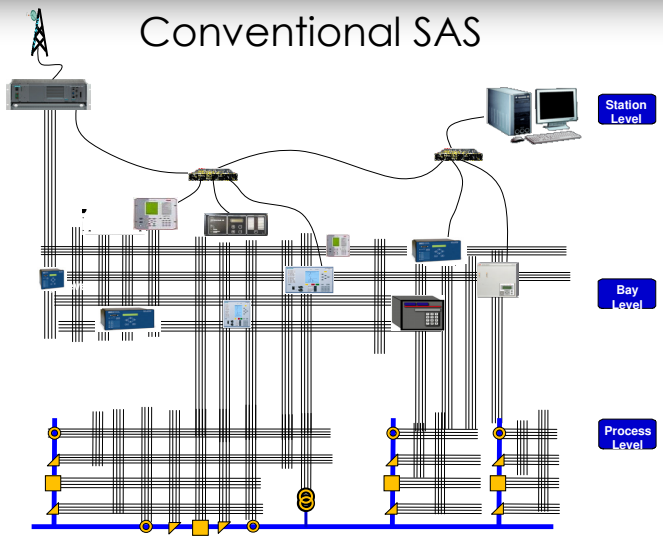
IEC61850 Wiring Solutions



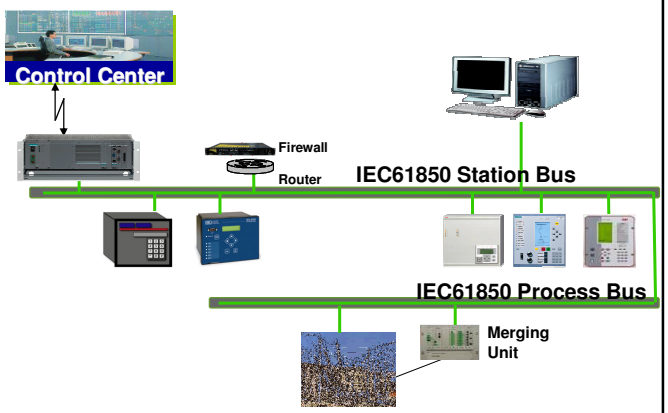
Unstructured

Conventional SAS

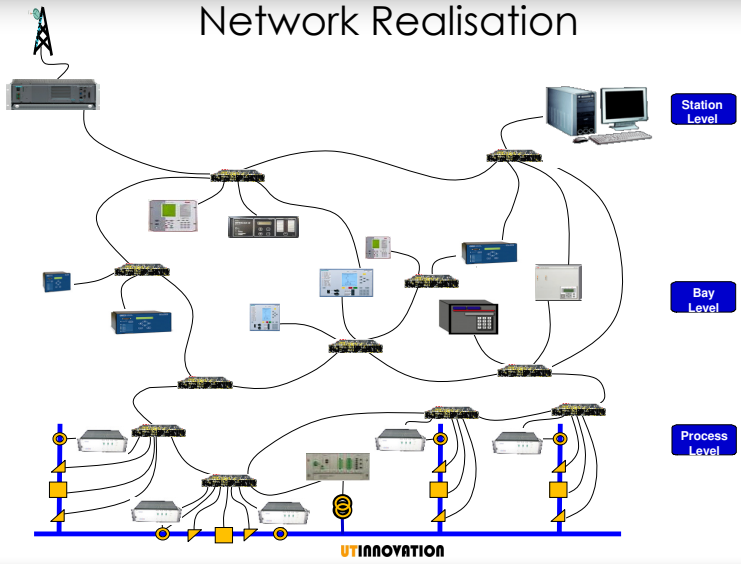


The 3 Level, 2 Bus Concept

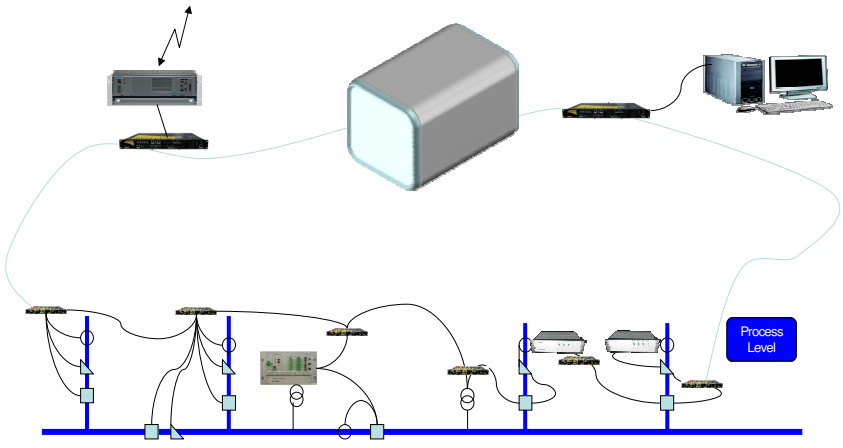
- Station Level
- Bay Level
- Process Level



Network Realisation



Or why not?



Approach

- Business Case
- Technical Strategy
- Implementation Objectives
- Project Selection Criteria
- Organisational Consequences

Business Case

- IEC 61850 to achieve operational goals based on business reasoning
- Initial engineering effort to develop new solutions
  - Initial 2-3 projects enable technology enhancements
- Implement IEC 61850 in a real CAPEX project.
  - Significant upfront investments in engineering, research & development

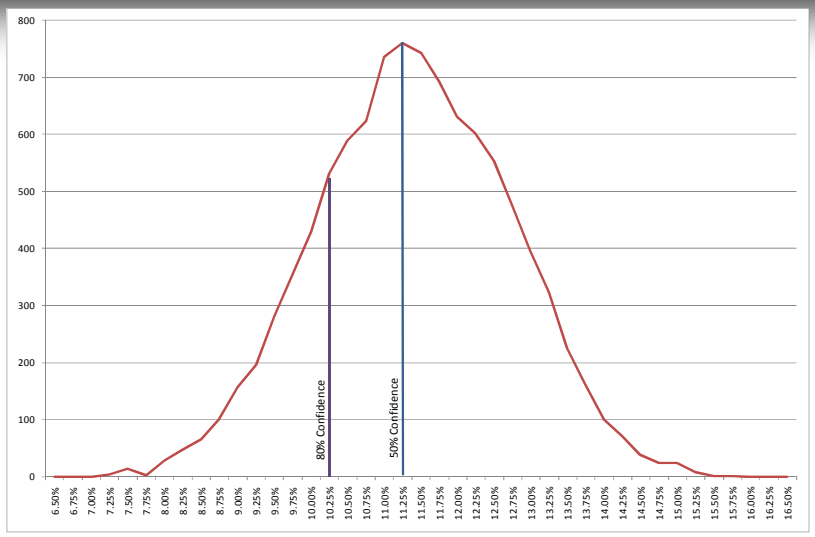
Business Case

- Return on investment for first project not in first project, but expect significant savings from the start, even through moderate deployment

- Improve
  - Engineering efficiency
  - Design
  - Commissioning and operation
  - Reduction of wires
  - Reducing of drawings
  - Re-usable solutions and automated testing

Business Case (cont'd)

Project component	Component Cost	Estimated Savings *)		
		Low	Med	High
Utility Organization	12%	0%	5%	10%
High Voltage System	25%	0%	4%	10%
Detailed Design	12%	10%	20%	25%
Process Interface	5%	40%	50%	60%
Control / Protection System	12%	15%	25%	30%
Switchyard / Civil	31%	0%	2%	4%
Commissioning	3%	40%	50%	60%
	100%	**7%**	**13%**	**18%**



- 10,000 Simulations

Process Bus alone

- CIGRE 2008 Paper B5-102 "Considerations For IEC 61850 Process Bus Deployment In Real-World Protection And Control Systems: A Business Analysis" by GE of USA and Canada

Table 4: Total Installed Cost comparison between hardwired and IEC 61850-9-2 process bus system

	Copper-Based	Process Bus	Savings
Engineering	$73,000	$40,000	45%
Drafting	$41,000	$18,000	56%
Construction	$87,000	$29,000	67%
Commissioning	$96,000	$51,000	47%
Total	**$297,000**	**$138,000**	**54%**

Maintenance Costs

- Distribution 2001, Brisbane: ABB

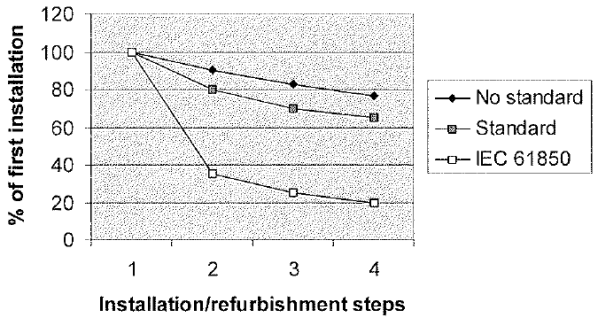


Fig.2 – The maintenance cost of secondary equipment over the life cycle of the substation

Small Utility Savings

- 5-Year CAPEX $650M
- Substation work = $300M
- Savings of $21M-$54M (7% - 18%)
  - 50% probability >$33.75M
  - 80% probability >$30.75M

Existing Risk Reduction

- Not able to test full system leaves latent errors & potential blackouts
- Wiring errors – possible loss of life, blackouts, consequential damage due to uncleared faults
- CT explosions eliminated with NCIT
- Documentation errors leading to testing mistakes, blackouts, loss of life
- Extensive I/O verification
- Multiple communication systems leading to cyber security

New Risk Management

- New technology
- Skills
  - Specification
  - Contractors
  - Maintenance provider
- First project delays
- First project budget
- Use of process bus
- New procedures
- New error/failure modes

Technical Strategy

- Implementation strategy is the basis for integration and deployment of IEC 61850 based solutions
- But:
  - Is the utility ready to implement new technology?
  - Is the new technology consistent with the utility's business objectives, vision and balanced score card?
  - Is it proven technology that will deliver true benefits to utility?

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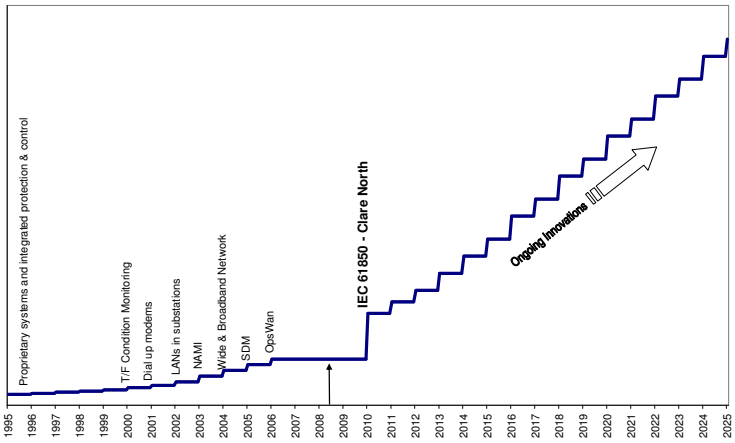
Technical Strategy

- Utilities understand the
  - Limitations of piecewise technology development
  - Need for holistic asset technology strategies and deployment to obtain significant reductions in cost and engineering time
- Do it only if the utility has the capability and desire to undertake a new technology implementation
- Utilize new technology, to drive step change improvements in the network

Holistic Innovation Platform



Technical Strategy

- Deal with significant ageing asset problem
- Use IEC 61850 to improve engineering, design, commissioning and operation
- Improve growth by reduction of substation life cycle costs
- Add value through increased functionality with access to asset performance data and further ongoing innovation
- By implementing proven state-of-the-art technology, utilities will be recognized as major thought leaders

Technical Strategy

- Real implementations
  - life cycle cost reductions of 10-30%
  - project lead times reduced by 6 – 12 months
- Amount of information available better than current solutions.
- Information available virtually for free and integral part of IEC 61850
  - enable new applications
  - enhance asset management
  - speed of fault location and restoration
  - integration of embedded generation
  - demand side management
  - loss reduction

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Technical Strategy

- Structured approach:
  - **Design** – integrated specification and standard design elements reduces effort for development of Substation Automation Systems with benefit of automated documentation
  - **Implementation** – automatic generation of validated configuration files
  - **Construction and installation** – elimination of wiring and potential errors throughout the substation through use of optical fiber connections
  - **Commissioning** – automatic test programs and ability to model and simulate systems reducing on site testing
  - **Documentation** – on line access to "as operating" documentation without the need to continually re-create as built documentation and eliminate database issues

Implementation Objectives

- Based on business cases and technical strategy implementation objectives of IEC 61850 are:
  - integration of IEC 61850 into utility design standards
  - training, simulation and development capabilities within the utility
- IEC 61850 strategy to achieve the following:
  - Develop essential knowledge and intellectual property within the utility
  - Select a real project to focus key R&D effort
  - Identify a regime for integration of IEC 61850 in future substation projects as a migration process
- Develop expertise to engineer, deploy, commission and operate IEC 61850 systems

Project Selection Criteria

- Reasonable time frame for development of the IEC 61850 solution and the essential training of the utility
- Serve as a basis for further projects
- Criticality in the network?
- Green-field development or the need to develop interface solutions for legacy systems?

Project Selection Criteria

- Common approach:
  - Start with IEC 61850 is to retain conventional high voltage system
  - Identify future scheme enhancements without major impact on operations
  - Expand implementation to full IEC 61850

Organisational Consequences

- Implementation of IEC 61850 requires specialists and new engineering processes
- Development of internal intellectual property and skills needed
- Knowledge from experienced IEC 61850 sources crucial for introduction and deployment

- Segregation of SA system from traditional D&C arrangements and appointment of an experienced IEC 61850 specialist organization responsible for the SA specification & design

Organisational Consequences

- Integrated engineering and configuration process, reduces risks of network and safety risk due to design, wiring and commissioning errors
- Achieve enhanced operational reliability through pre-engineered fall back states in the event of equipment failure or isolations of equipment
- Selection and training by experienced engineers to mitigate risks from possible lack of competent resources to final implementation not providing required functionality

Organisational Consequences

- Service providers, contractors and suppliers must be up-skilled and equipped
- Fall back scenario for deployment of the first project including agreements with contractors, service providers and vendors to deliver alternate solutions if required

Conclusions

- Bringing IEC 61850 to the substation allows the utility to have more agile and better manageable networks
- IEC 61850 sexes up the industry making it cutting edge thus giving back the engineer its status and associated compensation
- IEC 61850 will enable utilities to deal with the commercial imperatives to deliver projects more efficiently and with lower costs to yield direct benefits to the shareholders and stakeholders of their operations or in other words
- "More, Faster, Less, Less, Higher, Lower"

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